ANNUAL REPORT 2018

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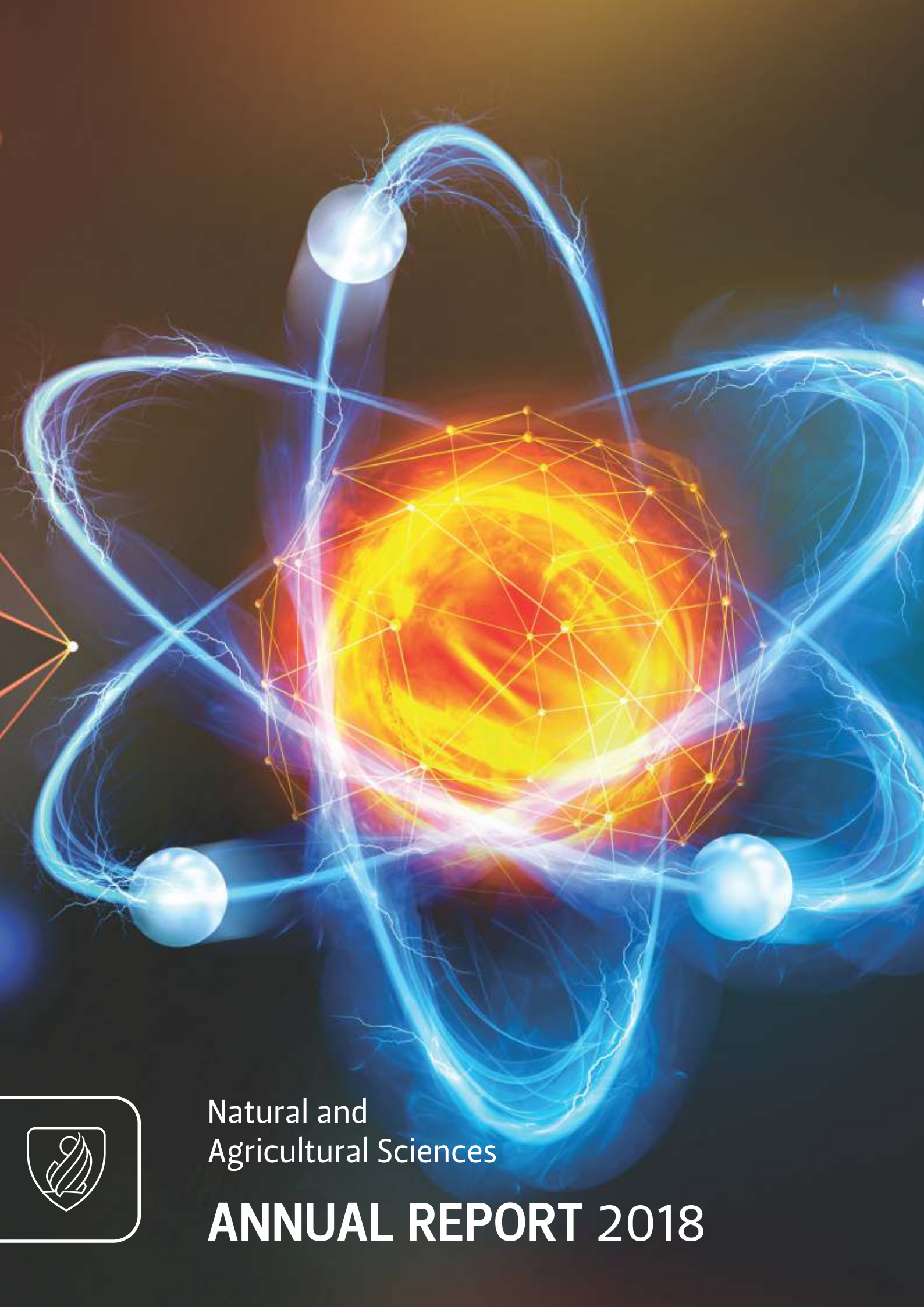

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ANNUAL REPORT 2018

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FOREWORD

MESSAGE FROM THE DEAN

In 2018, university life slowly returned to normal after the previous two turbulent years of debate around free education. However, the National Student Financial Aid Scheme (NSFAS) provided increased access to the university for a large number of students, increasing the teaching load of academics. Due to the relative stability on the campuses, academics had more time to concentrate on research. This resulted in a very good year for the faculty, with a marked increase in the number of research articles published and the number of postgraduate students who graduated.

INTERNATIONALISATION

This year, the theme of our report is 'Internationalisation'. Universities and policy makers in the sector consider internationalisation as one of the most significant aspects of an institutional strategy, and institutions worldwide are increasingly focusing on internationalisation. In theory, it is the process of integrating an international, intercultural, or global dimension into the purpose, functions, and delivery of postsecondary education. Internationalisation helps people grow and is necessary for real 'self-transformation'. Contact with international researchers and students enables people to see the world from vantage points that reach beyond their own backgrounds – and this allows them to learn about new cultures and countries. Internationalisation of universities is the process through which academics contribute to the world, while also being shaped by it. It helps people to see beyond themselves.

In the article, *Internationalization of Universities: Challenges, Threats and Opportunities for Third World Countries* (Abbas *et al*, 2018), the authors state that universities are trying their best in this era of change and uncertainty to meet public expectations and to increase income by augmenting their functions; in turn they are becoming more innovative, competitive, and global. This entrepreneurial attitude has ultimately forced universities to extend the range of their activities at global level. During the past two decades, the internationalisation of universities has increased appreciably in terms of scope, volume, and complexity, and it has also come to be considered as a worthwhile 'business' which involves gains for students, universities, and other stakeholders. Third World counties should join hands to create opportunities for the exchange of students, teachers, and other resources. They should not merely depend on the funding/aid from developed countries but should generate their own resources.

According to *Times Higher Education* Rankings Editor, Ellie Bothwell, "No institution can afford to stand still or remain inward looking. Global – and regional – competition is intensifying, and every university will have to be more resourceful, innovative and internationally oriented than ever to progress and reach their potential. Improving higher education is imperative to the future prosperity and stability of many emerging economies, especially Africa" (Times LIVE, 10 May 2018). Limited funding is a major internal and external obstacle to advancing internationalisation. Being at the southern tip of Africa is a disadvantage due to the distance from other countries, except the Southern African Development Community (SADC) countries; it thus takes a far greater effort for South African universities to be part of the global university fraternity. Therefore, it is very important for our academics and students to create contacts internationally, with an emphasis on also expanding our combined research efforts into Africa. In this regard, a very successful venture in which we have again invested, is the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) – the African organisation for agricultural universities, with 103 members throughout Africa. They have already invested in sustainable-agriculture research projects, funded by the European Union (EU).

As stated in the 2017 yearbook, in the current financial situation where academics have to rely more on finding their own funds by means of grants and interaction with industry, it is also necessary that we do market-related research that is needed by the industry. We cannot afford to only do research that is of an academic nature; we also have to adapt to what industry and the rest of the world requires from us. This implies that we will have to interact on a more regular basis with the various disciplines of industry. The requirements of the industry change year by year, and we have to make sure that we stay relevant. The faculty is in the process of establishing industry advisory boards in the different disciplines to facilitate this.

Staff members were involved in various international activities during the year, including:

- A number of international conferences were organised by various departments in the faculty.
- During the year, a delegation of staff from the Dean's Office and agriculture-related departments undertook a study tour of agricultural universities in Europe to study the latest trends in teaching and research in agriculture.
- The Centre for Environmental Management, in collaboration with the Technical University of Dresden, hosted a workshop to develop a research proposal for a transdisciplinary study investigating the development of a decision-support system to manage the threats associated with extreme climate events.
- Various research groups in the Department of Chemistry have research collaborations with a number of overseas universities in Manchester, Vienna, Antwerp, Leipzig, Bremen, Fribourg, Gothenburg, Missouri, and Zurich.
- The Department of Genetics hosted a number of international researchers during the year.
- DiMTEC participated in research projects with the National University of Public Service in Budapest, Hungary, the Technical University of Dresden, the University of Ljubljana, the Babeș-Bolyai University in Romania, as well as the United Nations University in Bonn.
- Members of the Department of Mathematics and Applied Mathematics continued their international collaboration with researchers from Slovakia, Saudi-Arabia, UAE, Ethiopia, Indonesia, Taiwan, and the USA.
- The Department of Physics hosted the 63rd Annual Conference of the South African Institute of Physics (SAIP 2018), which included a number of international researchers.
- The Department of Plant Sciences organised the very successful International Cereal Rusts and Powdery Mildews Conference (ICRPMC).
- The BRICS (Brazil, Russia, India, China and South Africa)-PLUS Conference on Water–Food–Health Nexus in BRICS-PLUS: Problems, Progress and Prospects, was successfully hosted by the Department of Urban and Regional Planning.

STAFF AND STUDENT ACHIEVEMENTS

We are proud of the many achievements of our staff and students, inter alia:

- Postdoctoral Research Fellow in Architecture, Dr Hendrik Auret, published a book based on his PhD, titled *Christian Norberg-Schulz's interpretation of Heidegger's Philosophy: Care place and architecture.* The book is a substantial contribution to the field of phenomenology and architectural theory.
- Prof Abdon Atangana of the Institute for Groundwater Studies (IGS) published his second book – *Numerical Methods for Fractional Differentiation.*
- Prof Pieter Blignaut (Department of Computer Science and Informatics) is currently the Vice-President of the South African Institute of Computer Scientists and Information Technologists (SAICSIT).
- The Department of Geology's centenary was celebrated with a mini conference and celebratory dinner on the Bloemfontein Campus.
- Prof Kahilu Kajimo-Shakantu was elected and inaugurated as the sixth and first female President of the Association of Schools of Construction of Southern Africa (ASOCSA).

RESEARCH PERFORMANCE

During the 2018 graduations, the Faculty of Natural and Agricultural Sciences conferred a large number of master's and doctoral degrees – the most in many years. A number of staff members also improved their National Research Foundation (NRF)-ratings, with Prof Meyer (Mathematics and Applied Mathematics) retaining his B2-rating and Prof André Roodt (Chemistry) improving his rating to a B2. Dr Kumar (Physics) obtained a Y1-rating. During 2018, four staff members obtained new ratings and 11 re-evaluations were successful. At the end of 2018, the faculty boasted 73 rated researchers.

Prof Abdon Atangana from the Institute for Groundwater Studies and Prof Hendrik Swart from the Department of Physics again emerged as the top research performers in 2018. The following academic outputs were obtained by the faculty during 2018:

- 410 publication output units, which is an improvement of 90 units from 2017. This comprises 38% of the total publication output units of the university.
- Of the 10 departments at the university that published more than 20 article units, 7 were from the faculty. The Department of Physics was again the top performer.

The Flash Facts Competition, a three-minute competition between departments (one for staff and one for postgraduate students), was introduced in 2018. Dr Richard Harris (Department of Physics) was adjudged the winner of the staff competition, while Christopher Rothmann (Department of Microbial, Biochemical and Food Biotechnology) won the postgraduate competition. The competition stimulates debate and gives researchers the opportunity to get insight and understanding of what other departments are doing and how they can potentially collaborate with other departments.

It is my pleasure as Dean to present to you our 2018 Annual Report. I extend my sincere congratulations and gratitude to the staff and students who have contributed to our academic footprint, as well as their selfless commitment to making this faculty and university great. I trust that 2019 will be just as fantastic an experience as 2018; the challenge now is that we will have to strive to improve our academic activities.

I want to conclude with the wise words of the Scottish professor of Geology, James Shand, who said in 1916: "A university is not a lecture theatre, or a library or a laboratory; it is not a building or a place at all; its essence is a frame of mind … Where two or three are gathered together in the name of knowledge, there is a university." Let us take this knowledge from our faculty globally and make our university proud.

Prof Danie Vermeulen
Dean of the Faculty of Natural and Agricultural Sciences

AGRICULTURAL SCIENCES

DEPARTMENT OF AGRICULTURAL ECONOMICS

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OVERVIEW OF 2018

The year 2018 will be remembered as one of the more normal agricultural production years in recent times. The rainfall was good in most summer rainfall areas, while the winter rainfall areas were also able to produce higher crop yields than the previous year.

Despite the more normal climatic conditions, the agricultural sector remained under pressure due to other factors. Some areas continued to struggle under the devastating drought, and producers felt the cost squeeze from rising input costs, while product prices did not show the same tendency. The economy remained weak, with low demand for especially higher-end food products. The issue of land expropriation without compensation placed a damper on investment in agriculture.

The Department of Agricultural Economics takes pride in standing together with agricultural producers during these challenging times. As a department, we try to be involved with primary producers and basic farm-production problems. Moreover, we seek solutions and opportunities in the rest of the value chain that will, in the end, also provide answers and/or solutions for both primary producers and end consumers.

Due to our intense involvement in the agricultural value chain, our teaching and learning, research, and community engagement are natural outflows of our primary involvement. We are therefore in a position to produce graduates, research, and community engagement that are geared towards industry.

ACHIEVEMENTS

Staff Achievements

Two of our staff members, Dr WA Lombard and Dr Frikkie Maré, obtained their PhD degrees in 2018. Dr Maré was also promoted to Senior Lecturer, while Mrs Pascalina Mohlotsane was promoted to Lecturer.

A number of our staff members, of whom we are very proud, received awards and prizes at our annual year-end function and prize-giving ceremony at the University of the Free State (UFS) Paradys Experimental Farm on 16 November 2018. The following prizes were awarded:

- Chairperson Trophy for Service to Department: Dr Nicky Matthews.
- HA Kotze Trophy for Outreach: Kobus van Staden.
- Theo Potgieter Trophy for Farmer Outreach: Walter van Niekerk.
- MF Viljoen Trophy for Research: Dr Yonas Batha.
- CS Blignaut Trophy for Teaching and Learning: Prof Bennie Grové.
- LK Oosthuizen Trophy for Community Service: Dr WA Lombard.
- Staff's Staff Member of the Year: Ina Combrink.
- ADH's Prize for Top Performance: Dr Henry Jordaan.
- Dean's Performer of the Year: Dr Frikkie Maré.

Dr Yonas Bahta attended an online course on 'Transforming for development: The science and practice of resilience thinking' from April to July 2018, organised by the Stockholm Resilience Centre, Stockholm University, and the Centre for Complex Systems in Transition, where he earned a certificate with distinction.

Student Achievements

The first annual Old Mutual Agricultural Student of the Year Competition was held in 2018. The main objective of the competition was to enhance the careers of agricultural students and to motivate prospective students to pursue careers in the agricultural sector. In order to participate, students were required to critically reflect and produce an essay on the major issues within the agricultural sector. We are proud that two students in our department won the Agricultural Economics and Animal Science divisions of the competition. Chéri-Lynn Steyn, with her essay on *Land expropriation without compensation*, was named the best Agricultural Economics Student, and Mario van den Heever, with his essay on *The South African meat classification system*, was named the best Animal Science Student.

Mario van den Heever and Chéri-Lynn Steyn with Adv Koos Nel from Old Mutual

The following students received awards and prizes at our annual year-end function and prize-giving ceremony:

- Best Master's Degree: Sebastian Nyam.
- Best Student Assistant Trophy: Mario van den Heever.
- Johan Willemse Trophy for Student Ambassador: Chéri-Lynn Steyn.

RESEARCH

Our research endeavours during 2018 centred around three broad themes, namely (i) water-related research funded by the Water Research Commission (WRC), (ii) research on livestock economics, mainly funded by Red Meat Research and Development South Africa (RMRD SA) and industry partners, and (iii) projects concerning drought.

Dr Henry Jordaan led two research projects on water-footprint assessment to inform sustainable water use for food and fibre production in South Africa. The first project was specifically concerned with the water footprint of selected field and forage crops, and the second with the water footprint of fuel and fibre crops. In addition, Dr Jordaan and Ms Pascalina Mohlotsane were involved in a collaborative research project with, among others, scientists from Stellenbosch University, exploring the scope of water-footprint assessment to inform sustainable water use in the production of table grapes and wine. In another collaborative research project, Drs Janus Henning and Henry Jordaan worked 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.

Prof Bennie Grové headed an interdisciplinary research team funded by the WRC. The team's research dealt 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. Another research project for the WRC, led by Dr Nicolette Matthews and Prof Grové, aimed to develop 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 worked with Prof Andries Jordaan from the UFS Disaster Management Training and Education Centre for Africa (DiMTEC) on a project for the WRC, exploring farmers' coping and adaptation strategies to drought and other water-related risks in an environment of changing climate.

Our Livestock Economics unit was involved in a variety of research projects related to the economics of livestock production in South Africa. Their research endeavours were mainly funded by RMRD SA, the Red Meat Producers' Organisation (RPO), and private agribusinesses. Research projects funded by RMRD SA included a project on predation in South Africa, of which Mr Walter van Niekerk was part. Dr WA Lombard led two other projects funded by RMRD SA. The first considered the economic impact of stock theft and the factors affecting stock theft in South Africa, and the second focused on research regarding eye-tracking technology for red-meat marketing in the Mangaung Metropolitan Municipality. Dr Frikkie Maré continued his research activities with the Sernick group on the economics and environmental impacts of beef production. Together with Mr Phillip Oosthuizen from Sernick, a feedlot experiment was 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. Dr Maré, Dr Bahta, and Mr Van Niekerk also conducted a follow-up research project for the RPO to assess the impact of the drought on livestock producers.

Dr Yonas Bahta's research explored household resilience to agricultural drought in the Northern Cape of South Africa by focusing on smallholder livestock farmers. The main objective of the project was to determine household resilience to recurrent agricultural drought among smallholder livestock farmers by identifying factors that affected the resilience of households, factors that can be adopted by the farming households, and other factors that will assist farmers to absorb adverse welfare effects due to agricultural drought. Dr Bahta presented his research at the African Economic Research Consortium (AERC) Workshop held in Mauritius in June 2018. The project, funded by a National Research Foundation (NRF) Thuthuka grant since 2018, will continue to 2020.

Dr Bahta (first on the left) with other delegates at the AERC Workshop held in Mauritius, 3 to 6 June 2018

Another NRF-Thuthuka project, led by Dr Abiodun Ogundeji, aimed at developing scenarios for the future management of agricultural water in South Africa in order to identify feasible alternative prospects for agricultural water management within the political, social, economic, and natural environment.

Miss Zimbini Coka worked on a research project with Profs Michael Aliber and Luvuyo Wotshela from the University of Fort Hare. The project looks at the history of land and land issues in the former Ciskei. Part of this research was a continuation of her master's research and was based on an extensive series of interviews, some already conducted and some ongoing, combined with archival material on what has already been done and which are ongoing, combined with archival research.

Many of the research projects are multidisciplinary, involving academics from different departments, such as the Department of Soil, Crop and Climate Sciences, the Department of Animal, Wildlife and Grassland Sciences, the Department of Computer Science and Informatics, and the Centre for Development Support.

COMMUNITY SERVICE

The department is dedicated to giving back to the farming community at large by providing the agricultural sector with relevant information. During 2018, this was done in various ways, including farmers' days, arranged farmer conferences, and popular media, such as *Farmer's Weekly, Veeplaas, Landbouweekblad, Stock Farm*, and *Farmbiz*. Our staff were also regular guests of radio programmes on *OFM* and *RSG*, as well as the occasional television show.

Dr WA Lombard was a guest speaker at the Unicom Agricultural Secondary School's Annual Farmers' Day in Tweespruit. He is also actively involved in the 'Veeplaas Schools Stud Project' through which stud animals (cattle, sheep, and horses) are donated to agricultural schools by stud breeders' organisations.

Dr WA Lombard with other speakers and hosts at the Unicom Agricultural School's Farmers' Day

Ms Zimbini Coka, Minister Naledi Pandor, and Mr Petso Mokhatla at the opening of the Tjheseho Community Learning Centre

Dr Janus Henning was a guest speaker at an information day in Thaba 'Nchu, organised by the Free State Department of Agriculture and Rural Development. He was also a judge at the 2018 Free State Agriculture's (FSA) Young Farmer of the Year competition, which was won by Mr Nelius Ferreira from Harrismith.

As part of community engagement, Miss Ringetani Matlou, a student and research assistant in the Department of Agricultural Economics, delivered a guest lecture on the topic 'Farming for success' to the African Farmers' Association of South Africa (AFASA). On 19 July 2018, she also reported on her MSc work at a conference for smallholder farmers at Hartswater in the Northern Cape. This related to the data collected for her project, titled 'Resilience of households to agricultural drought in the Northern Cape, South Africa', under the supervision of Dr Yonas T Bahta, and funded by the NRF-Thuthuka programme.

Mr Petso Mokhatla and Ms Zimbini Coka, lecturers in the department, together with a master's student, Mr Moatlhodi August, were guest speakers at an information day on beef markets and finance, hosted collaboratively by the Free State Department of Agriculture and Rural Development and the Agricultural Research Council (ARC) at Meadows, Bloemfontein, on 17 May 2018.

Mr Mokhatla and Miss Coka also represented the department at Kgotso-Uxolo Secondary School, Reitz, on 20 October 2018, where the Minister of Higher Education and Training, Dr Naledi Pandor, officially launched the Tjheseho Community Learning Centre as an agricultural skills hub, in collaboration with Vrystaat Koöperasie Beperk (VKB).

Dr Frikkie Maré was an invited speaker at various farmers' days, including the Springbok Farmers' Union annual Beef Farmers Day, held in Senekal. He was also an invited speaker at the popular Aldam Stockman School at Allemanskraal Dam.

Mr Walter van Niekerk remained actively involved with the National Lucerne Trust, which provides training days for lucerne producers and role players.

OTHER ACTIVITIES

As the department is part of a very diverse agricultural sector, we are involved in a wide range of activities in the sector. In addition to the activities related to research, community engagement, and collaboration mentioned above, the following activities are also worth noting.

On 19 April 2018, the Agricultural Management honours class in Farm and Agribusiness Management, presented by Miss Z Coka and Mr PZ Mokhatla, visited the Bishops Glen dairy farm of Mr Mick Quin. The farm was featured in the 23 March 2018 issue of *Farmer's Weekly*. The purpose of the visit was to give the students practical experience of farm business management. Mr Quin demonstrated his marketing strategies, the general policies followed on his farm, the different divisions on the farm (i.e. animals/pasture), and the roles of the farm managers in the different divisions, as well as his role as overall farm owner.

The Agricultural Management honours class with Mr Mick Quin during their farm visit

The department was represented at the African Livestock Fair (ALFA) agricultural expo, which was held at the Afridome in Parys, Free State, from 18 to 20 September 2018. The department was also one of the organisers of the Veeplaas Intensive Sheep Farming School. Four schools were presented in Bloemfontein, Pietermaritzburg (Royal Show), Port Elizabeth, and Bredasdorp (NAMPO Cape) during 2018. Dr Frikkie Maré acted as speaker at all four schools. In an additional education engagement, Dr Janus Henning, Dr WA Lombard, and Mr Petso Mokhatla presented an Agricultural Workshop at the Glen Agricultural College.

Theresa Lubbinge (Bayer), Dr Karin Wessels (Mamre), and Dr Frikkie Maré at one of the Intensive Sheep Farming Schools

Drs Enoch Owusu-Sekyere, Henry Jordaan, and Frikkie Maré, and Mr Tosho Adetoro

POSTGRADUATE STUDENTS

At the 2018 graduations, nine students graduated with BAgricHons majoring in Agricultural Economics, a further seven with BScHons majoring in Agricultural Economics, and three with BSc (Agriculture) Hons majoring in Agricultural Economics. Sixteen students graduated with the BAgricHons majoring in Agricultural Management.

A total of 19 postgraduate students were registered at master's and PhD level in the Department of Agricultural Economics for the year 2018.

Five master's students graduated in 2018 (Frederik Terblanche, Adetoso Adetoro, Mathule Mogano, Philip Brandt, and Dakalo Muthelo), and three PhDs were conferred:

Maré, Frikkie Alberts.
Thesis: *The water-economy nexus of beef produced from different breeds of cattle.*
Promoter: Dr H Jordaan.

Owusu-Sekyere, Enoch.
Thesis: *Multiple footprint indicator assessment: Implications on consumer preferences and welfare.*
Promoter: Dr H Jordaan.

Lombard, Willem Abraham.
Thesis: *Applying eye-tracking technology to investigate red meat consumer's purchasing preferences: A case study of the Mangaung Municipality.*
Promoter: Dr JH van Zyl.

POSTDOCTORAL RESEARCH FELLOWS

In 2018, the department hosted one Postdoctoral Research Fellow, Dr Enoch Owusu-Sekyere, from Cameroon.

STAFF MATTERS

Dr Frikkie Maré was appointed as Academic Head of Department for a period of five years on 1 July 2018, succeeding Dr Henry Jordaan.

Prof Ashok Chapagain was appointed as Senior Professor in the department. He holds a PhD in the field of Water Resources Management and Policy Analysis from the Delft University of Technology in the Netherlands. His appointment provides a unique opportunity to help establish the UFS at the forefront of water research in South Africa.

Prof Ashok Chapagain, Senior Professor in the Department of Agricultural Economics

RESEARCH OUTPUTS

RESEARCH ARTICLES

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CONFERENCE CONTRIBUTIONS

Bahta, YT and Owusu-Sekyere, E. 2018. *Impact of agricultural and food policy intervention on nutrition outcome among rural households in South Africa and Lesotho: The case of homestead food garden programmes.* Paper delivered at the African Economic Research Consortium (AERC), AREC-BMGF Agriculture and Food Policy Analysis for Nutrition Workshop, Port Louis, Mauritius. 3-7 June.

Matthews, N and Grové, B. 2018. *Precision scheduling for water and salt management.* Paper presented at the 8th South African National Commission on Irrigation and Drainage (SANCID) Symposium. White River, South Africa. 14-15 November.

Motaung, NA, Chapagain, AK, Owusu-Sekyere, E and Jordaan, H. 2018. *Water footprint of tobacco production in South Africa: Implications for water use policies at a farm level.* Paper delivered at the SA National Committee on Irrigation and Drainage Symposium 2018, White River, South Africa. 13-15 November.

Ncube, A, Bahta, YT, Jordaan, AJ. 2018. *Socio-economic coping and adaptation mechanisms employed by Sub-Saharan migrant women in South Africa.* Paper delivered at the SADC Regional Disaster Risk Reduction Conference, Menlyn, Pretoria, South Africa. 26-28 March.

Ogundeji, AA and Maré, FA. 2018. *Price transmission in the beef value chain – The case of Bloemfontein.* Paper delivered at the 30th International Conference of Agricultural Economists (ICAE), Vancouver, Canada. 28 July-2 August.

Owusu-Sekyere, E, Owusu, V, Donkor, E and Jordaan, H. 2018. *Welfare estimates of food safety and quality policy changes in southern Ghana.* Paper delivered at the 30th International Conference of Agricultural Economists (ICAE), Vancouver, Canada. 28 July-2 August.

Owusu-Sekyere, E, Mahlathi, YY and Jordaan, H. 2018. *Understanding South African consumers' preferences and market potential for environmentally sustainable products: Implications of water and carbon footprint labels.* Paper delivered at the South African National Committee on Irrigation and Drainage Symposium, White River, South Africa. 13-15 November.

DEPARTMENT OF AGRICULTURAL ECONOMICS

STAFF (2018)

Head of Department: Dr FA Maré

Senior Professor: Prof AK Chapagain

Associate Professor: Prof B Grové

Affiliated Professor: Prof M Bergman

Senior Lecturers: Dr FA Maré, Dr H Jordaan, Dr N Matthews, Dr AA Ogundeji, and Mr JJ van Staden

Lecturers: Dr JIF Henning, Dr WA Lombard, Mr P Mokhatla, Mr Wr van Niekerk, and Mr M Venter

Junior Lecturers: Ms P Mohlotsane and Ms Z Koka

Senior Researcher: Dr YT Bahta

Researcher: Ms P Madende

Research Assistants: Mr A Adetoro, Mr A Ferreira, Mr B Jammer, Mr M Monteiro, Mr M van den Heever, Ms N Motaung, Ms K Netshifhefhe, Ms C-L Steyn, Ms A Erasmus, Ms S Hayward, and Ms C Lues

Research Associates: Dr BG Riddout and Dr D Strydom

Affiliated Researcher: Mr PL Oosthuizen

Officers: Ms C van der Merwe and Ms CS Combrinck

DEPARTMENT OF
ANIMAL, WILDLIFE AND GRASSLAND SCIENCES

CONTACT DETAILS

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OVERVIEW OF 2018

The better rainfall in the first half of 2018 and the excellent prices obtained for basically all species, resulted in much higher profits for livestock farmers. This led to renewed optimism in the livestock industry and record prices were paid for breeding stock, with a Bonsmara bull selling for R1,8 million. Unfortunately, several areas in the summer-rainfall areas experienced drought during the second half of 2018. The Free State and North West was especially hard hit, and there were several reports on the plight of maize farmers in the western part of the province. Livestock farmers in the central part of the Karoo were also in dire need of assistance due to below-average rainfall of up to seven years. The Department of Animal, Wildlife and Grassland Sciences is actively involved in efforts to alleviate the plight of these farmers. The drought again highlighted the importance of not only proper veld management, but also adapted genotypes, as well as alternative feed sources such as spineless cactus pear. Research at the Vaalharts Research Station, undertaken in collaboration with the Agricultural Research Council (ARC) and the Department of Agriculture in the Northern Cape, demonstrated the importance of indigenous genotypes, especially in the era of climate change.

The outbreak of listeriosis, a serious foodborne disease and notifiable medical condition in South Africa since December 2017, had a serious negative impact on pork producers. The link between Listeria monocytogenes sequence type 6 (ST6) – found in a meat-processing plant – and 'polony' (a ready-to-eat processed meat), was believed to be the source of the outbreak. Pork prices at producer's level decreased with almost R8/kg in a short period of time due to the closure of meat-processing plants; this had a significant negative financial impact on farmers. The importance of strict biosecurity and hygiene-control measurements were once again emphasised, while the close relationship between the primary (pig farmers) and secondary (meat processors) agricultural industries highlighted the importance of the 'farm-to-fork' approach in terms of quality control.

The implications of the avian-influenza outbreak in the poultry industry during 2017 were still evident during the first half of 2018, with lower egg volumes traded and an increase in egg prices for producers. Consequently, the availability of point-of-lay hens as well as day-old broiler chickens was under pressure, making it more difficult for small-scale farmers to enter this market. It seems that large-scale poultry operations will diversify into smaller production units spread over different locations in order to mitigate the risk of disease outbreaks such as avian influenza.

The adoption of the policy on land expropriation without compensation by the African National Congress (ANC) placed a damper on the high spirit among farmers after the good rains in early 2018. The urgency of the matter sparked discussions at various levels, even in our own institution. Organised agriculture is actively involved in these discussions. It is, however, important to realise that land redistribution to people without the proper training and financial backing is doomed to failure. To mitigate this, our department is actively involved in training emerging and communal farmers through short courses and a mentoring programme on its experimental farms.

ACHIEVEMENTS

Staff Achievements

Dr Ockert Einkamerer received his PhD during 2018, while Miss J Paulse received her master's degree with distinction.

A documentary on giraffes by Dr Deacon was nominated for the 2019 New York Film Festival Awards.

Student Achievements

Ms Cheri-Lynn Steyn (Animal Science/Agricultural Economics) and Mr Mario van den Heever (Animal Science) were the winners of the Old Mutual National Agricultural Student of the Year competition as respectively the best Agricultural Economics and Animal Science final-year students in South Africa.

Old Mutual National Agricultural Students of the Year, Cheri-Lynn Steyn (Best Agricultural Economics Final-Year Student in SA – 3rd from the left) and Mario van den Heever (Best Animal Science Final-Year Student in SA – 7th from the left)

Five master's and doctoral students presented papers and posters at the 15th Kimberley Biodiversity Research Symposium, held at the McGregor Museum in Kimberley on 26 September 2018.

Ms Imke Stehn received the award for the best student poster at the conference. A number of students successfully participated in the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), held at ARC Roodeplaat, Pretoria.

Mr Marnus Smit was awarded the Best Platform Presentation by a young scientist, Ms Jamie Paulse won the award for the Best Research Poster, and Ms Imke Stehn was selected as the Best Undergraduate Grassland Science student over all study years.

Ms Steyn (BScAgric majoring in Grassland Sciences) also won the Dean's Medal for the final-year student who achieved the best results in respect of a first bachelor's degree (four-year curriculum) in the faculty.

RESEARCH

The department remained actively involved in both research and technology transfer in the various industries it serves. The department focused on several broad topics, namely animal breeding, monogastric (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 were quite diverse and applicable to current problems facing farmers, producers, and wildlife ranchers.

COMMUNITY SERVICE

The annual national Silage King competition, organised by Plaas Media, took place from June to July 2018. The UFS was entrusted to sample maize silage from contestants all over South Africa. Two UFS MSc (Agriculture) students, Mr Evan MacDonald and Mr Kobie van der Walt, were responsible for the correct sampling and logistics of the whole competition; in three weeks, they travelled 12 000 km while sampling a total of 77 silage bunkers.

Several community projects were continued in 2018. The first consists of two Nguni cattle projects in the Northern Cape and Free State in collaboration with the Industrial Development Corporation (IDC) and the respective provincial departments of agriculture, which have been successful in training black farmers for the past ten years. This project involved more than 90 farmers and over 1 000 head of registered Nguni cattle. The recognition received for this project has been very positive.

Another project investigated the use of spineless cactus pear *(Opuntia ficus-indica)* as a source of animal feed, as well as assistance to resource-poor farmers. More than 52 hectares of spineless cactus-pear orchards have been established on 26 farms.

A predator-management information centre has been established in the department. This centre conduct research on the impact of predators (black-backed jackal and caracal) on the livestock industry in South Africa. It is estimated that these predators cost the industry more than two thousand million rand annually. All the livestock sectors are involved in the centre.

Lectures were presented at several farmers' days in South Africa and Namibia, while research trials, sponsored by companies such as Voermol, Molatek, Nutri Feeds, Supreme Chicken, Sernick, and the ARC, were completed. Prof Frikkie Neser was a judge for the Pick n Pay National Stud Farmer of the Year and the Pick n Pay award for the farmer who has made the most progress in the past decade.

NATIONAL AND INTERNATIONAL COLLABORATION

Both national and international collaboration are important for any academic institution. For this department, collaboration with the ARC is of special importance. The two institutions shared several students and the ARC also funded some of the research conducted at the University of the Free State (UFS).

National collaboration was also extended to other organisations, such as the University of Pretoria, the University of Fort Hare, Stellenbosch University, the Department of Agriculture (Glen, Elsenburg, and Grootfontein), the majority of animal-breeding societies, artificial insemination (AI) stations, Breedplan SA, South African Studbook, and various poultry and feed companies. Drs Foch de Witt and Ockert Einkamerer, in collaboration with the technical committee of the Animal Feed Manufacturers Association (AFMA), were involved in evaluating the chemical quality of hominy chop by using different milling processes.

Internationally, collaborative projects were conducted with INRA in France and with several international researchers, such as Dr Mike MacNeil and Dr Vincent Ducrocq, who were also actively involved in both teaching and research in this department.

POSTGRADUATE STUDENTS

Eight students graduated with a BAgricHons majoring in Wildlife Management, while Jurgen Hendriks, Stephanus Els, and Tshepiso Sedumedi graduated with an MSc (Agriculture) in Animal Science.

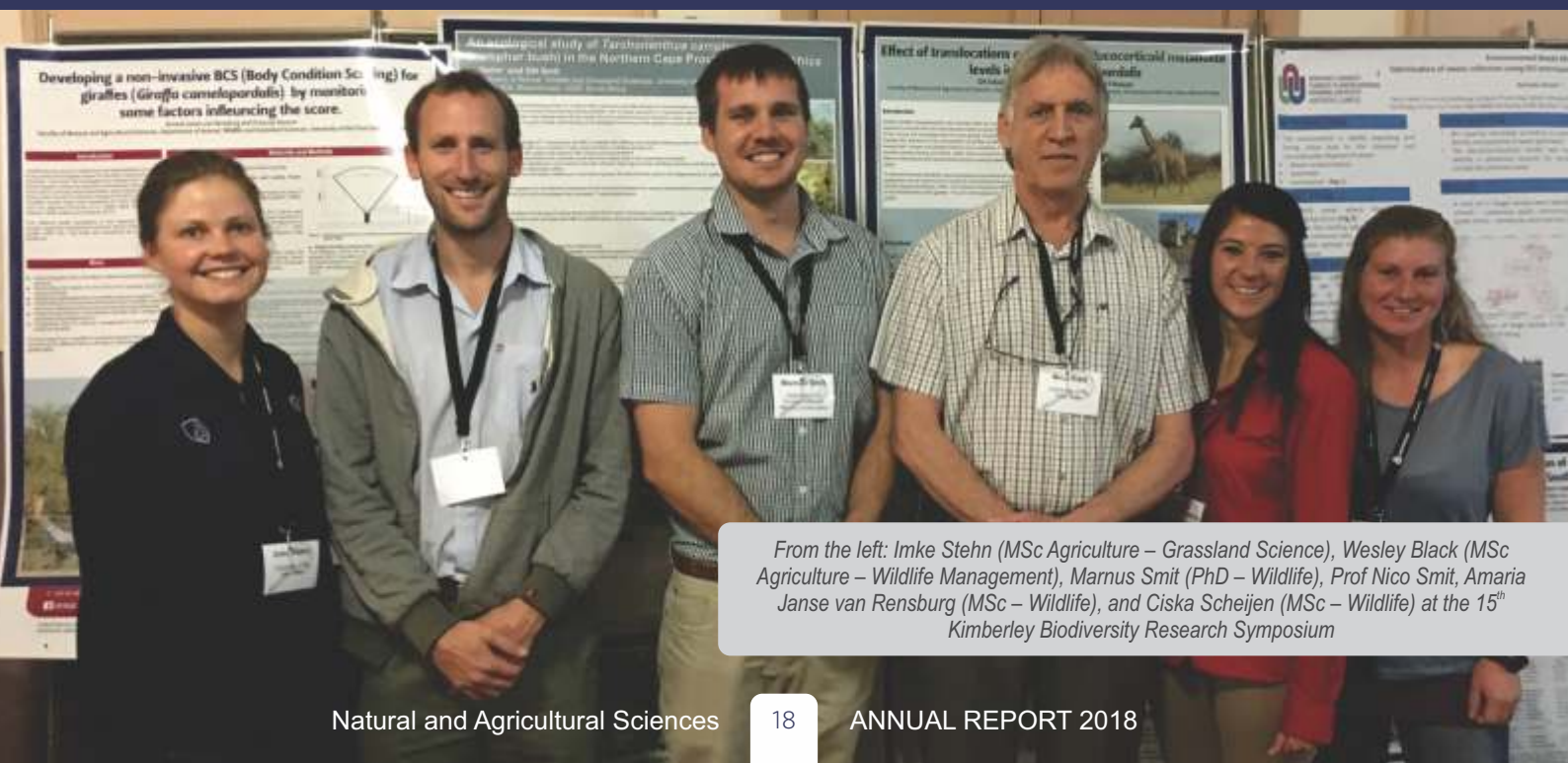
Two PhDs were awarded:

Van der Westhuizen, Lené.
Thesis: *Identification of quantitative trait loci affecting wet carcass syndrome in sheep using high density SNP genotypes.*
Promoters: Dr MD MacNeil and Prof FWC Neser.

Einkamerer, Ockert Bernard.
Thesis: *The effect of NDF, ADF and NPN content in finishing diets on the performance and meat quality of lambs.*
Promoters: Prof A Hugo and Dr V Ferreira.

There were 25 registered postgraduate students (MSc and PhD) in the different disciplines (Animal Nutrition, Animal Physiology, Animal Breeding, Grassland Science, and Wildlife Management) in various stages of their degrees.

Research in the department primarily focuses on applied research, identified in collaboration with the relevant industries, and was mostly driven by the postgraduate students.



From the left: Imke Stehn (MSc Agriculture – Grassland Science), Wesley Black (MSc Agriculture – Wildlife Management), Marnus Smit (PhD – Wildlife), Prof Nico Smit, Amaria Janse van Rensburg (MSc – Wildlife), and Ciska Scheijen (MSc – Wildlife) at the 15th Kimberley Biodiversity Research Symposium

POSTDOCTORAL RESEARCH FELLOWS

In 2018, the department hosted Postdoctoral Research Fellow, Dr Alfredo Lepori from Chile. He left during the course of the year.

STAFF MATTERS

No new appointments were made during 2018. Dr Foch Henry de Witt was promoted to Senior Lecturer.

Two staff members, Mr Benedict Raito and Mr Michiel van Niekerk, resigned during 2018, while Mr Willie Combrinck retired.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Akanno, EC, Chen, L, Abo-Ismail, MK, Crowley, JJ, Wang, Z, Li, C, Basarab, JA, MacNeil, MD and Plastow, GS. 2018. Genome-wide association scan for heterotic quantitative trait loci in multi-breed and crossbred beef cattle. *Genetics Selection Evolution* 50: 48.

Akanno, EC, Abo-Ismail, MK, Chen, LH, Crowley, JJ, Wang, ZQ, Li, CX, Basarab, JA, MacNeil, MD and Plastow, GS. 2018. Modelling heterotic effects in beef cattle using genome-wide SNP-marker genotypes. *Journal of Animal Science* 96: 830-845.

Basu, CK, Deacon, F, Hutchinson, JR and Wilson, AM. 2018. The running kinematics of free-roaming giraffes, measured using a low-cost unmanned aerial vehicle (UAV). *PeerJ* 7:e6312.

Buchanan, JW, MacNeil, MD, Raymond, RC, Nilles, AR and Van Eenennaam, AL. 2018. Comparison of economic returns among genetic evaluation strategies in a 2-tiered Charolais-sired beef cattle production system. *Journal of Animal Science* 96: 4076-4086.

Deacon, F and Bercovitch, F. 2018. Movement patterns and herd dynamics among South African giraffes (Giraffa camelopardalis giraffa). *African Journal of Ecology* 56(3): 620-628.

Deacon, F and Tutchings, A. 2018. The South African giraffe *Giraffa camelopardalis giraffa*: A conservation success story. *Oryx* 53(1): 45-48.

Aherin, DG, Bornmann, J, Heier Stamm, JL, MacNeil, MD and Weaber, RL. 2018. Decision-making tools: stochastic simulation model accounting for the impacts of biological variation on success of bovine embryo transfer programs. *Translational Animal Science* 2: 451–462.

Foster, LA, Fourie, PJ and Neser, FWC. 2018. Production parameters of a beef herd on transitional Cymbopogon-Themeda veld, receiving three different levels of lick supplementation. *South African Journal of Animal Science* 48(2): 213-221.

Leal, WS, MacNeil, MD, Carvalho, HG, Vaz, RZ and Cardoso, F. 2018. Direct and maternal breed additive and heterosis effects on growth traits of beef cattle raised in southern Brazil. *Journal of Animal Science 96*: 2536-2544.

Mapfumo, L, Grobler, SM, Mupangwa, JF, Scholtz, MM and Muchenje, V. 2018. Enteric methane output from selected herds of beef cattle raised under extensive arid rangelands. *Pastoralism: Research, Policy and Practice* 8: 15.

Mkhize, FN, Webb, EC and Scholtz, MM. 2018. Effects of non-genetic factors on the inter-calving period of Nguni cows in South Africa. *South African Journal of Animal Science* 48(6): 1121-1127.

Mokolobate, MC, Scholtz, MM, Neser, FWC and Jordaan, FJ. 2018. Retrospect evaluation of cow productivity in the South African landrace breeds and its environmental impact. *Journal of Animal Science* 96 Suppl 3:520–521.

Muller, Z, Bercovitch, F, Brand, R, Brown, D, Brown, M, Bolger, D, Carter, K, Deacon, F, Doherty, J, Fennessy, J, Fennessy, S, Hussein, AA, Lee, D, Marais, A, Strauss, M, Tutchings, A and Wube, T. 2018. Giraffa camelopardalis. (amended version of 2016 assessment). *The IUCN Red List of Threatened Species* 2018. e:T9194A136266699.

O'Neill, HA, Webb, EC, Frylinck, L and Strydom, PE. 2018. Effects of short and extended fasting periods and cattle breed on glycogenolysis, sarcomere shortening and Warner-Bratzler shear force. *South African Journal of Animal Science* 48(1): 71-80.

Pienaar, L, Grobler, JP, Scholtz, MM, Swart, H, Ehlers, K, Marx, M, MacNeil, MD and Neser, FWC. 2018. Genetic diversity of Afrikaner cattle in southern Africa. *Tropical Animal Health and Production* 50: 399-404.

Pienaar, L, Scholtz, MM and Nephawe, KA. 2018. To twin or not to twin. *Applied Animal Husbandry & Rural Development* 11, 68-75.

Pyoos, GM, Maquashu, AM, Scholtz, MM and Nedambale, TL. 2018. The comparison of three media on the in vitro maturation rate of pig oocytes. *South African Journal of Animal Science* 4: 1026-1031.

Pyoos, CM, Scholtz, MM, MacNeil, A, Theunissen, A and Neser, FWC. 2018. Production statistics for performance traits in fifteen different genotypes. *Journal of Animal Science* 96 Suppl. 3 (7 December): 517.

Teixeira, MBM, MacNeil, MD, Da Costa, RF, Dionello, NJL, Yokoo, MJ and Cardoso, FF. 2018. Genetic parameters and trends for traits of the Hereford and Braford breeds in Brazil. *Livestock Science* 208: 60-66.

Thallman, RM, Kuehn, LA, Snelling, WM, Retallick, KJ, Bormann JM, Freetly, HC, Hales, KE, Bennett, GL, Weaber, RL, Moser, DW and MacNeil, MD. 2018. Reducing the period of data collection for intake and gain to improve response to selection for feed efficiency in beef cattle. *Journal of Animal Science* 96: 854-866.

CHAPTERS IN BOOKS

Neser, FWC. 2018. Selection for adaptability and fertility. In: *Brahman 60 Year Commemorative Journal 1958-2018/Brahman 60 Jaar Gedenkboek 1958-2018* edited by A Gous. pp. 54-56.

Scholtz, MM, Mokolobate, MC, Jordaan, FJ, Pyoos, GM, Linde, DA, Theunissen, A, Seshoka, MM and Neser, FWC. 2018. An overview of ruminant production systems in sub-Saharan Africa and the outlook beyond 2025. In: *Scientific Challenges and Opportunities in the Protein Economy*, edited by EM Binder. Austria: Erber AG. pp. 165-178.

CONFERENCE CONTRIBUTIONS

Black, WJ, Deacon, F and Zietsman, P. 2018. *Objective calculation of a resilience score using ungulates, plants and soils as indicators.* Poster presented at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Black, WJ, Deacon, F and Zietsman, P. 2018. *The calculation of a resilience score, using ungulates, plants and soils as indicators.* Paper delivered at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 2-27 July.

Deacon, F. 2018. *Game Ranching and Giraffes: Connections between Conservation and Sustainable ownership.* Paper delivered at the North American Congress for Conservation Biology 2018, Toronto, Canada. 21-26 July.

Deacon, F, Butler, H, Daffue, W, Smit, N, Haupt, M and Black, W. 2018. *Effective capture and collaring of giraffe.* Paper delivered at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Deacon, F, Butler, H, Daffue, W, Smit, N, Haupt, M and Black, W. 2018. *Effective tranquilization, capturing and collaring of giraffe.* Poster presented at the 9th Oppenheimer-De Beers Group Research Conference, Johannesburg, South Africa. 16-17 October.

Ducrocq, V, Van Niekerk, M and Neser, FWC. 2018. *Comparison of fixed and random regression models for the estimation of (co)variance components for milk production in South African Holsteins under two production systems.* Poster presented at 67th Annual Meeting of the European Association of Animal Production, Dubrovnik, Croatia. 27-31 August.

Janse van Rensburg, A and Deacon, F. 2018. *Determining the BCS (Body Condition Scoring) of giraffes (Giraffa camelopardalis) in different farming systems.* Poster presented at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 22-27 July.

Janse van Rensburg, A and Deacon, F. 2018. *Developing a non-invasive Body Condition Scoring for giraffes (Giraffa camelopardalis) by monitoring some factors influencing the score.* Poster presented at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Kotze, E, Snyman, HA and Du Preez, CC. 2018. *Effect of rangeland management on soil properties in South Africa.* Poster presented at the 21st World Congress of Soil Science, Rio de Janeiro, Brazil. 12-17 August.

Luther-Binoir, I, Daffue, W, Mueffels, J, Deacon, F and Bercovitch, FB. 2018. *Successful semen collection from free-ranging giraffe (Giraffa camelopardalis) by means of electro-ejaculation.* Poster presented at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Luther-Binoir, I, Daffue, W, Mueffels, J, Deacon, F and Bercovitch, FB. 2018. *Successful semen collection from free-ranging Giraffe (Giraffa camelopardalis) by means of electro-ejaculation.* Poster presented at the Wildlife Group of the SAVA (South African Veterinary Association) Congress, Lanseria, South Africa. 1-3 March.

Mokolobate, MC, Schultz, MM, Neser, FWC and Jordaan, FJ. 2018. *Retrospect evaluation of cow productivity in the South African landrace breeds and its environmental impact.* Poster presented at the World Congress on Animal Production, Vancouver, Canada. 5-8 July.

Ngayo, M, Ducrocq, V, Fair, MD, Neser, FWC, Scholtz, MM and Van Wyk, JB. 2018. *Survival analysis for prediction of productive herd life in Nguni cows.* Poster presented at the 69th Annual Meeting of the European Federation of Animal Science, Dubrovnik, Croatia. 27-31 August.

Paulse, J, Couldridge, V, Cupido, C and Deacon, F. 2018. *The diurnal behaviour and diet selection of extralimital giraffe in the Little Karoo.* Poster presented at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 22-27 July.

Pyoos, CM, Scholtz, MM, MacNeil, A, Theunissen, A and Neser, FWC. 2018. *Production statistics for performance traits in fifteen different genotypes.* Poster presented at the World Congress on Animal Production, Vancouver, Canada. 5-8 July.

Scheijen, CPJ, Luther-Binoir, I, Ganswindt, A and Deacon, F. 2018. *Effect of translocations on the faecal glucocorticoid metabolism levels of Giraffa camelopardalis.* Poster presented at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 22-27 July.

Scheijen, CPJ, Luther-Binoir, I, Ganswindt, A and Deacon, F. 2018. *Effect of translocations on the faecal glucocorticoid metabolite levels in Giraffa camelopardalis.* Poster presented at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Smit, M, Deacon, F, Malan, P and Smit, N. 2018. *The influence of phenology on browse availability for game species in a semi-arid environment of the Northern Cape Province.* Paper delivered at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 22-27 July.

Smit, M, Deacon, F, Malan, P and Smit, N. 2018. *The influence of phenology on browse availability for game species in a semi-arid environment of the Northern Cape Province.* Poster presented at the 15th Kimberley Biodiversity Research Symposium (KBRS), Kimberley, South Africa. 26 September.

Theunissen, A, Mokolobate, MC, Scholtz, MM and Neser, FWC. 2018. *Crossbreeding as a potential tool for the South African beef industry's challenge of adaptation and mitigation to global warming.* Paper delivered at the 11th World Congress of Genetics Applied to Livestock Production, Auckland. New Zealand. 11-16 February.

Van der Merwe, C-A, Deacon, F and Marnewick, K. 2018. *Development of a biodiversity management plan for giraffe (Giraffa camelopardalis giraffa) in South Africa.* Poster presented at the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA), Pretoria, South Africa. 22-27 July.

CONFERENCE PROCEEDINGS

Fair, MD, Neser, FWC and Van Wyk, JB. 2018. Estimation of genetic parameters of type and production traits for Namibian Brahman beef cattle. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production*. Auckland, New Zealand. 11-16 February. pp. 894.

Grobler, SM, Scholtz, MM, Neser, FWC, Greyling, JPC, Morey, L and Calitz, FJ. 2018. Effect of high utilization grazing and controlled selective grazing on veld condition in the Sourish Mixed Bushveld. In: *Proceedings of the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA)*, Pretoria, South Africa. 23-26 July. pp. 45.

Hendriks, HJ, Scholtz, MM, Neser, FWC and Van Wyk, JB. 2018. Investigation into genetic parameters for feedlot traits of two cattle breeds in South Africa. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production*. Auckland, New Zealand. 11-16 February. pp. 10.

Josling, GC, Lepori, AA, Neser, FWC, Lubout, PC and Van Wyk, JB. Preliminary results evaluating horn traits of economic importance in sable antelope *(Hippotragus niger niger)*. In: *Book of Abstracts of the 69th Annual Meeting of the European Federation of Animal Science.* Dubrovnik, Croatia. 27-31 August. pp. 609.

Lepori, AA, Josling, GC, Neser, FWC, Lubout, PC and Van Wyk, JB. 2018. Preliminary results evaluating horn traits of economic importance in Cape buffalo *(Syncerus caffer caffer)*. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production*, Auckland, New Zealand. 11-16 February. pp. 530.

Lepori, AA, Josling, GC, Neser, FWC, Lubout, PC and Van Wyk, JB. 2018. Preliminary results evaluating horn traits of economic importance in Cape buffalo *(Syncerus caffer caffer)*. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production.* Auckland, New Zealand. 11-16 February. pp. 530.

Malan, PJ and Snyman, HA. 2018. Understanding the resilience of the Karoo shrub, Nenax microphylla to water availability and defoliation. In: *Proceedings of the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA),* Pretoria, South Africa. 22-23 July. pp. 34.

Scholtz, MM, Mokolobate, MC, Theunissen, A, Seshoka, M, Pyoos, GM and Neser, FWC. 2018. Sustainable livestock production in the era of climate change through targeted interventions. In: *Proceedings of the 53rd Annual Congress of the Grassland Society of Southern Africa (GSSA),* Pretoria, South Africa. 23-26 July. pp. 29.

Van der Westhuizen, L, MacNeil, MD, Scholtz, MM and Neser, FWC. 2018. Genetic variability and relationships among nine southern African and exotic cattle breeds. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production.* Auckland, New Zealand. 11-16 February. pp. 550.

Van der Westhuizen, L, Scholtz, MM, Neser, FWC and MacNeil, MD. 2018. A case-control study to identify a genetic component contributing to wet carcass syndrome in sheep. In: *Proceedings of the World Congress of Genetics Applied to Livestock Production*. Auckland, New Zealand. 11-16 February. pp. 568.

DEPARTMENT OF
ANIMAL, WILDLIFE AND GRASSLAND SCIENCES

STAFF (2018)

Head of Department: Prof FWC Neser

Professors: Prof FWC Neser and Prof GN Smit

Senior Lecturers: Dr MD Fair, Dr F Deacon, and Dr FH de Witt

Lecturers: Dr BB Janecke, Dr HA O'Neill, Dr PJ Malan, Dr OB Einkamerer, Dr MB Raito (resigned), Dr M van Niekerk (resigned), and Ms GC Josling

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

Affiliated Professors: Prof H Snyman, Prof JB van Wyk, Prof M MacNeil, Prof A Maiwashe, Prof TL Nedambale, Prof M Makgahlela, and Prof MM Scholtz

Affiliated Researcher: Ms L vd Westhuizen

Technician: Ms JAM van der Merwe

Chief Officer: Mr WJ Combrinck (retired)

Assistant Officer: Ms NAK Green and Ms CJ Williams

Technical Assistants: Mr NK Long and Mr SA Rowles

Messenger: Ms MV Moses

Cleaner: Ms NM Mokoallo

DEPARTMENT OF
SOIL, CROP AND CLIMATE SCIENCES

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OVERVIEW OF 2018

With three permanent staff members retiring at the end of 2018 and a set of new appointments, the department has undergone some major personnel changes. Prof Chris du Preez retired formally from the university but will still be associated with the department on a part-time basis to continue research and student supervisory activities. In early 2018, Prof Linus Franke took over from Prof Du Preez as the Academic Head of Department.

The department was externally reviewed in October 2018. The recommendations arising from the review were much appreciated and will set the agenda for the transformation of the department in the next few years. In response to the recommendations of the review committee, the department will revise its undergraduate curricula, with the aim of reducing the overlap between modules and placing more emphasis on the development of general academic skills and other identified gaps in modules. This revision should lead to a reduction in the teaching load for academic staff, so that more time can be devoted to postgraduate supervision, research activities, and the development of research outputs. Attention will also be given to the development of a more vibrant research culture in the department and raising the research profile and outputs. In order to broaden the research base in the department, attention will be given to increasing the number of academic staff with a PhD.

ACHIEVEMENTS

Staff Achievements

Dr Allemann was elected as President of the Southern African Weed Science Society (SAWSS), and Dr Elmarie van der Watt was elected as the Secretary of the South African Society of Crop Production (SASCP).

During the 2018 African Combined Congress in Cape Town, Dr Gert Ceronio was elected as the Chairperson of the local organising committee for the 2019 Combined Congress, which will be held on the Bloemfontein Campus. Other staff members (Dr Coetzer, Dr van der Watt, Dr Allemann, and Miss Henning) will serve on the committee.

Dr Allemann won the CropLife award for the best presentation in Weed Science at the African Combined Congress, with a paper titled *Evaluation of metham sodium for the control of volunteer potatoes.*

Dr Allemann receiving the CropLife Award for the best presentation in Weed Science at the African Combined Congress

Prof Du Preez, Dr Kotze, and Prof Van Huyssteen were invited to write two chapters for the book *South African Landscapes and Environmental Change*, published by Routledge and edited by PJ Holmes and J Boardman. The chapters included Chapter 3: CC du Preez, E Kotze, and CW van Huyssteen, titled 'South African soils and their susceptibility to degradation', and Chapter 12 by CW van Huyssteen, CC du Preez, and PJ Holmes, titled 'Agriculture and a changing environment'.

Prof Van Tol was invited to contribute to the International Union of Soil Sciences (IUSS) book on soils and sustainability goals.

Prof Linus Franke was appointed by the National Research Foundation (NRF) to serve on the rating panel of the Earth Sciences Committee for a period of five years. He was also elected as the Chair of the Management Board of the *South African Journal of Plant and Soil.*

Prof Cornie van Huyssteen attended the 21st Congress of the IUSS in Rio de Janeiro, Brazil, in August 2018, during which he acted as co-convener of the session on the World Reference Base (WRB), represented South Africa at the IUSS council meetings, and coached a South African team at the Third International Soil Judging Contest. The South African team finished fifth out of 12 teams, while the best individual South African contestant finished tenth out of 47 contestants.

South African contestants at the Third International Soil Judging Competition held in Rio de Janeiro

Ingrid Allemann receiving the Syngenta Award for the best student presentation in Weed Science at the African Combined Congress

Student Achievements

Miss Ingrid Allemann won the Syngenta award for the best student presentation in Weed Science with a paper, titled *Impact of drought on the allopathic effects of Amaranth*, during the African Combined Congress in Cape Town. She was also elected as Secretary of the SAWSS. At the same congress, PhD student, Mr Allan Machakaire, won the Daan F Retief Floating Trophy for the Best Paper (<40 years) in Crop Science for his paper titled *Eddy covariance techniques to quantify dry matter production and evapotranspiration in potato-maize system.*

Mr HJ Maree was awarded the Omnia award for the best final-year student in Crop Production in the BSc (Agriculture).

Allan Machakaire receiving the Daan F Retief Floating Trophy for the best paper (<40 years) in Crop Science at the African Combined Congress

RESEARCH

Prof Leon van Rensburg's research group includes Dr Johan Barnard, Dr Sabelo Mavimbela, Dr Zaid Bello, as well as Mr Frans Joseph from the Free State Department of Agriculture; Prof Rianto van Antwerpen and Dr Ashiel Jumman from the South African Sugarcane Research Institute (SASRI); Dr Pieter van Heerden of PICWAT; and Dr Willem de Clercq from Stellenbosch University. The team also comprises a number of master's and doctoral students.

In this team, Dr Sabello continued to lead the research on the hydro-physical properties of selected ecotopes at the Kolomela iron mine near Postmasburg. The research aims to provide answers on how rainfall is partitioned between runoff, drainage, evaporation, transpiration, and deep drainage, and is undertaken in response to farmers' concerns about the negative impact of dewatering the mine on the groundwater supply and thus also on farming activities.

Dr Bello's research concentrated on the water footprint of beer, a project sponsored by the Winter Cereal Trust and AB InBev. This project, utilising glasshouse and field studies, focused on the irrigation scheduling of barley. The main findings were captured in the Soil Water Management Programme (SWAMP) model by Dr Barnard.

The other team members (Mr Frans Joseph, Prof Rianto van Antwerpen, and Dr Ashiel Jumman) were involved in a project funded by the Water Research Commission (WRC) related to management guidelines for technology transfer to reduce salinisation 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 soil is spatially monitored over two cropping seasons under ten centre pivots located in four provinces.

Prof Chris du Preez and Dr Johan Barnard were members of a team that completed a WRC report titled *Risk-based, site-specific irrigation water quality guidelines: Decision support system* (WRC Report TT727/17).

Chris du Preez, Elmarie Kotze, Johan Barnard, Johan van Tol, and Cornie van Huyssteen, together with two students (Anizka Stolk and Mischke Bouwer), attended the 21st World Congress of Soil Science in Rio de Janeiro

Prof Van Tol and Dr Van Zijl (now at North-West University) finalised a Department of Environmental Affairs (DEA) project as part of the National Resource Management Programme (NRMP) in the Tsitsa catchment of the Eastern Cape. This project focuses on the mapping of erosion-sensitive areas in order to assist the DEA with rehabilitation planning. The project was conducted in collaboration with the University of Fort Hare and included two MSc students from that university.

Prof Van Tol, Dr Kotze, and Dr Makhosazana successfully negotiated funding from the DEA to develop rehabilitation norms for three NRM priority areas. This project will commence early in 2019. In addition, Prof Van Tol was successful in obtaining funding from the NRF for two projects to be funded over three years (2019–2021). The first is a trilateral project between Zambia, Mozambique, and South Africa which aims to limit biological contamination from pit latrines in sandy soils, while the second project will focus on the interpretation and disaggregation of regional soil information for use in the hydrological model (Soil and Water Assessment Tool [SWAT]).

Prof Van Tol was also part of the Soil Classification Working Group which was tasked with updating the soil-classification system of South Africa. The book, titled *Soil Classification: A Natural and Anthropogenic System for South Africa*, was published in 2018.

During 2018, Prof Cornie van Huyssteen attended the WRB for Soil Resources workshops in Poland and Romania. The WRB for Soil Resources is the official soil-classification system of the IUSS. Prof Van Huyssteen served as Vice-Chair of the WRB working group until August 2018 and will continue to serve on the working group. In 2018, Prof Van Huyssteen's research focused on the wetland soil indicators for the estivation of Rift Valley Fever virus-hosting mosquitoes, relating soil morphology to soil genesis in WRB Retisols, and quantitative determination of soil-water saturation favouring obligate upland and wetland grass species.

Dr Elmarie Kotzé attended the Ecology of Soil Microorganisms (ESM) Conference in Helsinki, Finland in June 2018, where she presented a poster and networked with international experts on soil biology. She hosted a workshop on the determination of soil-active carbon for South African conditions in October 2018, during which the Agricultural Research Council-Small Grain (ARC-SG) Institute and the Department of Agriculture in Elsenburg contributed to the establishment and fine-tuning of a recognised protocol for this very sensitive parameter of soil quality.

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. Research into cactus pear also continued with great success, and a gene bank of 60 cultivars was established on the West Campus. Natural product screening to identify plants producing potential fungicides, pharmaceuticals, insecticides, and herbicides continued during the year, and produced some encouraging results.

Research on a project to evaluate the influence of cold stress on the yield and quality of malting barley (*Hordeum vulgare* L.), sponsored by AB InBev, commenced in June 2018 and promising results were achieved. Jerry Dlamini attended a six-week workshop at Rothamsted Research in Devon, UK, in June 2018, where he worked on greenhouse gas emissions from crop/agricultural lands with different buffer strips.

Jerry Dlamini at Rothamsted Research, Devon

Mr Charles Tharaga conducted research for his PhD on the measurements of evapotranspiration and water-use efficiency of sweet cherry trees in the Eastern Free State. This project is funded by NRF-Thuthuka and Iphekade. In 2018, a new meteorological tower was installed at Ionia Farm outside Ficksburg where the research was conducted, in order to measure the components required to calculate evapotranspiration. A sap-flow system was also installed in the orchard to measure transpiration of the trees.

Mrs Linda de Wet continued with research to analyse rainfall trends in the Free State, while Mr Stephan Steyn conducted research on assessing climate-related fire danger across the central grassland biome of South Africa; this forms part of his PhD and is funded by Iphekade.

Dr Weldemichael Tesfuhuney conducted water-stress-related studies on alternative crops, including teff *(Eragrostis tef)*, other essential mint-family chia seeds *(Salvia hispanica)*, and the pseudocereal amaranth *(Amaranthus cruentus)*. To this end, field trials were conducted at the Kenilworth Experimental Farm for the second consecutive growing season. In addition to determining the yield potential and evapotranspiration rate, the aim of the project is to characterise the degree of drought tolerance and to evaluate the performance of the AquaCrop model under various irrigation levels.

Prof Linus Franke headed research on water and nutrient dynamics in potato-based rotations, with field trials in North West, the western Free State, and the Sandveld (Western Cape). This included field-detailed work using lysimeters and eddy-covariance systems to quantify drainage, leaching, and evapotranspiration, as well as simulation modelling of water and nutrient dynamics in potato-based crop rotations. He was also involved in a WRC-funded project on the contribution of arable agriculture to nitrogen and phosphorus pollution of surface and sub-surface waters, focusing on the lower Vaal River watershed.

Charles Tharaga installing instruments on the meteorological tower at Ionia Farm, Ficksburg

COMMUNITY SERVICE

Dr Weldemichael Tesfuhuney spearheaded demonstration trials in both arable fields and homestead backyard plots in the Thaba 'Nchu district. This forms part of the WRC-funded project on the uptake of knowledge, technology, and practices for improving water productivity in rainfed cropping systems. In this community-based research, farmers are considered as active agents during the implementation processes.

Backyard demonstration plots after rain in Thaba 'Nchu

NATIONAL AND INTERNATIONAL COLLABORATION

Prof JJ van Tol continued his collaboration with the University of Fort Hare through DEA-funded projects. New collaborative agreements were reached with the University of Zambia and the Eduardo Mondlane University in Mozambique through a trilateral NRF-funded project.

Research projects were undertaken with AgraForum, WRC, AB InBev, and Potatoes SA. A collaborative workshop on cactus-pear research was held with the ARC.

Mr Lucas Serage, a PhD student in Agrometeorology supervised by Dr Tesfuhuney, conducted field trials at the Sensako research station located in Meets near Bethlehem. Various micrometeorological and crop-phenological measurements were performed at different growth stages of 12 cultivars under 5 different sowing dates. The aim of this study is to assess the effect of temperature and rainfall variation on wheat vernalisation of different cultivars with different planting dates. Such collaboration outside Bloemfontein is becoming increasingly important in the face of increased climate variability and change, rendering local field trials unsuccessful during times of prolonged drought.

Prof Linus Franke visited the South African Environmental Observation Network (SAEON) monitoring site at Cathedral Peak in May to discuss possibilities for research collaboration at the Afromontane Research Unit (ARU).

Prof Franke also visited the South Africa-Sweden University Forum and established research collaboration with Lund University in Sweden. He visited Wageningen University in the Netherlands to deepen the ongoing collaboration and attend the graduation ceremony of one of the PhD students he had supervised, Dr Daniel van Vugt.

Discussions were held between Mr Stephan Steyn and Dr Winifred Jordaan of the Regional Training Centre at the South African Weather Service on greater collaboration in terms of training of agrometeorological, meteorological, and climatological personnel in Southern Africa.

Through the Office of the Dean, discussions were initiated with Grain SA to establish a long-term research collaboration and the possible establishment of a centre for summer grains at the University of the Free State (UFS).

Johan van Tol, Sue van Rensburg, and Linus Franke at Cathedral Peak

POSTGRADUATE STUDENTS

At the 2018 graduations, five students graduated with a BScHons in Agriculture majoring in Soil Science, and a further four majoring in Agronomy. Four students qualified with a BScHons majoring in Agrometeorology and five graduated with a BScHons majoring in Soil Science.

Five students graduated with their MSc (Agriculture) in Soil Science – Catherine Odendaal, Gladys N Mjanyelwa (with distinction), Johannes J Schimper, Virginia Mathinya, K Bianca, and Andrie Venter.

Five PhDs were also awarded:

Sakumona, Mushekwa.
Thesis: *Growth, yield and physiological response of Zambian winter wheat cultivars in two ecotopes.*
Promoter: Dr J Allemann.

Bouwer, Darren.
Thesis: *Integration of soil morphology, chemistry and hydrometry for optimization of hydrological response models.*
Promoter: Dr JJ van Toll.

Loke, Palo Francis.
Thesis: *Response of soil carbon fractions to land use systems under arid to semi-arid climates in South Africa.*
Promoter: Dr E Kotze.

Hattingh, Astrid Magdalena.
Thesis: *Spatial variability of soil properties in two maize producing areas surveyed for precision farming in North-West Province, South Africa.*
Promoter: Prof CC du Preez.

Tfwala, Cinisani Mfan Fikile.
Thesis: *Contribution of soil water and groundwater towards transpiration of three species in the Ghaap Plateau.*
Supervisor: Prof LD van Rensburg.

POSTDOCTORAL RESEARCH FELLOWS

The department hosted four Postdoctoral Research Fellows in the course of 2018 – Dr Tendai Chibarabada from Zimbabwe, Dr Paulo Loke from South Africa, Dr Zaid Bello from Nigeria, and Dr George Waswa from Kenya. Dr Fabrizio Casales left the department during 2018.

STAFF MATTERS

Prof Chris du Preez retired at the end of 2018 and was subsequently appointed on a contract basis. Dr Linus Franke took over as Departmental Head.

Dr Allemann also retired at the end of 2018; Dr Nester Mashingaidze from Zimbabwe has been appointed to replace him.

Mrs Rida van Heerden, the Departmental Secretary, retired in 2018 and was replaced by Mrs Debre Terblanche.

Dr Johan van Tol was promoted from Senior Lecturer to Associate Professor in the department.

Dr Makhosazana Aghoghovwia obtained her PhD at Stellenbosch University, while Ms VN Mathinya commenced with a sandwich PhD in the Plant Production Systems Group at Wageningen University, under the supervision of Prof Ken Giller, Dr Gerrie van de Ven, and Prof Linus Franke.

Dr Elmarie van der Watt was appointed as Programme Director for the department. The availability of a dedicated director greatly improved the advisory services provided to students. Dr Gert Ceronio has taken over the day-to-day management of the experimental farm, Kenilworth, from Prof Van Rensburg, who will retire at the end of 2019.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Bah, S, Labuschagne, MT and Van der Merwe, R. 2018. Genetic diversity of improved varieties of intraspecific *(O. sativa and O. glaberrima)* and interspecific *(O. sativa x O. glaberrima)* rice. *Genetic Resources and Crop Evolution* 65(3): pp. 797-809.

Casales, FG, Van der Watt, E and Coetzer, GM. 2018. In vitro propagation of pecan - A review. *African Journal of Biotechnology* 17(18): 586-605.

Chungag, A, Van Tol, JJ and Magagula, BK. 2018. Effect of unguided cattle husbandry on selected soil physical properties in common property regimes in Alice, Eastern Cape, South Africa. *Range Management and Agroforestry* 38: 176-180.

Ezui, K, Leffelaar, P, Franke AC, Mando, A and Giller, K. 2018. Simulating drought impact and mitigation in cassava using the LINTUL model. *Field Crops Research* 219: 256-272.

Franke, AC, Van den Brand, G, Vanlauwe, B and Giller, K. 2018. Sustainable intensification through rotations with grain legumes in Sub-Saharan Africa: A review. *Agriculture, Ecosystems & Environment* 261: 172-185.

Gabriel, M, Toader, C, Faul, F, Roßkopf, N, Grundling, PL, Van Huyssteen, CW and Zeits, J. 2018. Peatland substrates in northern KwaZulu-Natal: A study of the forming environments, properties and an approach towards classification. *South African Journal of Plant and Soil* 35(2): 149-160.

Gabriel, M, Toader, C, Faul, F, Roßkopf, N, Grundling, PL, Van Huyssteen, CW, Grundling, A and Zeits, J. 2018. Physical and hydrological properties of peat as proxies for degradation of South African peatlands: Implications for conservation and restoration. *Mires and Peat* 21(23): 1-21.

Jacobs, AJ, Van Tol, JJ and Du Preez, CC. 2018. Farmers' perceptions of precision agriculture and the role of agricultural extension: a case study of crop farming in the Schweizer-Reneke region, South Africa. *South African Journal of Agricultural Extension* 48(2).

Kermah, M, Franke, AC, Adjei-Nsiah, S, Ahiabor, B, Abaidoo, R and Giller, K. 2018. N2-fixation and N contribution by grain legumes under different soil fertility status and cropping systems in the Guinea savanna of northern Ghana. *Agriculture, Ecosystems & Environment* 261: 201-210.

Kosters, R, Du Preez, CC and Amelung, W. 2018. Lignin dynamics in secondary pasture soils of the South African Highveld. *Geoderma* 319: 113-121.

Lebenya, RM, Van Huyssteen, CW and Du Preez, CC. 2018. Change in soil organic carbon and nitrogen stocks eight years after conversion of sub-humid grassland to Pinus and Eucalyptus forestry. *Soil Research* 56: 318-330.

Loke, PF, Kotzé, E, Du Preez, CC and Twigge, L. 2018. Long-term effects of wheat production management practices on some carbon fractions of a semi-arid Plinthustalfs. *Soil Research*, 56: 601-614.

Magomani, MI and Van Tol, JJ. 2018. Impact of fire frequency on selected soil physical properties in a semi-arid savannah Thornveld. *Acta Agriculturae Scandinavica Section B - Plant Soil Science.* DOI: 10.1080/09064710.2018.1495253.

Makuvaro, V, Walker, S, Masere, P and Dimes, J. 2018. Smallholder farmer perceived effects of climate change on agricultural productivity and adaptation strategies. *Journal of Arid Environments* 152: 75-82.

Mamera, M and Van Tol, JJ. 2018. Application of hydropedological information to conceptualise pollution migration from dry sanitation systems in the Ntabelanga area, South Africa. *Air, Soil and Water Research* 11. doi.org/10.1177/1178622118795485.

Mavimbela, SSW, Dlamini, P and Van Rensburg, LD. 2018. Infiltration-excess runoff properties of dryland floodplain soil types under simulated rainfall conditions. *Arid Land Research and Management.* [Online]. doi.org/10.1080/15324982.2018.1531441.

Mengistu, AG, Van Rensburg, LD and Mavimbela, SW. 2018. Shallow groundwater effects on evaporation and soil temperature in two windblown sands (Eutric Cambisol and Chromic Luvisol) in South Africa. *Geoderma Regional* 15 e00190.

Mohlotsane, PM, Owusu-Sekyere, E, Jordaan, H, Barnard, JH and Van Rensburg, LD. 2018. Water footprint accounting along the wheat-bread value chain: Implications for sustainable and productive water use benchmarks. *Water.* 10(1167): 1-16.

Nell, J and Van Huyssteen, CW. 2018. Prediction of primary salinity, sodicity and alkalinity in South African soils. *South African Journal of Plant and Soil* 35(3): 173-178.

Parwada, C and Van Tol, JJ. 2018. Effects of litter quality on macroaggregates reformation and soil stability in different soil horizons. *Environment, Development and Sustainability.* [Online]. doi.org/10.1007/s10668-018-0089-z.

Parwada, C and Van Tol, JJ. 2018. Effects of litter source on the dynamics of particulate organic matter fractions and rates of macroaggregate turnover in different soil horizons. *European Journal of Soil Science* 69 (6): 1126-1136.

Parwada, C and Van Tol, JJ. 2018. Litter quality on particulate organic matter fractions dynamics and macroaggregate turnover rate in different soil horizons. *European Journal of Soil Science.* doi: 10.1111/ejss.12726.

Swanepoel, C, Rötter, R, Van der Laan, M, Annandale, J, Beukes, D, Du Preez, CC, Swanepoel, L, Van der Merwe, A and Hoffmann, M. 2018. The benefits of conservation agriculture on soil organic carbon and yield in southern Africa are site-specific. *Soil and Tillage Research* 183: 72 - 82.

Tfwala, CM, Van Rensburg, LD, Schall, R and Dlamini, P. 2018. Drought dynamics and interannual rainfall variability on the Ghaap plateau, South Africa, 1918–2014. *Physics and Chemistry of the Earth* 107: 1-7.

Tfwala, CM, Van Rensburg, LD, Bello, ZA and Green, SR. 2018. Calibration of compensation heat pulse velocity technique for measuring transpiration of selected indigenous trees using weighing lysimeters. *Agricultural Water Management* 200: 27-33.

Van Tol, JJ and Lorentz, SA. 2018 Hydropedological interpretation of soil distribution patterns to characterise groundwater/surface-water interactions. *Vadose Zone Journal* 17(1).

Van Vugt, D, Franke, AC and Giller, K. 2018. Understanding variability in the benefits of N2-fixation in soybean-maize rotations on smallholder farmers' fields in Malawi. *Agriculture, Ecosystems & Environment* 261: 241-250.

Van Vugt, D and Franke, AC. 2018. Exploring the yield gap of orange-fleshed sweet potato varieties on smallholder farmers' fields in Malawi. *Field Crops Research* 221: 245-256.

Van Zijl, GM. 2018. Digital soil mapping approaches to address real world problems in Southern Africa. *Geoderm* 2019: 1301 - 1308.

CHAPTERS IN BOOKS

Ezui, KS, Leffelaar, PA, Franke, AC, Mando, A, Giller, KE. 2018. Decision Support System for Site-Specific Fertilizer Recommendations in Cassava Production in Southern Togo. In: *Improving the Profitability, Sustainability and Efficiency of Nutrients Through Site Specific Fertilizer Recommendations in West African Agro-Ecosystems, edited by A Bationo, D Ngaradoum, S Youl, F Lompo, and JO Fening. J. Springer,* Cham. pp. 125-138.

Van Tol, JJ, Lorentz, SA, Van Zijl, GM and Le Roux, PAL. 2018. The contribution of hydropedological assessments to the availability and sustainable water, for all (SDG#6). In: *Soil and Sustainable Development Goals,* edited by R Lal, R Horn, R Kosaki, T Kosaki, and T Catena-Schweizerbart, Stuttgart. pp.102-117.

RESEARCH REPORTS

Van Tol, JJ, Akpan, W, Maroyi, A, Mutengwende, N, Huchermeyer, N, Ngesi, S, Nqandeka, HM, Mamera, M, Bradley, G and Rowntree, KM. 2018. *The Mzimvubu Water Project: Baseline indicators for long-term impact monitoring. WRC project No. K5/2433.* Research Report to the Water Research Commission.

Van Tol, JJ, Van Zijl, GM, Manyevere, A, Kanuka, G and Du Plessis, C. 2018. *Characterisation and mapping of erodibility of soils in selected land types in support of the Ntabelanga and Laleni Ecological Infrastructure Project (NLEIP).* Research Report to the Department of Environmental Affairs, National Resource Management.

CONFERENCES CONTRIBUTIONS

Allemann, I, Allemann, J, Van der Watt, E and Cawood, M. 2018. *Impact of drought on the allelopathic effects of Amaranthus.* Paper delivered at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Barnard, JH, Van Rensburg, LD, Bennie, ATP, Du Preez, CC. 2018. *Benefits of soil water measurements for irrigation scheduling of shallow groundwater table cropping systems.* Paper delivered at the 21st World Congress of Soil Science, Windsor Convention and Expo Center, Rio de Janeiro, Brazil. 12-17 August.

Casales, FG, Van der Watt, E and Coetzer, GM. 2018. *In vitro propagation of cactus pear (Opuntia ficus-indica) and establishment.* Poster presented at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Casales, FG, Van der Watt, E and Coetzer, GM. 2018. *Sterilization of pecan [Carya illinoensis (Wangenh.) K. Koch] buds during in vitro culturing.* Poster presented at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Chichongue, OJ, Van Tol, JJ, Du Preez, CC and Ceronio, GM. 2018. *Effects of tillage practices and cropping systems on Maize grain yield in Mozambique.* Paper delivered at the Combined Congress, Cape Town, South Africa. 15-18 January.

Franke, AC, Baijukya, F, Kantengwa, S, Reckling, M, Vanlauwe, B, Giller, KE. 2018. *Poor farmers – poor yields: socio-economic, soil fertility and crop management indicators affecting climbing bean productivity in northern Rwanda.* Paper delivered at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Kotzé, E, Du Preez, CC, Sandhage-Hofmann, A and Amelung, W. 2018. *Effect of rangeland management on soil microbial communities in a sandy savanna and clayey grassland ecosystem, South Africa.* Paper delivered at Ecology of Microorganisms Conference, Hall of Culture, Helsinki, Finland. 17-21 July.

Kotzé, E, Snyman, HA and Du Preez, CC. 2018. *Effect of rangeland management on soil properties in South Africa.* Paper delivered at the 21st World Congress of Soil Science, Windsor Convention and Expo Center, Rio de Janeiro, Brazil. 12-17 August.

Machakaire, A, Ceronio, GM and Franke, AC. 2018. *Eddy covariance techniques to quantify dry matter production and evapotranspiration in potato-maize system.* Paper delivered at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Mokgakala, K, Mathabatha, M and Coetzer, GM. 2018. *Illumina sequencing and characterization of methylated regions in the cactus pear (Opuntia ficus-indica) genome.* Paper delivered at the African Combined Congress, Cape Town, South Africa. 15-18 January.

Tandathu, T, Van der Watt, E and Kotze, E. 2018. *The effect of glyphosate and bio stimulants on ryegrass seedlings (Lolium spp.)* Paper delivered at the Iphakade Congress, Clarens, South Africa. 22–25 October.

Van Tol, JJ and Lorentz, SA. 2018. *The application of hydropedological surveys to quantify the near surface impacts from mining wastes.* Paper delivered at the 11th International Mine Water Association Conference, Pretoria, South Africa. 10-14 September.

Van Tol, JJ, Lorentz, SA, Van Zijl, GM and Le Roux, PAL. 2018. *The contribution of hydropedological assessments to the sustainable management of water for all.* Paper delivered at the 21st World Congress of Soil Science, Windsor Convention and Expo Center, Rio de Janeiro, Brazil. 12-17 August.

DEPARTMENT OF SOIL, CROP AND CLIMATE SCIENCES

STAFF (2018)

Head of Department: Prof AC Franke

Professors: Prof CW van Huysteen and Prof LD van Rensburg

Senior Lecturers: Dr JH Barnard, Dr GM Ceronio, Dr GM Coetzer, Dr E Kotzé, Dr E van der Watt, and Dr JJ van Tol

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

Junior Lecturer: Ms VN Mathinya

Affiliated Associate Professor: Prof CC du Preez

Secretaries: Ms Rida van Heerden and Ms Debré Terblanche

Senior Officers - Professional Services: Ms L Henning and Mr TO Khitsane

Officer - Professional Services: Ms N Radebe

Senior Assistant Officers: Ms A Moffat, Ms R Etzebeth, and Ms Rida van Heerden


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BUILDING
SCIENCES

DEPARTMENT OF ARCHITECTURE

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OVERVIEW OF 2018

The 2018 academic year presented many challenges, but it was nevertheless a productive and rewarding year. The department hosted the prestigious 30th Sophia Gray Memorial Lecture in the Kopanong Auditorium (KovsieKerk). Prof 'Ora Joubert, a former Head of Department, presented *La Promenade Architecturale*. The event was well-attended and well-received by professionals and students. The fashion parade inspired by Prof Joubert's buildings and modelled by students from the Tshwane University of Technology (TUT), was a highlight of the evening. Her lecture also served as a continuing professional development (CPD) event, thus benefiting the architectural profession while at the same time educating students. The Oliewenhuis Art Museum hosted the accompanying exhibition, with experimental models and relief models of Prof Joubert's work produced by our BArch third-year class and students from Nelson Mandela University. Mr Hein Raubenheimer assisted as curator.

ACHIEVEMENTS

Staff Achievements

In March, Dr Gerhard Bosman was rewarded for his research skills and contribution to the university by being promoted to Associate Professor. He received a faculty teaching-achievement award and an additional award in the service-learning category from the Centre for Teaching and Learning.

Ms Wanda Verster chaired the theme on 'Urbanisation in the 21st century' at the South Africa-Sweden University Forum (SASUF) research symposium in Pretoria. She also presented ongoing research and served on the editorial advisory board of *Architecture SA (ArchSA)*, the journal of the South African Institute of Architects (SAIA).

Student Achievements

MArch (Professional) student, Mr Sam Pellisier, received the Free State Corobrik Student of the Year regional prize for his design of a dwelling/institution at the Lamu port in Kenya. Mr Phadi Mabe received the second prize for his design of a Reliquary for the Reverence of Ordinaries in Bloemfontein. Ms Jonel de Wet received the third prize, and the prize for the best use of masonry was awarded to Eugenie Lombard.




Corobrik winners: Sam Pellisier (Student of the Year), Phadi Mabe (2nd prize), Jonel de Wet (3rd prize), and Eugenie Lombard (best use of masonry)

The MArch class of 2018 did very well, with four students earning distinctions in all three modules comprising the structured master's degree.

Mr Stephan Diedericks travelled to Milan with lecturer Zack Wessels as part of the PG Bison Award which he received in 2017.

The third-year BArch students also accepted the challenge to compete in the PPC Imaginarium and PG Bison design competitions.

RESEARCH

Postdoctoral Research Fellow, Dr Hendrik Auret, published a book based on his PhD, titled *Christian Norberg-Schulz's interpretation of Heidegger's Philosophy: Care place and architecture.* The book is a substantial contribution to the field of phenomenology and architectural theory. Dr Auret launched the publication at the experimental dwelling designed and built as part of the Earth Unit research outreach. He also presented components of his research at the PhD with Design Mini Conference.

Mr Kobus du Preez researched aspects of the names of spaces and buildings on the three campuses of the University of the Free State (UFS); this was published as an internal report and may lead to future publications.

Prof Peters co-authored a chapter with Dr Debbie Whelan, titled 'Southern Africa's vernacular diversity' as a component of the book, *Habitat: Vernacular Architecture for a Changing Planet.* Prof Bosman also published work on vernacular architecture in Southern Africa.

COMMUNITY SERVICE

In 2018, Mr Raubenheimer and Prof Bosman continued with the Community Service Learning (CSL) project, 'An experimental earth-constructed dwelling in Mangaung'. Student involvement on site was facilitated within the existing CSL modules of the Department of Architecture. As part of their design and construction modules, small groups of students spent time with community builders and lecturers on site.

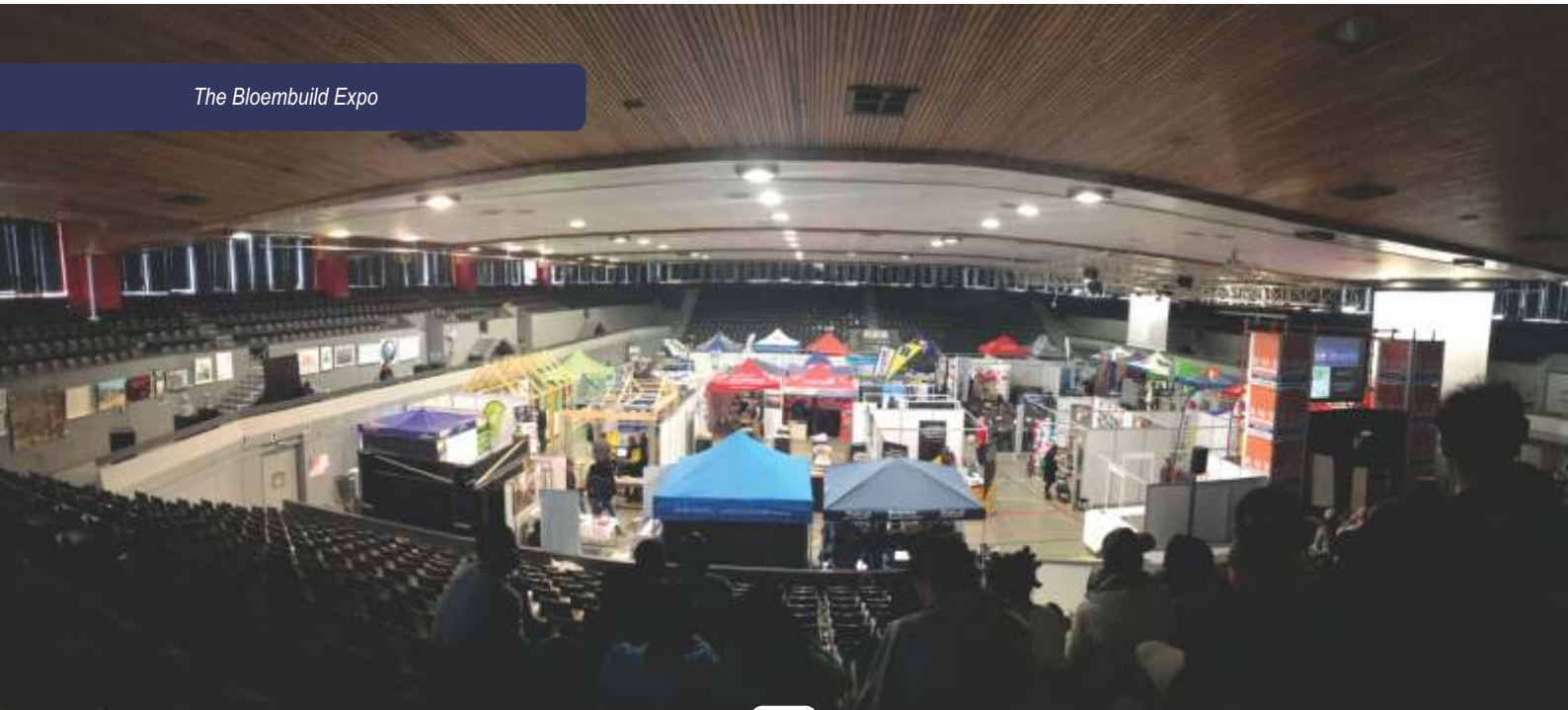
Safintra sponsored the roof sheeting for the project, and building material was recycled from other university projects to create the screen wall. Students also played an active role in the construction of finishes, and the second-year BArch students designed and manufactured pavers. Architecture students in different year-groups received practical instruction on the physical construction of the house, including the casting of a concrete floor bed, electrical installation, painting of internal walls, plumbing, and roof and wall cladding.

Programme Director, Mr Jako Olivier, and Lecturer, Mr Jan Ras, launched a bursary fund for deserving Architecture students. This fund was launched at the 29th Sophia Gray Memorial Lecture and was again highlighted at the 30th Sophia Gray Lecture. The fund is slowly growing, with seven donors generously contributing to date.

Mr Kobus du Preez represented SAIA and the department during school open days in the Free State.

The department co-hosted the 2018 Bloembuild Expo with the SAIA Free State branch and University Estates. Mr Zack Wessels, with the help of the A5 student team and the SAIA Free State staff, managed and organised the event. The theme for the 2018 BloemBuild was 'How to survive the drought' and the lectures and exhibitors focused directly on energy-saving materials, grey-water systems, and environmentally friendly products.

Progress at the experimental house in April 2018



The Bloembuild Expo

Architecture students exhibited their models and were awarded first place in the Corobrik tower-building challenge. Lecturers, Mr Kobus du Preez and Mr Jan Ras, also presented CPD lectures at the event. Members of the public and professionals participated in the colouring-in and photography competitions, which were included in the programme for the first time. First prize in the colouring-in competition was awarded to BArch student Bronwyn Matchett, while BArch Honours students Stephan Diedericks and Matthew Russel received first prize in the CAD challenge.

Mr David van der Merwe teamed up with the Oliewenhuis Art Museum to create a hands-on project for the construction modules in the undergraduate programme. The first-year BArch students placed their skills on display by designing and manufacturing concrete pavers for the labyrinth project at the Oliewenhuis Art Museum in September. Mr Jan Ras and Mr David van der Merwe worked closely with the museum and the additions were covered in the local media *(Volksblad)*.

Students Matthew Russel and Stephan Diedericks at the CAD competition during Bloembuild

Wanda Verster in Stockholm, Sweden

NATIONAL AND INTERNATIONAL COLLABORATION

The collaboration between the Departments of Architecture, Art History, and Image Studies continued with the help of Mr Martin Rossouw. The programme builds the research capacity of honours students in Architecture. Mr Martin Rossouw, Head of the Department of Image Studies, collaborated on Research of Theory of Architecture in the BArchHons programme. Some changes were made to the curriculum of this module to include film research and elements of experiential learning. Mr Rossouw's expertise in film studies also supported students to create short films that were screened during the Vrystaat Arts Festival.

Similarly, the collaboration with the Department of Quantity Surveying and Construction Management ensured exposure to the most relevant information and strategies between the allied professions.

Ms Wanda Verster continued to work with contacts at Uppsala University in Sweden to promote potential collaboration. She was invited to present two lectures at Uppsala University in November. She was also involved in establishing collaborative projects with the Central University of Technology (CUT) under the SASUF project.

Prof Jonathan Noble, Dr Hendrik Auret, and Linelle Visagie, a PhD with Design candidate, attended the RMIT Practice Research Symposium (Europe) from 22 to 25 November 2018, hosted by the BAU Design College of Barcelona, Spain. The symposium provided the opportunity to strengthen the support networks for the new PhD with Design degree programme at the UFS.

The Earth Unit continued with responsibilities as a United Nations Educational, Scientific and Cultural Organisation (UNESCO) Earth Architecture member, by participating in the scientific committees of international conferences hosted by UNESCO partners.

Prof Jonathan Noble during the RMIT Symposium in Barcelona

OTHER ACTIVITIES

As part of a tour organised by Martie Bitzer, the first-year students visited surrounding areas in the Free State, including the iconic Red House and Dutch Reformed Church Welkom West.

Mr Kobus du Preez served on the committee involved with the debate regarding the Pres Steyn Statue on the UFS Bloemfontein Campus. He was involved with the installation on the Red Square aimed at encouraging and facilitating debate on the statue's place and meaning at a 21st century South African university.

Research Assistant Wanda Verster organised a satellite event for the SASUF Research Week with the help of the A5 and master's student assistants. The Department of Urban and Regional Planning and the Office for International Affairs provided support for the event. Rural Urban Dynamic, a two-day research seminar, was attended by researchers from the UFS and CUT, as well as Prof Nils Ekelund and Dr Per Schubert from Malmö University, Sweden. The seminar's exhibition also formed part of the Faculty Open Day.

During the Vrystaat Arts Festival, the department hosted the annual Winter School for Grade 11 and 12 learners who are considering architecture as a career. This event has been a core supplement to departmental marketing activities since 2006.

In March, Dr David Pittaway shared his knowledge with the BArchHons students and presented a special lecture, titled 'The need for remedies to Promethean progress'. He provided practical examples of how he engages with sustainable practices.

Mr Jan Ras and Mr Kobus du Preez organised the events around the August architecture activities at the UFS and assisted with the exhibition of Prof 'Ora Joubert's presentation during the annual Sophia Gray Memorial Lecture.

The department hosted the Architecture Heads of School and the South African Council for the Architectural Profession (SACAP) educational committee meetings. Prof Roger Fischer, representing SAIA, hosted a workshop for academic writers.

Prof Jonathan Noble organised the symposium for the PhD by Design programme. Students and supervisors presented their work during a mini conference as part of the Sophia Gray Memorial Lecture activities. Prof Walter Peters presented a doctoral forum for master's and doctoral students who are following higher degrees by traditional research.

POSTGRADUATE STUDENTS

At the 2018 graduations, thirty-nine students graduated with the BArchHons, and a further four with the BArch Studorium Honours. Twenty-five graduated with the Master of Architecture, with Willem Boshoff and Jani Schreuder obtaining the degree with distinction. A further four students graduated with the Master of Architecture (Professional).

Prof Jonathan Noble supervised the design and implementation of the PhD with Design programme, which saw its first registered candidates in 2018. The programme included a mini conference during the Sophia Gray Memorial Lecture Week, where students could present their work. Prof Noble also used this opportunity to promote the programme to the professional audience. The first cohort of candidates in this programme has also significantly bolstered the higher-degree programme of the department.

Students travelled to the Architecture ZA *We the city* conference (#AZA18) in Pretoria, where Su-Elna Bester represented the department, presenting her 2017 MArch (Professional) design dissertation during the national Corobrik Student of the Year competition.

POSTDOCTORAL RESEARCH FELLOWS

The Postdoctoral Research Fellow hosted by the Department of Architecture, Dr Hendrik Auret, was a very active and involved member of the department in 2018. He represented the department at the Faculty of Natural and Agricultural Sciences Fast Fact Competition with a unique musical presentation, adding creative flair to the faculty event.

He served on the Free State Heritage Resources Authority Permit Committee and supported the conservation of the Free State built environment. He played a significant role in the MT Steyn statue debate by designing the installation on campus, as well as contributing archival research on the statue. He presented a public lecture, titled 'Care, captivation and social cohesion', during the Social Cohesion and Reconciliation Community Conversation at the National Museum in Bloemfontein on 12 December 2018.

STAFF MATTERS

Mr Henry Pretorius's term as Academic Head of Department concluded at the end of 2018. Mr Jako Oliver also ended his term as Programme Director after years of diligent work to ensure effective registration, curriculum design, and compliance with regulatory requirements. He continues to lecture in the department. The responsibility of Programme Director now lies in the capable hands of Mr Kobus du Preez.

Mr Jamie Mitchell, *alumnus* of the department, joined as a contract staff member in Technical Drawing in the first year of the BArch programme, in which he presented SketchUp as a computer-drafting tool. Mrs Hymne Nel, also an alumna, presented Photography in the first year on contract basis.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Noble, JA. 2018. Assimilation, ambiguity and artefacts: Renovating the home of architect Peter Rich. *South African Journal of Art History* 33(3): 74-87.

Verster, W and Jansen van Vuuren, A. 2018. From rural naïveté to urban discontent: Framing post-apartheid South African film identities. *Journal of African Cinemas* 10(1/2): 111-129.

BOOKS

Auret, HA. 2018. *Christian Norberg-Schulz's interpretation of Heidegger's Philosophy: Care, place and architecture.* 1st edition. London, UK: Routledge.

CHAPTERS IN BOOKS

Peters, WH and Whelan, D. 2018. *Southern Africa's vernacular diversity. In: Habitat. Vernacular architecture for a changing planet,* edited by S Piesak. London, UK: Thames & Hudson. pp. 226-235.

REPORTS

Du Preez, JI. 2018. *Report on the naming of streets and buildings UFS.* Delivered to the UFS Naming committee. (Unpublished).

Verster, W. 2018. *Report: SASUF urban rural dynamics peripheral event.* 1. Delivered to Gustaf Cars, Uppsala University, and Chevon Jacobs, Office for International Affairs. (Unpublished).

CONFERENCE CONTRIBUTIONS

Auret, HA. 2018. *Care, design and the site of the moment.* Presented at the Sophia Gray mini congress: PhD with Design, Bloemfontein, South Africa. 30 August.

Verster, W. 2018. *Institutional thresholds as design engagement: A university campus as catalyst for transformative design.* Paper delivered at the Higher Seminar Konstvetenskapliga Institutionen, Uppsala, Sweden. 30 October.

Verster, W. 2018. *Urban and Rural Dynamics: Thaba N'chu and Bloemfontein, dealing with apartheid planning in democratic South Africa.* Paper delivered at the Konstvetenskapliga Institutionens Vänner, Uppsala, Sweden. 5 November.

CONFERENCE PROCEEDINGS

Bosman, G. 2018. Planning of acceptable contemporary earth construction in South Africa. In: *Vernacular and Earthen Architecture: Conservation and Sustainability: Proceedings of SosTierra 2017,* edited by C Mileto, FV Lopez-Manzanares, L Garcia-Soriano, and V Cristini. Valencia, Spain. 14-16 September 2017. pp. 731-736.

Bosman, G and Van Vuuren, C. 2018. The influence of urbanism on the acceptability of traditional earth-constructed houses. In: *Proceedings of the 2016 National Human Settlements Conference.* Boardwalk Conference Centre, Port Elizabeth, South Africa. 5-7 October 2016. pp. 001-007.

Verster, W. 2018. Framing the Gallery: Crossing the threshold in the South African urban context. In: *Proceedings of the International Journal of Arts and Sciences (IJAS).* Florence, Italy. 24-28 June. pp. 167-181.

DEPARTMENT OF ARCHITECTURE

STAFF (2018)

Head of Department: Mr HB Pretorius

Professor: Prof JA Noble

Associate Professor: Prof G Bosman

Senior Lecturers: Mr JL du Preez, Mrs MM Bitzer, and Ms A Wagener

Lecturers: Mr JH Nel, Mr JW Ras, Mr H Raubenheimer, and Mr ZG Wessels

Junior Lecturers: Mr JI Olivier, Mr DPG van der Merwe, and Mr HB Pretorius

Contract Lecturers: Mrs K Salzmann-McDonald, Mr V Moutzouris, Mr J Mitchell, Mr J Deetlefs, and Mrs H Nel

Affiliated Associate Professor: Prof JD Smit

Research Associate: Ms MY le Roux

Research Fellow: Emeritus Prof WH Peters

Secretary: Mrs Y Pretorius

Assistant Officer – Professional Services: Ms W Verster

Assistant Officer: Mr LT Kewsa and Mrs Z Bronkhorst

Messenger: Ms TJ Mohatlane

DEPARTMENT OF
QUANTITY SURVEYING AND CONSTRUCTION MANAGEMENT

CONTACT DETAILS

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OVERVIEW OF 2018

The year 2018 was very demanding but exciting as it built on the momentum of 2017. Both staff and students excelled in various aspects. The department was well-prepared for the South African Council for the Quantity Surveying Profession (SACQSP) programme accreditation visit, which took place on 16 October 2018. This was a major highlight for the department. For most of the year, the focus was on improving the quality and standard of the programmes offered. The staff participated in various research activities, as well as teaching and learning engagements. The research outputs also showed an improvement and it is hoped that this upward trend will continue. The department appreciates its team of dedicated staff for their enthusiasm and valuable contributions towards achieving its vision of becoming the department of choice in the built environment.

ACHIEVEMENTS

From the left: Prof J Smallwood (ASOCSA past president), Prof D Thwala (ASOCSA past president), Prof K Kajimo-Shakantu (ASOCSA incoming president), Mr F Fester (ASOCSA past president), Prof T Haupt (ASOCSA past president)

Staff Achievements

Prof Kahilu Kajimo-Shakantu was elected and inaugurated as the sixth and first female President of the Association of Schools of Construction of Southern Africa (ASOCSA) at the 12th Built Environment Conference held in Durban from 6 to 7 August 2018.

Student Achievements

The department is extremely proud of its students for their achievements in 2018.

Miss Melissa Moss (honours graduate student of 2017 class) was the recipient of the Association of South African Quantity Surveying (ASAQS) 2018 Gold Medal Award. This is the premier award of the ASAQS.

Miss Mariska Karsten (third-year student) was a runner-up for the prestigious ASAQS 2018 Future Leader Award.

Miss Liane van Wyk (honours student) won the Best Student Research Proposal Initiative at the ASOCSA 12th Built Environment Conference.

Prof Kahilu Kajimo-Shakantu (left) with Melissa Moss (centre), recipient of the ASAQS 2018 Gold Medal Award, and Mariska Karsten (right), runner-up for the ASAQS 2018 Future Leader Award

At the Faculty of Natural and Agricultural Sciences prize-giving day, 12 of our students received prizes in various categories in recognition of their academic achievement. These included:

Ms S Louw (first-year student, BSc in Quantity Surveying), Mr A Stoman (second-year student, BSc in Quantity Surveying), Ms M Karsten (third-year student, BSc in Quantity Surveying), Ms M Moss (BScHons in Quantity Surveying), Mr Q Smit (first-year student, BSc in Construction Management), Ms L van Coppenhagen (second-year student, BSc in Construction Management), Mr H Oesterle (third-year student, BSc in Construction Management), and Ms L Liebenberg (BScHons in Construction Management). Ms Karsten also received the prize for the Best Overall Student in any year of study.

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Academic staff members with the visiting SACQSP Accreditation Panel

Special Achievements

The SACQSP re-accredited the BSc in Quantity Surveying and BScHons in Quantity Surveying programmes until the next accreditation cycle.

Tyler Beling, a BSc Quantity Surveying undergraduate who also doubles as a middle-distance athlete for the university, was named the Junior Sportswoman of the Year at the KovsieSport Honours Function held in August 2018.

RESEARCH

A group of three academic staff members, led by Dr C Amoah, was awarded a Faculty Central Research Fund grant for research in Sustainable Human Settlements. The research focuses on examining the level of satisfaction among beneficiaries and determining the extent of community involvement in the low-cost human settlement development process. The project also seeks to examine the capacity of, and challenges faced by the implementation of public-sector agencies.

The department was also represented at a number of national and international conferences, including the 5th International Conference on Development and Investment in Infrastructure (DII) Strategies for Africa in Livingstone, Zambia (one paper presented), the 9th International Conference on Engineering, Project, and Production Management (EPPM) in Cape Town (one paper presented), the 12th Built Environment conference by ASOCSA in Durban (four papers presented), the 10th SACQSP International Research Conference in Johannesburg (three papers presented), the 10th Postgraduate Conference hosted by the Construction Industry Development Board (CIDB) in Port Elizabeth (one paper presented), and the International Conference on Education, Development and Innovation (INCEDI) held in Accra, Ghana (one paper presented) in August.

COMMUNITY SERVICE

Staff and students undertook a community engagement project at the ABC Pre-primary School in Bloemfontein on 21 April 2018. This provided a wonderful learning experience for the students as they applied a variety of their acquired knowledge and skills related to painting, building of play facilities and the maintenance thereof.

NATIONAL AND INTERNATIONAL COLLABORATION

International collaboration efforts resulted in the publication of two journal papers with three collaborators from Obafemi Awolowo University, Ile-Ife, Nigeria. At national level, there was research collaborations with the Nelson Mandela University that yielded one conference publication.

OTHER ACTIVITIES

Departmental First-year Orientation

First-year students, together with their families, were treated to an exciting welcoming function, which included presentations by the Head of Department, Prof Kahilu-Shakantu, and the Programme Director, Mrs Esti Jacobs.

Student Initiative Drive

The South African Council for the Project and Construction Management Professions (SACPCMP) visited the department on 11 May 2018. This was part of a nationwide awareness campaign to encourage the youth to become involved in the organisation's activities. Students were enlightened about the council's activities through an entertaining performance by two actors.

Departmental Day

Coinciding with the SACPCMP, the department held its first 'Departmental Day' on 11 May 2018. This was aimed at creating an informal, interactive platform to engage with students on academic and non-academic matters of mutual interest. It is envisaged to present the event once per semester.

Site visits for students

A number of site visits in Bloemfontein and its surrounds were organised to provide students with exposure to construction activities; this is aimed at enhancing their classroom learning experiences.

Winter School

A successful Winter School was organised for the second time; this took place from 17 to 21 July 2018, mainly for third- and fourth-year students. The focus was on various career paths in the built environment, and guest speakers from industry, lecturers, specialist building-material demonstrations, site visits, and software-application training, including WinQS, DimX and MSPROJECT, formed part of the programme.

POSTGRADUATE STUDENTS

Nineteen students graduated with the BScHons (Quantity Surveying) and one student with the BScHons (Construction Management). Seven students graduated with the BScHons majoring in Construction Management, and 27 majoring in Quantity Surveying.

One PhD in Construction Management was conferred in 2018:

Xhala, Ncedo Cameron.
Thesis: *Challenges and lessons learnt in the financing of public infrastructure in South Africa, Czech and Slovak Republics: A comparative study.*
Promoter: Prof K Kajimo-Shakantu.

Jhon Thatcher participated and presented a paper at the 10th Postgraduate Conference hosted by the CIDB in Port Elizabeth, while Nita Geyer, Patience Mangese, Willem Groenewald, Farzana Thomas, and Marise Bam attended the 10th SACQSP International Research Conference in Johannesburg. Liane van Wyk and Isabella Chandi presented papers at the ASOCSA 12th Built Environment Conference in Durban.

Prof Kahilu Kajimo-Shakantu with past and present students at the 10th SACQSP International Research Conference

POSTDOCTORAL RESEARCH FELLOWS

The department welcomed Dr Akintayo Opawole from Nigeria as a Postdoctoral Research Fellow during 2018.

STAFF MATTERS

Mrs C Ferreira attained registration with the SACQSP as a Professional Quantity Surveyor, while Mr H du Plessis obtained his registration with the SACPCMP as a Professional Construction Project Manager. Mr P Oosthuizen regained his registration as a Professional Quantity Surveyor and also obtained Royal Institution of Chartered Surveyors (RICS) membership.

The department was pleased to welcome two new appointments – Dr C Amoah as Lecturer, and Ms Rhonda Runkel as Senior Assistant Officer.

Mr O Litheko (Senior Assistant Officer) left the department in 2018; his service to the university is appreciated.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Alao, OO, Jagboro, GO and Opawole, A. 2018. Cost and time implications of abandoned project resuscitation: A case study of educational institutional buildings in Nigeria. *Journal of Financial Management of Property and Construction* 23(2): 185-201.

Du Plessis, H, and Oosthuizen, P. 2018. Construction project management through building contracts, a South African perspective. *Acta Structilia* 25(1): 152-181.

Opawole, A, Kajimo-Shakantu, K, Alao, OO and Ogbaje, CP. 2018. Risk factors associated with procuring university hostel facilities through build-operate-transfer model. Journal of Engineering, *Design and Technology* 17(1): 136-154.

CONFERENCE CONTRIBUTIONS

Amoah, C. 2018. *Evaluation of the need of the implementing agents in the public infrastructural delivery in KwaZulu-Natal.* Paper delivered at the South African Council for the Quantity Surveying Profession (SACQSP) 2018 International Research Conference, Johannesburg, South Africa. 31 September-1 October.

Amoah, C and Shakantu, W. 2018. *The impact of foreign construction firms on the capacity building of the local contractors in Ghana.* Paper delivered at 12th Built Environment Conference – Association of Schools of Construction of Southern Africa (ASOCSA), Durban, South Africa. 6-7 August.

Chandi, I, Kajimo-Shakantu, K and Opawole, A. 2018. *An investigation into health and safety factors in the South African construction industry.* Paper delivered at the 12th Built Environment Conference – Association of Schools of Construction of Southern Africa (ASOCSA), Durban, South Africa. 6-7 August.

Du Plessis, H, and Oosthuizen, P. 2018. *A South African perspective on construction contract management. Smallwood, J, Emuze, F.* Paper delivered at the 9th International Conference on Engineering, Project and Production Management (EPPM), Cape Town, South Africa. 24-26 September.

Fungai, SC, Kajimo-Shakantu, K and Opawole, A. 2018. *Exploring public-private partnership as an alternative housing delivery model in Namibia.* Paper delivered at the 12th Built Environment Conference – Association of Schools of Construction of Southern Africa (ASOCSA), Durban, South Africa. 6-7 August.

Mshumpela, SA, Kajimo-Shakantu, K and Opawole, A. 2018. *Critical factors in maintenance of municipal building: a case of Buffalo City Metropolitan Municipality building, Eastern Cape, South Africa.* Paper delivered at the 12th Built Environment Conference – Association of Schools of Construction of Southern Africa (ASOCSA), Durban, South Africa, 6-7 August.

Opawole, A and Kajimo-Shakantu, K. (2018) *Assessment of build-operate-transfer model for hostel facilities procurement in the Nigerian public universities.* Paper delivered at the International Conference on Education, Development and Innovation (INCEDI), Accra, Ghana. 27-28 August.

Opawole, A and Kajimo-Shakantu, K. 2018. *A conceptual framework for procuring PPP contracts in developing countries: an empirical case study of South western Nigeria.* Paper delivered at the South African Council for the Quantity Surveying Profession (SACQSP) 2018 International Research Conference, Johannesburg, South Africa. 31 September-1 October.

Thatcher, J and Els, MM. 2018. *Urban regeneration in South Africa.* Paper delivered at the 10th Construction Industry Development Board (CIDB) Postgraduate Conference, Port Elizabeth, South Africa. 25-27 February.

Xhala, NC, and Kajimo-Shakantu, K. 2018. *Multifaceted Financing Constraints in Public Infrastructure Investment and Development.* Paper delivered at the 5th International Conference on Development and Investment in Infrastructure Strategies for Africa (DII), Livingstone, Zambia. 11-13 July.

CONFERENCE PROCEEDINGS

Mudau, P and Kajimo-Shakantu, K. 2018. Natural disaster occurrences and poverty linkages in rural communities in Vhembe District Municipality with a focus on service and housing conditions. In: *2016 National Human Settlements Conference Proceedings.* Port Elizabeth, South Africa. 5-7 October 2016. pp. 84-92.

Sithole B and Kajimo-Shakantu, K. 2018. *An investigation exploring renewable energy sources in South African rural areas. In: 2016 National Human Settlements Conference Proceedings.* Port Elizabeth, South Africa. 5-7 October 2016. pp. 93-100.

DEPARTMENT OF QUANTITY SURVEYING AND CONSTRUCTION MANAGEMENT

STAFF (2018)

Head of Department: Prof K Kajimo-Shakantu

Professor: Prof K Kajimo-Shakantu

Lecturers: Dr C Amoah, Mr PM Oosthuizen, Mrs M-M Els, Mrs T Bremer, Mrs E Jacobs, Mr H du Plessis, Mr R Seedat, Mr AH Deacon, and Ms TL van Schalkwyk

Junior Lecturer: Mrs C Ferreira

Secretary: Mrs E van der Walt

Officers - Professional Services: Ms M Roux, Mr TH Mogorosi, and Mrs A Beukes

Senior Assistant Officers: Ms M Sepheka, Ms R Runkel, and Mr O Litheko (resigned)

Assistant Officer: Mrs S Olivier

Messenger: Ms P Mosala

DEPARTMENT OF
URBAN AND REGIONAL PLANNING

CONTACT DETAILS

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OVERVIEW OF 2018

The Department of Urban and Regional Planning again excelled in 2018 in terms of strengthening international collaborations and obtaining funding. The BRICS (Brazil, Russia, India, China and South Africa)-PLUS Conference on Water–Food–Health Nexus in BRICS-PLUS: Problems, Progress and Prospects, was successfully hosted by Dr Thulisile Mphambukeli and her team on the Bloemfontein Campus from 2 to 4 September 2018. Over 30 academics and scholars from universities, research institutions, and non-governmental organisations in Russia, India, Ghana, Nigeria, Zimbabwe, Malawi, and South Africa attended the conference. Furthermore, Dr Mphambukeli successfully secured seed funding and seminal grants from the National Institute for the Humanities and Social Sciences (NIHSS).

ACHIEVEMENTS

Staff Achievements

Mr Thomas Stewart was requested to present a training session for parliamentarians on the theory and practice of upgrading informal settlements. This provided him an opportunity to inform policy, as the delegates who attended his workshop were the members of parliament who would formulate and debate housing policy.

Student Achievements

The 8th Planning Africa Conference took place at the Cape Town International Convention Centre from 14 to 17 October 2018. Six of our students were selected to participate in the Young Planners' Colloquium, where they received the first prize for their thought-provoking and insightful presentation with the theme *Planning on the Metro Scale*.

8th Planning Africa Conference's Young Planners' Colloquium. From the left are master's and honours students in Planning: Phelelani Mkhize, Peter Mokonyama, Qhamani Thazi, Tebello Raphuthing, Refilwe Khabe, and Nkululeko Radebe

RESEARCH

Mr Stuart Denoon-Stevens is the primary investigator (PI) of the £10 million South African Planning Education Research (SAPER) project, jointly funded by the Economic and Social Research Council (ESRC) in the United Kingdom (UK) and the National Research Foundation (NRF) Newton Call for Collaborative Research on Higher Education in South Africa. 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 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 collaborating on the project.

Dr Thulisile Mphambukeli was invited to present her work at the BRICS Academic Forum in Sandton. She was also invited to form part of the South African delegation of experts to attend the BRICS Academic Forum in Fuzhou, China.

Following her attendance of the second Urban African Planning Conference in Lisbon in 2017, Prof Verna Nel was invited to submit two chapters (co-authored with PhD candidate Mr Martin Lewis) for a forthcoming book.

The SAPER team, consisting of Mr Stuart Denoon-Stevens, Prof Verna Nel, Ms Rouve Bingle, Ms Mischka Jacobus, and Mr Martin Lewis, shared a fruitful writing retreat with colleagues from the University of Birmingham in Milton Keynes in June. Several policy briefs have already been published.

The SAPER team with University of Birmingham colleagues at a writing retreat in Milton Keynes (UK)

Master's students working on a community-service project during a site visit to Setsoto Local Municipality

COMMUNITY SERVICE

As town planners are required to combine local insights with their professional techniques in a collective attempt to improve place qualities, the 21 students registered for the Applied Urban Planning Project in 2018, were tasked with identifying interventions that could improve the lives of the residents of Setsoto Local Municipality, which includes Ficksburg and Meqheleng.

A spatial analysis and synthesis were initially conducted, followed by a draft Spatial Development Framework document presented to Mr Mohapi Radiopane, the Spatial Planner for the Municipality. Afterwards, Mr Radiopane invited the students to Setsoto to discuss their findings and proposal at a Setsoto Municipal Council meeting. Reciprocal knowledge-sharing between the students and the community has empowered both parties.

NATIONAL AND INTERNATIONAL COLLABORATION

Staff of the department was closely involved in various BRICS-related activities, including hosting the BRICS-PLUS Conference, and participation – through Dr Thulisile Mphambukeli – in the BRICS Academic Forum.

Prof Verna Nel, Prof Maléne Campbell, Mr Thomas Stewart, and Mr Stuart Denoon-Stevens are part of a small mining and communities study group focusing on mining towns. The study group published a co-edited book on Postmasburg (iron ore) in collaboration with Dr Thulisile Mphambukeli and Mr Kgosi Mocwagae. A second proposal was submitted to Edinburgh University Press for a book on Emalahleni (coal). Household surveys and qualitative interviews are undertaken, after which researchers are invited to submit papers for presentation at a conference held annually in November.

The 2018 event was held in Bloemfontein on 12 and 13 November, during which Prof Franklin Obeng-Odoom from Development Studies at the Helsinki Institute of Sustainability Science delivered the keynote address. He subsequently paid a visit to the Northern Cape mining areas, where one of our PhD students, Michelle Goliath, accompanied him to the site of her case study on artisanal mining.

From the left: Prof Innocent Chirisa (University of Zimbabwe), Dr Thulisile Mphambukeli (UFS), and Dr Dillip Das (Central University of Technology) at the BRICS-PLUS conference

The department hosted Dr Suzanne Speak of the Newcastle University (UK), who has visited the department annually since 2015. She presented various research workshops to our research master's and doctoral students.

Ms Latoya Mwanda and Ms Thato Maila, two honours students in Spatial Planning, attended the Economics of Urbanisation summer school at the Vrije Universiteit Amsterdam from 30 June to 14 July.

Latoya Mwanda and Thato Maila in Amsterdam for the summer school at the Vrije Universiteit Amsterdam

Prof Franklin Obeng-Odoom (Development Studies at the Helsinki Institute of Sustainability Science) with PhD candidate, Michele Goliath, at her artisanal mining case study site in Kimberley

OTHER ACTIVITIES

The South African SAPER Team hosted a candidacy workshop at the CSIR (Council for Scientific and Industrial Research) Knowledge Commons in Pretoria in November. This workshop was a platform to gain insight into issues related to planning candidacy registration and finding solutions to these issues regarding graduates in the Planning field. Mr Denoon-Stevens opened the presentations by highlighting and providing insight into 'early-planning career challenges'. Prof Nel addressed the candidacy registration guidelines in a presentation titled 'SACPLAN experiences: Capacity challenges facing candidacy'. The workshop provided a holistic view on the direction in which the planning profession needs to shift in order to progress and improve.

POSTGRADUATE STUDENTS

In 2018, thirty-one students graduated with a Bachelor of Spatial Planning Honours, two of whom obtained the qualification with specialisation in Human Settlements. A total of 25 students graduated with master's degrees – 24 obtained the Master of Urban and Regional Planning (Professional) and one obtained the Master of Urban and Regional Planning (Research).

The Southern African – Nordic Centre (SANORD) awarded the Brian O'Connell (BOC) scholarship to Mr Andile S Mshumpela, who is enrolled for a Master of Human Settlements. Malmö University in Sweden will host him for three to six months while he is conducting research for his dissertation.

POSTDOCTORAL RESEARCH FELLOWS

The department hosted Postdoctoral Research Fellow, Dr Victor Okorie from Nigeria, in 2018.

STAFF MATTERS

Ms Ayanda Duma joined the department in April as a National Research Foundation intern.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Campbell, M and Drewes, E. 2018. A tripartite approach to ensure municipal service delivery: The case of a mining town in South Africa. *Journal of Settlements and Planning* November: 93-102.

Chirisa, I, Mavhima, B and Matamanda, AR. 2018. Youth, the Big Man Syndrome and Human Factor Decay in Urban Land Delivery in Zimbabwe. *Review of Human Factor Studies* 24(1): 46-65.

Denoon-Stevens, SP and Ramaila, E. 2018. Community facilities in previously disadvantaged areas of South Africa. *Development Southern Africa* 35(4): 432-449.

Makunde, G, Chirisa, I, Mazorodze, C, Pfukwa, C and Matamanda, A. 2018. Local governance system and the urban service delivery in Zimbabwe: Issues, practices and scope. *International Journal of Technology and Management* 3(1): 13-13.

Marais, L, Cloete, J, and Denoon-Stevens, S.P. 2018. Informal settlements and mine development: Reflections from South Africa's periphery. *Journal of the Southern African Institute of Mining and Metallurgy* 118(10): 1103-1111.

Marais, L, Cloete, J, Van Rooyen, D, Denoon-Stevens, SP and Nel, V. 2018. Place attachment and social disruption in Postmasburg, a rapidly growing South African mining town. *GeoJournal* [Online first]: https://doi.org/10.1007/s10708-018-9851-x.

Okorie, VO. 2018. From Oil to Water? The deepening crises of primitive accumulation in the waterscapes of Nigeria's Niger Delta. *Africa Spectrum* 53(1): 113-128.

Smit, E and Nel, V. 2018. Spatial divided campus: Divided spatial subculture? *International Planning Studies* 23(3): 239-249.

CHAPTERS IN BOOKS

Beck, BM, Das, DK, Thompson, M, Chirisa, I, Eromobor, S, Kubanza, S, Rewal, T and Burger, E. 2018. Cities as forces for good in the environment: A systems approach. In: *Systems Analysis Approach for Complex Global Challenges*, edited by P Mensah, D Katerere, S Hachigonta, and A Roodt. Springer, Cham. pp. 9-39.

Chirisa, I, Mukarwi, L and Matamanda, AR. 2018. Social costs and benefits of the transformation of the traditional families in an African urban society. In: *Urbanization and Its Impact on Socio-Economic Growth in Developing Regions*, edited by U Benna and I Benna. IGI Global. pp. 179-197.

Chirisa, I, Mukarwi, L and Matamanda, AR. 2018. Sustainability in Africa: The service delivery issues of Zimbabwe. In: *The Palgrave Handbook of Sustainability*, edited by R Brinkman and S Garren. Palgrave Macmillan, Cham. pp. 699-715.

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Chirisa, I, Matamanda, A and Mutambwa, J. 2018. Africa's dilemmas in climate change communication: Universalistic science versus indigenous technical knowledge. In: *Handbook of Climate Change Communication:* Vol. 1, edited by W Leal Filho, E Manoles, AM Azul, UM Azeiteiro, and H McGhie. Springer, Cham. pp. 1-14.

Chirisa, I and Tinashe, B. 2018. Informal sector operations and the environment: Reconnoitering the African urban space for sustainable urban stewardship. In: *Handbook of Research on Urban Governance and Management in the Developing World*, edited by J Mugambwa and MW Katusiimeh. IGI Global. pp. 361-378.

Cloete, J and Denoon-Stevens, S. 2018. Mineworker housing. In: *Mining and Community in South Africa: From small town to iron town*, edited by L Marais, P Burger, and D van Rooyen. London & New York: Routledge. pp. 141-156.

Denoon-Stevens, S, Nel, V, Mphambukeli, T. 2018. Spatial planning for Postmasburg. In: *Mining and Community in South Africa: From small town to iron town,* edited by L Marais, P Burger, and D van Rooyen. London & New York: Routledge. pp. 77-96.

Drewes, E and Campbell, M. 2018. The Tsassamba Committee. In: *Mining and Community in South Africa: From small town to iron town,* edited by L Marais, P Burger, and D van Rooyen. London & New York: Routledge. pp. 63-76.

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Okorie, VO. 2018. Retooling Africa's development: Child and youth inclusion in the development agenda. In: *The Development of Africa: Issues, diagnoses and prognoses,* edited by O Akanle and JO Adesina. Springer. pp. 189-206.

Stewart, T and Drewes, E. 2018. The Khumani approach to homeownership in Postmasburg. In: *Mining and Community in South Africa: From small town to iron town,* edited by L Marais, P Burger, and D van Rooyen. London & New York: Routledge. pp 156-170.

Toba, L and Campbell, M. 2018. Homelessness by choice and by force. In: *Encyclopedia of the UN Sustainable Development Goals.* WL Filho, PG Özuyar, AM Azul, L Brandli, U Azeiteiro, and T Wall. Springer Nature [Online].

CONFERENCE CONTRIBUTIONS

Campbell, M and Drewes, E. 2018. A *hybrid local government approach towards planning and development.* Paper delivered at the Royal Institution of Chartered Surveyors (RICS) Construction, Building and Real Estate (COBRA) Research Conference, London, United Kingdom. 23-24 April.

Denoon-Stevens, SP. 2018. *Principles for designing safe low-income settlements in South Africa.* Paper presented at the Biennial Conference of the Society of South African Geographers, University of the Free State, Bloemfontein, South Africa. 1-5 October.

Okorie, V. 2018. *Revisiting and redeeming the commons: Whither BRICS' political economies?* Paper delivered at the Institute for Global Dialogue (IGD) associated with UNISA, and South African BRICS Think Tank (SABTT) BRICS 2018 Symposium, Johannesburg, South Africa. 22 November.

Massey, R, Denoon-Stevens, S and Nel, V. 2018. *Planning practice at local government level in South Africa: challenges, implications and new approaches.* Paper delivered at International Conference: 50 years of Local Governance 1980-2030, University of Lisbon, Portugal. 4-5 September.

Melore, T and Nel, V. 2018. *Climate change resilience of informal settlements in montane areas.* Paper delivered at the South African Planning Institute (SAPI) Planning Africa Conference, Cape Town, South Africa. 14-17 October.

Muleya, N. 2018. *Sensation and perception: An exploration of human multi-sensory experiences, needs and preferences to enhance planning of the public space in the City of Bulawayo, Zimbabwe.* Paper delivered at the South African Planning Institute (SAPI) Planning Africa Conference, Cape Town, South Africa. 14-17 October.

Reynolds, C and Nel, V. 2018. *A vision for modern African settlements: design and supportive processes.* Paper delivered at the South African Planning Institute (SAPI) Planning Africa Conference, Cape Town, South Africa. 14-17 October.

Steÿn, JJ. 2018. *A third Afrikaner migration: Plans for survival of a people.* Paper delivered at the Regional Studies Association Winter Conference, London, United Kingdom. 15-16 November.

DEPARTMENT OF URBAN AND REGIONAL PLANNING

STAFF (2018)

Head of Department: Prof MM Campbell

Professor: Prof VJ Nel

Associate Professor: Prof MM Campbell

Senior Lecturer: Dr TN Mphambukeli

Lecturers: Mr SP Denoon-Stevens, Mr KS Mocwagae, and Mr T Stewart

Researchers/Research Assistants: Mr G Ceretti, Miss A Duma, Miss RNP Khabe, Miss AM Khumalo, Mr P Mokonyama, Miss T Raphuting, and Mr Q Tshazi

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

Secretary: Mrs MC Hugo

Senior Assistant Officer: Miss A Mgwele

NATURAL
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DEPARTMENT OF CHEMISTRY

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OVERVIEW OF 2018

The Department of Chemistry continues to support the strategic priorities of the University of the Free State (UFS) and the Faculty of Natural and Agricultural Sciences, demonstrated by a steady increase in postgraduate students as prescribed by the Integrated Transformation Plan set up by the UFS top management. The Department of Chemistry is present on all three UFS campuses, with the South Campus concentrating on the extended BSc programme, as well as the University Access Programme (UAP) (approximately 300 students in total); the Qwaqwa Campus catering for 230 local residential students and specialising in Polymer Science research; while the Bloemfontein Campus teaches approximately 920 undergraduate students and conducts research in all four classic Chemistry divisions, namely Analytical, Inorganic, Organic, and Physical Chemistry.

The postgraduate students on the Bloemfontein Campus included 19 honours, 40 MSc, and 20 PhD students, while 7 MSc and 6 PhD students were active on the Qwaqwa Campus. The department hosted 12 Postdoctoral Research Fellows from as far afield as India, Nigeria, Sudan, Ethiopia, and Cameroon.

The research productivity of the personnel and students is clearly demonstrated by the research outputs of 2018, with 62 research articles published (all campuses) in national and international accredited journals and 36 presentations made at local and international conferences, while eight PhD and seven MSc students (two from the Qwaqwa Campus supervised by Dr JP Mofokeng) graduated from the department.

The continued contribution and support of all personnel in the Department of Chemistry, the Dean's Office, the faculty, and senior UFS management are gratefully acknowledged.

STRUCTURE OF THE DEPARTMENT OF CHEMISTRY

The Department of Chemistry on both the Bloemfontein and Qwaqwa Campuses 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, Susan Bonnet, Karel von Eschwege, and Dr Ernie Langner, while Mr Khotso Mpitso is the Subject Head on the Qwaqwa Campus.Analytical, Inorganic, Organic, and Physical Chemistry.

Staff Achievements

In December 2018, Prof Lizette Erasmus received a C3-rating from the National Research Foundation (NRF), while Dr Marietjie Schutte-Smith received a Y2-rating, and Dr Alice Brink a Y1-rating.

Dr Alice Brink presented an invited lecture at the SciDataCon Meeting during the International Data Week in Botswana. She was also nominated for the NRF 2018 Emerging Researcher Award by the UFS Directorate for Research Development, and was a finalist in the Jan Boeyens Prize, which is awarded triennially at the Indaba Series of international conferences held in the Kruger National Park, South Africa.

Dr Alice Brink at the SciDatCon Meeting during the International Data Week in Botswana
From the left: Prof John Helliwell (University of Manchester, UK), Dr Alice Brink (UFS), Dr Amy Sarjeant and Dr Suzanna Ward (Cambridge Structural Data Centre)

Prof Andreas Roodt concluded his 15-year term on the Executive Committee of the European Crystallographic Association and finished his 14-year term as divisional head of Inorganic Chemistry.

During 2018, he presented lectures (one plenary, three keynote, and four invited lectures) at international conferences and venues in the Ivory Coast, Switzerland, Germany, India, and South Africa.

Student Achievements

Ms E Chiyindiko from the Conradie Group won the regional heat of the FameLab competition on 21 February. She then went on to win the FameLab SA 2018 national competition on 10 May.

At the annual faculty prize-giving ceremony, the following students received prizes as best students (2017) in the different categories: Mr G Swart (best second-year student), Mr D Maier (Merck Prize for best third-year student), Miss L Parrott (best honours student), Miss JBM-L Smit (PET Labs 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).

TEACHING

The undergraduate students on the Bloemfontein Campus are trained in theory and practical aspects of all four classical chemistry divisions (Analytical, Inorganic, Physical, and Organic) from the first to the third year, which include approximately 600 first-year students, 100 second-years, and 50 third-year students. Practicals for the first-years are organised, prepared, and controlled by Mss Magda Meyburgh and Jeanette Mmope for approximately 800 students, which include students who access the Bloemfontein stream programmes from the UAP and extended programmes on the South Campus (1st semester). Another laboratory in the Chemistry Building was converted into an additional first-year laboratory to do away with the need for evening practicals. The honours course involved the teaching of 21 students in all four divisions of Chemistry, which included the Forensic Science students who only followed the Analytical modules.

The teaching of Chemistry modules on the South Campus was managed by Ms Rina Meintjes, assisted by four full- and five part-time facilitators. They also manage the Chemistry first-year teaching activities on the Qwaqwa Campus (90 students), as well as the Chemistry enrolment and courses at Further Education and Training (FET) colleges, such as the Goldfields FET College in Welkom (eight students) and the Flavius Mareka FET College in Sasolburg (eight students). A total of 217 students were enrolled at the beginning of 2018 in the first-year Chemistry modules for the BSc Extended Programme on the South Campus, while 76 were enrolled in the UAP programme, which is designed to prepare students with low Admission Point (AP) scores for acceptance/enrolment in mainstream courses on the Bloemfontein Campus.

A new multi-disciplinary laboratory was built and opened on the South Campus in the second semester of 2018. Dr Uwe Siegert was appointed as laboratory manager and trained approximately 220 students in the practical aspects of Chemistry. In future, all the students following Chemistry and Biology on the South Campus will perform their practicals in this laboratory, eliminating the need for daily commuting between the campuses and reducing the pressure on the Bloemfontein Campus laboratories.

Official opening of the multi-disciplinary laboratory on the South Campus by the Rector, Prof Francis Petersen. From the left: Prof D Vermeulen (Dean of Natural and Agricultural Sciences), Prof W Purcell (Head of the Department of Chemistry), Ms E Oosthuizen (Teaching and Learning Manager: Faculty of Natural and Agricultural Sciences), Prof F Petersen (Rector: UFS), and Mr F Marais (Assistant Director: South Campus)

Teaching on the Qwaqwa Campus also involves the theory and practical aspects of all four classic Chemistry divisions, from the first to the third year. This involved approximately 72 first-year students, 70 second-year students, and 60 third-year students. The honours course had an enrolment of eight students, involving the teaching of subjects applicable to Polymer Science, as the research on this campus focuses on Polymer Science.

RESEARCH

Analytical Chemistry

Prof Karel von Eschwege (C3-rated) headed the division. Other staff members in the division include Prof Walter Purcell (C3-rated), Dr Rebotsamang Shago, and Professional Officer, Dr Marianne Conradie-Bekker (Y2-rated and UFS Prestige Scholar). The division was supported by one PhD and five MSc students, as well as one Postdoctoral Research Fellow. One MSc student graduated in this period. The division was involved in one publication in national and international journals, three book chapters, attended three conferences, and made two oral and one poster contributions.

The group focused on a number of 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 to accurately quantify and separate the different elements therein. These projects were conducted in collaboration with the Nuclear Energy Corporation of South Africa's (NECSA) Advanced Metals Initiative (AMI).

Different advanced analytical techniques were 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 Ultraviolet-visible (UV/Vis) Scanning Calorimetry (DSC), and Thermal Gravimetric Analysis (TGA) were also utilised. Elements which continued to be investigated were 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 local and national companies.

The group also focused on different inorganic chemistry projects, such as kinetic and structural studies of organometallic complexes of Ir(I) and Rh(I) oxidative addition reactions, Zr (IV) and Hf (IV) fluoride complexes. All of these studies utilised X-ray crystallography, infrared (IR) spectroscopy, UV/vis, Nuclear Magnetic Resonance (NMR), and computational methods.

In yet another thrust, the group was involved in the investigation of chemical reactions that exhibit multiple chromisms in different transition metal complexes, with potential applications in a variety of sensors and molecular switching devices. Charge-transfer complexes (involving iron, ruthenium, and osmium), with potential applications in dye-sensitised solar-cell technology and photocatalytic reduction of water to hydrogen gas, or carbon dioxide to carbon monoxide syngas, were studied on an ongoing basis. Techniques such as ultra-fast femtosecond pulsed laser, UV/visible, IR, NMR, cyclic-voltammetry, single-molecule Langmuir-Blodgett thin films, Quantum Computational Chemistry (Amsterdam Density Functional [ADF] and Gaussian), and X-ray crystallography were employed. The Analytical section was responsible for the element analyses of other groups in the Departments of Chemistry, Geology, Physics, and Microbiology.

Inorganic Chemistry

This division consisted of two separate research groups which were independently headed by Prof André Roodt (B2-rated) and Prof Deon Visser (C2-rated), respectively.

The research in **Prof Roodt's Group** continued successfully, supported by grants under the prestigious Swiss South Africa Joint Research Programme (SSAJRP: 2017-2020), the NRF Rated Researcher Programme, and grants from SASOL. Drs Johan Venter, Alice Brink (NRF-Thuthuka grant holder) and Marietjie Schutte-Smith were the other senior members within the group. Research was further supported by Dr Truidie Venter (NRF-Thuthuka grant holder) as Chief Officer – Professional Services. The group included five Postdoctoral Research Fellows, eight MSc, and eight PhD students, of whom five PhD and two MSc students graduated during 2018. Both Dr Brink (Y1) and Dr Schutte-Smith (Y2) were UFS Prestige Scholars and received their NRF ratings at the end of 2018. The Roodt Group was involved in 15 publications and one preliminary Patent Cooperation Treaty (PCT) application, while group members attended numerous conferences and made 28 oral and poster contributions during the year. Prof André Roodt and Dr Alice Brink jointly submitted and were successfully granted an NRF National Equipment Programme Grant to the value of R8,5 million for a new state-of-the-art X-ray diffractometer in December 2018. Dr Brink was also successful with a specialised project proposal to SASOL and received a grant for a three-year period.

This group focused 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 probed the 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 Roodt hosted the 1st Microsymposium on Reaction Mechanisms (ReMec1) on the UFS Bloemfontein Campus in November. Other members of the group (Dr Johan Venter, Alice Brink, Marietjie Schutte-Smith, and Truidie Venter) served on the local organising and scientific committees. Prof Roodt was also a co-editor of the book *Systems Analysis Approach for Solving Complex Global Problems.*

Dr Alice Brink managed the X-ray Crystallographic facility for the Department of Chemistry, as well as the international databases (Cambridge Crystallographic Data Centre [CCDC] and Inorganic Crystal Structure Database [ICSD]) which allow any UFS student from the Bloemfontein and South Campuses access to the WebCSD – the online portal to the Cambridge Structural Database (CSD).

Prof Visser's Group focused their research 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 included X-ray crystallography, NMR, chemical kinetics, and photoluminescence and cell fluorescence spectroscopy. The group published six articles in 2018 and delivered one PhD and two MSc students. Currently, the group includes five MSc students and two PhD students.

Organic Chemistry

The division was headed by Dr SL Bonnet, with Prof Vladimir Azov (appointed in 2018), Drs Anke Wilhelm, Charlene Marais, and Linette Twigge (0.4 SLE) as lecturing staff, Mr Rudi Swart as Professional Officer, and Prof Ben Bezuidenhoudt as Research Fellow. The groups were involved in ten papers in the international chemistry literature (two papers by the Phytochemistry group, three papers by the Process Chemistry group, two papers by Dr Twigge, and three papers by Prof Azov). Eight MSc and six PhD students were involved in the division. Two PhD students and one MSc student from Process Chemistry graduated during 2018. One Postdoctoral Research Fellow also enhanced his skills in Organic Chemistry in the Phytochemistry group.

The Organic Chemistry division consisted of three distinct research directions, the Phytochemistry group (Drs Bonnet and Wilhelm) that focused on the isolation and synthesis of natural products and compounds with therapeutic potential and testing of these compounds in a zebrafish model; the Process Chemistry group (Dr Charlene Marais and Prof Ben Bezuidenhoudt) that investigated new methodologies for the synthesis of organic compounds, with the emphasis on catalyst development and evaluation for industrial and other processes; and Prof Azov who investigated tetrathiafulvalenes as building blocks in supramolecular chemistry and dynamic molecular architectures.

Drs Bonnet and Wilhelm established the zebrafish bioassay at the Department of Chemistry, and toxicity screenings of seven-day post-fertilisation zebrafish larvae and activity tested for South African botanicals, which demonstrated the potential of being developed into possible lead compounds against diseases of the central nervous system (CNS), such as epilepsy, mood disorder, anxiety, and insomnia; these investigations will commence shortly.

Dr Bonnet and Dr Wilhelm at the First Conference of Biomedical and Natural Sciences and Therapeutics (CoBNeST) in Stellenbosch

Dr Charlene Marais, Prof Ben Bezuidenhoudt, and the postgraduate students in the Industrial Process Chemistry (IPC) research group visited Klydon (radiopharmaceuticals and aerodynamic separation) and Chemical Process Technologies (CPT) on 19 and 20 June. The research group was briefed on the Klydon and CPT processes and taken on guided tours through the industrial facilities. In turn, the IPC group gave presentations on their research and discussed possible future collaborations with the executives of these companies.

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

Industrial Process Chemistry (IPC) division visit to Chemical Process Technologies (CPT)
Front from the left: Dr Mukut Gohain (CPT), Sibusiso Mncwangi, Jeanette Leygonie, Bathabile Makathini, Melanie Visser, Sangeeta Baruah Gohain (CPT), Chantal Scholtz (CPT), Masibulele Spogter (CPT)
Back from the left: Isaac Mudau (CPT), Jireh de Klerk, Rudi Swart, David Maier, Dr Hannes Malan (CPT), Prof Ben Bezuidenhoudt

Physical Chemistry

The Physical Chemistry division was divided into five distinct and separate research groups which were independently supervised by Prof Jannie Swarts (C1-rated), Prof Jeanet Conradie (C1-rated), Prof Lizette Erasmus (C3-rated), Dr Ernie Langner, and Dr Eleanor Müller (Y2-rated). The division's Professional Officer was Ms Ina du Plessis. Profs Swarts and Conradie both held two NRF research grants (Rated Researcher and Competitive Rated Researcher), while Dr Müller held an NRF-Thuthuka Grant. The Swarts, Erasmus, and Langner groups were funded by research grants from Syngaschem BV. Prof Erasmus was also funded by SASOL. Dr Langner received funding from the Central University of Technology (CUT) and the UFS Joint Research Programme. Postgraduate students in this division included eleven MSc and six PhD students, as well as five Postdoctoral Research Fellows. The division was involved in 32 publications in high-impact journals, attended seven conferences, and made 20 oral and poster contributions.

Prof Swarts' Group focused on synthetic and physical chemistry aspects of multinuclear metallocenes, and concentrated 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.

Visit from alumnus, Dr Jan Beetge (PhD 1994) from Hexion Inc., Houston, with Prof Karel van Eschwege (left) and Prof Jannie Swarts (right)

The research in **Prof Conradie's Group** focused on the synthesis, characterisation, computational chemistry, electrochemistry, kinetics, etc., of ligands, transition-metal complexes, transition states, and reaction-intermediates for application in drugs, dye-sensitised solar cells (DSSC), catalysis, etc.

Prof Erasmus' Group focused on heterogeneous catalysis of especially model catalysts on flat surfaces and materials characterisation with XPS techniques, while **Dr Langner's Group** studied Metal Organic Frameworks (MOFs), especially for catalysis, gas adsorption, and desorption studies, and thermal analysis thereof. **Dr Müller's** research concentrated on polymer chemistry, anti-cancer research, and organometallic chemistry.

Polymer Science

On the Qwaqwa Campus, the research group of **Dr Mngomezulu** and **Dr Mofokeng** focuses on the syntheses of cellulose nanocrystals from office wastepaper and evaluating these nanocrystals as flame retardant bio-based polymer-graphite nanocomposites. The aim of their research is to minimise the amount of waste added to landfill sites to produce new value-added products from the waste material and to create new economic opportunities for wealth creation.

COMMUNITY SERVICE

Academics from the department acted as external reviewers for chemistry journals and for the NRF, and served on faculty and UFS committees, while others made their contributions as external examiners for a number of universities at undergraduate and postgraduate levels and represented the UFS on international research councils, thus contributing a valuable service to the scientific community. In particular, they acted as reviewers for international acclaimed journals, *inter alia*:

- Dr Alice Brink was a reviewer for *Acta Crystallographic C, Journal of Coordination Chemistry,* and *Crystallographic Reviews.*
- Prof Roodt was a member of the Editorial Board for the *Journal of Coordination Chemistry* and acted as a reviewer for publications therein, as well as in 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.*
- Prof Conradie acted as the Physical Chemistry Editor for the *South African Journal of Chemistry,* as well as reviewer for *Inorganica Chimica Acta, Journal of Molecular Structure, ACS Omega (ACS), Dalton (RSC), Arabian Journal of Chemistry, Journal of Organometallic Chemistry, New Journal of Chemistry (RSC),* and *the South African Journal of Chemistry.*
- Dr Erasmus acted as a reviewer for the *SA Journal of Chemistry, ACS Applied Chemistry,* and the *International Journal of Experimental Spectroscopic Techniques.*
- Prof Swarts acted as a reviewer for *Organometallics, Inorganic Chemistry, Inorganica Chimica Acta, Polyhedron,* and the *Journal of Coordination Chemistry.*
- Dr Müller acted as a reviewer for *Inorganica Chimica Acta, Inorganic Chemistry,* and *Transition Metal Chemistry.*
- Prof Azov served as a reviewer for the *Journal of Natural Products, Journal of Organic Chemistry, Chemistry - A European Journal, Journal of Molecular Liquids, Journal of Molecular Structure,* and *Helvetica Chimica Acta.*
- Prof Bezuidenhoudt was a reviewer for the *Journal of Natural Products* and the *Journal of Organic Chemistry.*
- Dr Bonnet was a reviewer for the *Journal of Natural Products, Phytochemistry,* and *Phytochemistry Letters.*
- Dr Wilhelm was a reviewer for the *Journal of Natural Products, Phytochemistry Letters,* and *Natural Product Communications.*
- Dr Marais was a reviewer for the *Journal of Natural Products.*

Prof Karel von Eschwege responded extensively to several private-sector requests on especially sustainable energy, including a radio talk show regarding latest developments in energy storage.

NATIONAL AND INTERNATIONAL COLLABORATION

The Purcell Group continued their research collaboration with Dr Ettienne Snyders from NECSA, Prof Herman Potgieter from the Wits School of Chemical and Metallurgical Engineering, 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 related to a multi-disciplinary research project with the Laser Research Institute in the Department of Physics at the Stellenbosch University, studying electronic transitions and transfers, as well as fast isomerisations of light-sensitive molecular assemblies in real time. Together with the University of Pretoria, highly ordered single-molecule thin films were grown of photo-sensitive materials, for potential application in energy transfer and/or photo-catalytic reactions.

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

Drs Bonnet and Wilhelm continued their collaboration with Prof M Hamburger from the University of Basel in Switzerland, and Prof S Hering from the University of Vienna in Austria, involving phytochemical projects. Drs Bonnet and Wilhelm also collaborated with Prof V Wepener and Dr T Botha from the North-West University on the zebrafish project, and with Dr Leon van Kralingen from the Wattle Industry, Pietermaritzburg on projects involving the sulfomethylation and Mannich reactions of tannins.

Prof Azov collaborated with Dr S Kunz (University of Bremen) on the creation of stereoselective heterogeneous catalysts, with Dr M Zeller (Purdue University), and Prof Vande Velde (University of Antwerp) on crystallography of organic molecules. He also continued to participate in a large international collaborative effort involving scientists from several universities (Purdue University, PNNL, Leipzig University, University of Bremen), related to the gas-phase chemistry of dodecaborates.

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 with Dr Gregory Smith from the University of Cape Town. He also hosted Prof Alessia Bacchi (President of the European Crystallographic Association; University of Parma, Italy), and Prof Lars Öhrström (University of Gothenberg, Sweden) at the UFS, where they presented lectures and held intensive discussions with students.

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 (PET Labs, SA), and Prof Ted E Kroon (UFS Department of Physics) continued during 2018. A preliminary South African patent on multi-nuclear theranostic model agents was granted in December 2017 and revised again in 2018 for an international PCT patent application. 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, Russia, Dr Esna du Plessis (SASOL), the ESRF (Grenoble, France), as well as Dr Fanie Otto (SASOL). Moreover, the research on environmental chemistry, i.e., hydrogen generation and carbon-dioxide utilisation in collaboration with Prof Roger Alberto (University of Zurich, Switzerland), proceeded very well. Ms Valeria Burianova (Russian MSc student) also visited the Roodt group in August to undertake 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 included Dr Louise Natrajan and Dr Simon Tanley (University of Manchester), Dr Colin Levy (Manchester Institute of Biotechnology, UK), Prof Dirk Opperman (UFS Department of Microbial, Biochemical and Food Biotechnology), and Prof Ted Kroon (UFS Department of Physics). A collaboration with the Department of Pharmacology, the University of Pretoria, and the University of Missouri (USA) was initiated in association with Dr Truidie Venter. In February 2018, Dr Brink was a research visitor to the School of Chemistry at the University of Manchester, and in October 2018 she hosted Prof John Helliwell at the UFS. During his visit he presented lectures and mentored the UFS Prestige Scholars.

Prof Swarts collaborated with Prof M Landman (University of Pretoria) on crystallography, Prof Mike Cook (University of East Anglia, UK) on phthalocyanines, Prof Manuel Aquino (Saint Francis Xavier University, Canada) on metal carboxylates, Prof Henry Lang (Chemnitz University of Technology, Germany) on metal carboxylates and electrochemistry, and Prof Hans Niemantsverdriet (Syngaschem BV at DIFFER, Eindhoven University of Technology, the Netherlands) on heterogeneous catalysis. Prof Swarts visited and presented a lecture to the research groups of Prof Henry Lang (Chemnitz University of Technology, Chemnitz, Germany) to further existing collaboration in the fields of electrochemistry, metallocenes, and phthalocyanines. He also visited the Syngaschem BV at DIFFER, Eindhoven University of Technology, the Netherlands, to further existing collaboration in the field of heterogeneous catalysis.

Prof Conradie collaborated with Prof M Landman, Prof P van Rooyen, and Dr F Malan (University of Pretoria), Dr Gurthwin Bosman (Laser Research Institute, Department of Physics, Stellenbosch University), and Dr CGCE van Sittert (North-West University). She also collaborates with Prof Abhik Ghosh (Department of Chemistry and Centre for Theoretical and Computational Chemistry, University of Tromsø, Norway), Prof Irena Hoskovcová (University of Chemistry and Technology, Prague, Czechia), Prof Penny Brothers (University of Auckland, New Zealand), Prof JH Potgieter (Wits and Manchester Metropolitan University, UK), and Claude P Gros (Université de Bourgogne, Dijon, France), Karl M Kadish (University of Houston, Texas, United States), and Dr Jean Jules Fifen (University of Ngaoundéré, Cameroon).

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

Dr Langner collaborated with Dr Kobus van der Walt (CUT) on the development of polypropylene powders for laser sintering, and Prof Hans Niemantsverdriet (Syngaschem BV at DIFFER, Eindhoven University of Technology, the Netherlands) on CO_2 adsorption.

An interdisciplinary research project was initiated between Dr Langner and Dr Richard Harris from the Department of Physics, titled 'Synthesis and computational modelling of selected Metal Organic Framework (MOF) materials with applications in catalysis, drug-delivery and water-purification'. The project was extended to include enhancing CO_2 adsorption of ZIF-8.

Inorganic Chemistry hosting award-winning researcher in Synchrotron and Protein Crystallography, Prof John Helliwell from Manchester University, UK.
Back (from the left): Dr Johan Venter, Mr Mokete Motente (MSc), Prof Andre Roodt, and Prof John Helliwell (Manchester University)
Front (from the left): Dr Orbett Alexander (postdoc) and Ms Zanele Morewa (MSc)

POSTGRADUATE STUDENTS

At the 2018 graduations, 18 students graduated with the BScHons majoring in Chemistry and a further four majoring in Polymer Science. The following seven students received their MSc degrees in 2018: Jireh Smit (Organic Chemistry – with distinction), Marisca Esterhuysen, Verity Gantso, Reabetswe Marogoa (Inorganic Chemistry), Roy Kankwanzi Tuipendi (Analytical Chemistry), Refilwe Mogale (Physical Chemistry), and Tebello Tsotetsi (Polymer Science).

The following students received their PhD degrees in 2018:

Belay, Alebel Nibret.
Thesis: *Coordination chemistry of Niobium(V) and Tantalum(V) with hard O-donor ligands: A solution and solid-state investigation.*
Promoter: Dr JA Venter.

Kama, Dumisani Vincent.
Thesis: *Structural and reactivity relationships in aryl and alkylamine bisphosphine complexes of Tc(I) and Re(I).*
Promoter: Prof A Roodt.

Mokolokolo, Petrus Pennie.
Thesis: *Solid state and mechanistic study of Schiff-base complexes of middle transition and platinum group metal complexes.*
Promoter: Prof A Roodt.

Molokoane, Pule Petrus.
Thesis: *Solid state and mechanistic study on pyrone-based complexes of early, middle and platinum group transition metal elements.*
Promoter: Prof A Roodt.

Elmakki, Mohammed Abdelaziz Eikhidir.
Thesis: *Crystallographic and Mechanistic study of iodomethane oxidative addition to Rh(I) complexes comprising sterically restrained bidentate ligands.*
Promoter: Dr JA Venter.

Alexander, Orbett Teboho.
Thesis: *The effects of structure and ligand variations on the luminescence of Europium(III) complexes.*
Promoter: Prof HG Visser.

Kuo, Chen-Miao.
Thesis: *Synthesis, conformation analysis, and characterization of physiologically important flavonoids and isoflavonoids.*
Promoter: Prof BCB Bezuidenhoudt.

Du Plessis, Maretha.
Thesis: *Palladium catalysed mydroesterification and aminocarbonylation of substituted alkenes and alkynes.*
Promoter: Prof BCB Bezuidenhout.

For the first time in its existence, five PhDs graduated from a single group in Inorganic Chemistry. These are the first five students in the above list.

Inorganic Chemistry PhD graduates at the July 2018 Graduation Ceremony
Front (from the left): Alebel Belay, Dumisani (Tom) Kama, Orbett Alexander, Pennie Mokolokolo, and Pule Molokoane
Back (from the left): Supervisors and co-supervisors Prof Andreas Roodt, Dr Marietjie Schutte-Smith, Dr Alice Brink, and Dr Johan Venter

Two PhD students, Ms A Crause and Mr PJ Swarts, together with Postdoctoral Research Fellow, Dr N Meyer, presented posters at the 10th International Conference on Porphyrins and Phthalocyanines (ICPP-10) held in Munich, Germany.

Mr M Mabaleha, a PhD student, delivered an oral presentation at the NULISTICE 2018 conference held in Maseru, Lesotho from 23 to 27 January, while another PhD student, Mr M Mabaleha, and MSc student, Ms T Molahloe, delivered oral presentations at the 1st African Traditional and Natural Product Conference held in Polokwane from 16 to 19 October.

POSTDOCTORAL RESEARCH FELLOWS

The Department of Chemistry was privileged to host 12 Postdoctoral Research Fellows during 2018. They were

Dr Nadine Meyer (Germany).
Dr Ebrahim Both (South Africa).
Dr Manish Sinha (India).
Dr Bertrand Sone (Cameroon).
Dr Adebayo Adeniyi (Nigeria).
Dr Orbett Alexander (South Africa).
Dr Ben Buitendach (South Africa).
Dr Tom Kama (South Africa).
Dr Pennie Mokolokolo (South Africa).
Dr Mametsi Maseme (South Africa).
Dr Chih-Wei Tsai (China).
Dr Anwar Nor El Jaleel (Sudan).

Dr Buitendach visited Syngaschem BV at DIFFER, Eindhoven University of Technology in the Netherlands, to further existing collaboration in the field of electrocatalysis.

Drs Tom Kama, Pennie Mokolokolo, and Orbett Alexander delivered short oral presentations at the 9th Indaba Meeting, Skukuza, Kruger National Park, and they also attended the 3rd European Crystallographic School (ECS3) held in Stellenbosch. In addition, Dr Ebrahiem Botha gave an invited lecture at the 31st European Crystallographic Meeting in Oviedo, Spain, while Dr Kama conducted research at the University of Zurich (December 2018) to work in a radiopharmaceutical laboratory under the supervision of Prof Roger Alberto. This research falls within the Bilateral Swiss-South Africa Joint Research Programme (SSAJRP) agreement between the Roodt Group and the University of Zurich.

STAFF MATTERS

Prof Vladimir Azov joined the department in February 2018 and was appointed as Professor in the Organic Chemistry division.

Inauguration of Prof Vladimir Azov. From the left: Prof Azov, Prof Hendri Kroukamp (Acting Vice-Rector: Academic), Prof Walter Purcell (Head of the Department of Chemistry), and Prof Danie Vermeulen (Dean of Natural Sciences and Agriculture)

Prof Ben Bezuidenhoudt was appointed as a Research Fellow in the Process Chemistry group and Dr Charlene Marais was appointed as Senior Lecturer.

Ms Alet van Rooyen received a service certificate for 30 years. She retired as departmental secretary at the end of 2018 and Ms Alecia Pieters was appointed in her place.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Adeniyi, AA and Conradie, J. 2018. The stability, kinetic and inter-fragment electron communication of the tautomers of twelve selected β-diketone molecules: A computational study. *Journal of Molecular Graphics and Modelling* 85: 25-39.

Alexander, OT, Donka, R, Van Tonder, JH, Bezuidenhoudt, BCB and Visser, HG. 2018. The crystal structure of 6-(4-bromobenzyl)-1,2,5-trimethyl-7-[henyl-1,5-dihydro-2H-pyrrolo[3,2-d]pyrimidine-2,1(3H)-dione, C22H20BrN3O2. *Zeitschrift fur Kristallographie: New Crystal Structures* 233(3): 395-397.

Azov, VA, Egorova, KS, Seitkalieva, MM, Kashin, AS and Ananikov, PV. 2018. "Solvent-in-salt" systems for design of new materials in chemistry, biology and energy research. *Chem. Soc. Rev.* 47: 1250-1284. (non-UFS contribution).

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Buitendach, BH, Erasmus, E, Niemandtsverdriet, JW, and Swarts, JC., 2018. Can Electrochemical Measurements be Used to Predict X-ray Photoelectron Spectroscopic Data? The Case of Ferrocenyl-β-Diketonato Complexes of Manganese(III). *Transition Metal Chemistry* 43: 409-420.

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BOOKS

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Lötter, SJ, Purcell, W, Nel, JT and Van Brecht, B. 2018. Cation Influence on Zirconium/Hafnium Fluoride Coordination. In: *Emerging Trends in Chemical Sciences* edited by P Ranasanum, MG Bhowan, SJ Laulloo and HLK Wah. ICPAC 2016. Cham, Switzerland: Springer. pp. 239-265.

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Adeniyi, AA and Conradie, J. 2018. *Anticholinesterase activities of peptidomimetic drugs physostigmine ((-)-phy) and its three analogues (-)-her, (-)-phe and (+)-phe in their interaction with Acetylcholinesterase (AChE) and butyrylcholinesterases (BChE).* Lecture delivered at the CECAM Workshop on Protein-peptide interactions: peptide identification, binding prediction and design, Paris, France. 16-10 October.

Adeniyi, AA and Conradie, J. 2018. *The theoretical investigation of reduction potentials and spectroscopic properties of nitrobenzene and keto-enol molecules.* Lecture delivered at the Centre for High Performance Computing (CHPC) National Conference, Century City Conference Centre, Cape Town, South Africa. 2-6 December.

Alexander, OT, Khasemene, M, Alberto, RA and Roodt, A. 2018. *Some general aspects on cobalt chemistry and optimistic forecast on its water (in)soluble complexes as potential water splitting catalysts.* Paper delivered at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

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Azov, VA. 2018. *Dynamic molecular architectures based on tetrathiafulvalenes.* Paper presented at the 43rd National Convention of the South African Chemical Institute SACI-2018, Pretoria, South Africa. 2-7 December.

Bonnet, SL, Wilhelm, A, Phungula, K, Stadler, M and Hering, S. 2018. *In vitro screening of South African plant extracts for GABAergic activity via an automated two-microelectrode voltage clamp assay on Xenopus oocytes.* Paper presented at the First Conference of Biomedical and Natural Sciences and Therapeutics (CoBNeST), Spier Estate, Stellenbosch, South Africa. 7-10 October.

Botha, E and Roodt, A. 2018. *Carbon dioxide fixation in succulent plants: A crystal engineering, solid state modeling and kinetics approach.* Paper presented at the 31st European Crystallographic Meeting, Oviedo, Spain. 22-27 August.

Botha, E, Roodt, A, Alberto, RA and Hernandez, D. 2018. *Carbon dioxide fixation in succulent plants, synthesis and characterization of metal carboxylates, plastic recycling, water purification and heavy metal recovery.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Brink, A. 2018. *The challenges of interoperability between chemical and protein crystallography.* Keynote paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Brink, A. 2018. *Modifying the RheManTec Triad – A small molecule meanders into the macromolecular world.* Poster presented at the 31st European Crystallographic Meeting, Oviedo, Spain. 22-27 August.

Brink, A. 2018. *Small molecule to macromolecular - A wonderland journey for radiopharmaceuticals.* Invited paper at the SciDataCon 2018 – International Data Week, Gaborone, Botswana. 5-8 November.

Conradie, J. 2018. *A DFT view of CH3I Oxidative Addition to Monocarbonylphosphine [Rh(b-diketonato)(CO)(PPh3)] Complexes: Steric and Electronic Effects.* Lecture delivered at the 28th International Conference on Organometallic Chemistry (ICOMC), Congress and Exhibition Centre, Florence, Italy. 15-20 July.

Conradie, J. 2018. *REDOX behaviour of Metal-b-diketonato Complexes: A Frontier Molecular Orbital Energy approach.* Poster presented at the Centre for High Performance Computing (CHPC) National Conference, Century City Conference Centre, Cape Town, South Africa. 2-6 December.

Conradie, J. 2018. *HPC insights into chemistry mysteries.* Lecture delivered at the Centre for High Performance Computing (CHPC) National Conference, Century City Conference Centre, Cape Town, South Africa. 2-6 December.

Conradie, J and Kuhn, A. 2018. *A DFT view of the reduction of bis(cyclopentadienyl) mono(ß-diketonato) titanium(IV) cationic complexes.* Poster presented at the 28th International Conference on Organometallic Chemistry (ICOMC), Congress and Exhibition Centre, Florence, Italy. 15-20 July.

Crause, A and Swarts, JC. 2018. *Synthesis, spectroscopic and electrochemical properties of contracted and expanded porphyrins.* Poster presented at the 10th International Conference on Porphyrins and Phthalocyanines (ICPP-10) Munich, Germany. 1- 6 July.

Elmakki, M, Venter, JA, Venter, GJS and Roodt, A. 2018. *Influence of selected bidentate ligands on the reactivity of Rh(I) complexes.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Jacobs, FJF, Brink, A and Venter, GJS. 2018. *Rhenium radiopharmaceutical models inspired by biological moieties.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Kama, DV, Brink, A, Alberto, RA and Roodt, A. *Systematic phosphine ligand design: Some structural implications on catalysis and radiopharmaceucals.* Flash oral presentation and poster presented at the Indaba 9, Skukuza, Kruger National Park, South Africa. 2-7 September.

Kama, DV, Brink, A, Schutte-Smith, M, Swart, C, Alberto, RA and Roodt, A. 2018. *Selective diphosphinoamine ligand design: For Platinum-Grup Metal catalysts and Group 7 theranostic synthons.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Kamiński, R, Jarzembska, KN, Paliwoda, D, Petříček, V, Pretorius, C and Roodt, A. 2018. *High-pressure single-crystal X-ray diffraction study of a model Rh complex exhibiting metallophilic interactions in the solid state.* Poster presented at the 31st European Crystallographic Meeting, Oviedo, Spain. 22-27 August.

Khasemene, M and Roodt, A. 2018. *Middle and late transition metal complexes as model water reduction catalysts.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Malan, FP, Singleton, E, Van Rooyen, PH, Conradie, J and Landman, M. 2018. *Base-free glucose dehydration catalysed by NHC-stabilised heterohalo cyclopentadienyl Cr(III) complexes.* Poster resented at the 28th International Conference on Organometallic Chemistry (ICOMC), Congress and Exhibition Centre, Florence, Italy. 15-20 July.

Masene, M and Erasmus, E. 2018. *Bimetal cyanometallates used as a heterogeneous catalyst.* Paper presented at the CATSA 2018, Legend Golf & Safari Resort, Limpopo, South Africa. 11-14 November.

Meyer, N and Swarts, JC. 2018. *Electrochemical and spectroscopic studies on sterically hindered corroles and their gold(III) complexes.* Poster presented at the 10th International Conference on Porphyrins and Phthalocyanines (ICPP-10), Munich, Germany. 1-6 June.

Mogale, R and Langner, EHG. 2018. *ZIF-8(Zn) and NH2-MIL-53(Al) as supports for Pd and Ag crystallites with application in heterogeneous catalysis.* Paper presented at the CATSA 2018, Legend Golf & Safari Resort, Limpopo, South Africa. 11-14 November.

Mogale, R and Langner, EHG. 2018. *ZIF-8(Zn) and NH2-MIL-53(Al) as supports for Pd and Ag crystallites with application in heterogeneous catalysis.* Paper presented at the NanoSmat-Africa 2018, NH The Lord Charles Hotel, Western Cape, South Africa. 19-23 November.

Mokolokolo, PP, Tsosane, MS, Kama, DV, Schutte-Smith, M, Brink, A, Visser, HG, Meola, G, Frei, A, Alberto, RA and Roodt, A. 2018. *Electronic and steric manipulation of Schiff-base and Oxine-type ligand systems to selected middle and late transition metal carbonyl cores.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Morerwa, ZG, Roodt A and Venter, GJS. 2018. *Environmentally friendly Rhodium (1) model catalysts.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Motente, M, Schutte-Smith, M and Roodt, A. 2018. *Radiopharmaceuticals: Developing potential radiopharmaceutical agents using natural product ligand systems.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Mphuthi, L and Langner, EHG. 2018. *Metal exchange in nZIF-8 and nZIF-67 with Fe(II) for heterogeneous catalytic applications,* Poster presented at the NanoSmat-Africa 2018, NH The Lord Charles Hotel, Western Cape, South Africa. 19-23 November.

Nkoe, PI, Brink, A and Schutte-Smith, M. 2018. *Investigation of the coordination behaviour of nitrogen and oxygen containing ligands with rhenium(I) tricarbonyl and the potential use as radiopharmaceuticals.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Redgard, S and Roodt, A. 2018. *Nucleophile assisted CO_2 fixation for a cleaner environment.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Roodt, A. 2018. *Detailed reaction mechanisms: Quo vadis?* Keynote paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Roodt, A. 2018. *Advanced studies of reaction mechanisms.* Invited paper presented at the New Frontiers in Chemical Science (NFCS), Indian Institute for Technology Bombay, Mumbai, India. 13-14 December.

Roodt, A. 2018. *Expanding diagnostic nuclear medicine: some perspectives.* Keynote paper presented at the official Inauguration and IUCr Open laboratory, Abidjan, Ivory Coast. 22-31 March.

Roodt, A. 2018. *Properties and applications of crystals/crystallography.* Plenary paper presented at the 5th European Crystallographic School, University of Stellenbosch, South Africa. 8-14 July.

Roodt, A. 2018. *Successful modelling of the total chemical process: is this viable and possible?* Keynote paper presented at the Indaba 9, Skukuza, Kruger National Park, South Africa. 2-7 September.

Schutte-Smith, M, Manicum, AL and Visser, HG. 2018. *A solid state and mechanistic study of carbonyl activation in Rhenium(I) complexes.* Paper presented at the 7th EuCheMS Chemistry Congress in Liverpool, England, UK. 26-30 August.

Schutte-Smith, M, Twigge, L, Alexander, OT, Visser, HG, Roodt, A and Manicum, A-L. 2018. *Carbonyl activation in Rhenium(I) Complexes – a solid and solution state study*. Keynote paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Swarts, JC, Lewtak, J and Langner, EHG. 2018. *Syntheses, mesophase behaviour, and electrochemical properties of metallocenyl-substituted phthalocyanines.* Paper presented at the 10th International Conference on Porphyrins and Phthalocyanines (ICPP-10), Munich, Germany. 1-6 July.

Swarts, PJ, Conradie, J and Swarts, JC. 2018. *Synthesis, electrochemical and spectroscopic studies on new subphthalocyanines.* Poster presented at the International Conference on Porphyrins and Phthalocyanines (ICPP-10), Munich, Germany. 1- 6 July.

Taoana, TN, Twigge, L and Venter, JA. 2018. *Structural and mechanistic study on a rhodium acetylacetonato derivative.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Tsai, C-W, Langner, EHG, Terblans, JJ, Swart, HC and Harris, RA. 2018 *Computational study of ZIF with functional groups for CO_2 adsorption.* Poster presented at the 63rd Annual Conference of the South African Institute of Physics, Bloemfontein, South Africa. 25-29 June.

Tsai, C-W, Langner, EHG, Terblans, JJ, Swart, HC and Harris, RA. 2018. *Zeolitic Imidazolate Framework nanomaterial with functional groups for CO_2 adsorption,* Poster presented at the NanoSmat-Africa 2018, The Lord Charles Hotel, Western Cape, South Africa. 19-23 November.

Van der Westhuizen, D, Conradie, J and Von Eschwege, K. 2018. *DFT studies of Fe, Ru & Os light-sensitive energy conversion dyes/catalysts.* Poster presented at the Centre for High Performance Computing (CHPC) National Conference, Century City Conference Centre, Cape Town, South Africa. 2-6 December.

Venter, GJS. *β-diketones and their derivatives in Rh(I) dicarbonyl and phosphine complexes.* Keynote paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Venter, JA. 2018. *Structural and reactivity studies on related rhodium phosphine complexes.* Poster and oral presented at the 28th International Conference on Organometallic Chemistry (ICOMC), Florence, Italy. 15-20 July.

Venter, JA, Belay, AN and Roodt, A. 2018. *Crystallographic and kinetic study of Niobium(V) and Tantalum(V) complexes with O,O´-bidentate ligands.* Poster presented at the 28th International Conference on Organometallic Chemistry (ICOMC), Florence, Italy. 15-20 July.

Venter, JA, Drost, RM and Warsink, S. 2018. *Steric and electronic relationships in selected rhodium phosphine complexes.* Keynote paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November.

Viljoen, JA, Roodt, A and Visser, HG. 2018. *Some aspects of the coordination environment of hafnium.* Paper presented at the ReMec1: 1st Symposium on Reaction Mechanisms, Bloemfontein, South Africa. 13-14 November 2018.

Wilhelm, A, Moradi-Afrapoli, F, Van der Merwe, H, Swart, K, Stadler, M and De Meiri, M. 2018. *HPLC-based activity profiling for GABAA receptor modulators in Searsia pyroides using a larval zebrafish locomotor assay.* Paper delivered at the First Conference of Biomedical and Natural Sciences and Therapeutics (CoBNeST). Spier Estate, Stellenbosch, South Africa. 7-10 October.

Xantini, Z and Erasmus, E. 2018. *Preparation, characterisation and comparing 3 different catalytic supports for hydrogenation of unsaturated carbonyl compounds.* Poster presented at the CATSA 2018, Legend Golf & Safari Resort, Limpopo, South Africa. 11-14 November.

DEPARTMENT OF CHEMISTRY

STAFF (2018)

Head of Department: Prof W Purcell

BLOEMFONTEIN CAMPUS
Distinguished Professor: Prof A Roodt

Professors: Prof HG Visser, Prof JC Swarts, Prof J Conradie, Prof VA Azov, Prof E Erasmus, Prof KG von Eschwege, and Prof W Purcell

Senior Lecturers: Dr A Brink, Dr JA Venter (Programme Director: Physical Sciences), Dr M Schutte-Smith, Dr EH Langner, Dr E Müller, Dr S Bonnet, and Dr A Wilhelm

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

Researchers/Research Assistant: Mr FMA Muller

Research Associates: Prof AS Luyt, Prof KJ Swart, and Prof BCB Bezuidenhoudt

Secretary: Ms A Pieters

Senior Officers - Professional Services: Ms T Swarts, Ms R Wales (Finances), and Mr MP Coetzee

Officers – Professional Services: Ms I du Plessis (Marketing), Dr T Venter, Mr R Swart, Dr MM Conradie, Ms M Meyburgh, Ms A Allemann

Technical Aid Assistants: Mr ID Fish, Mr JP Masedi, Mr KJ Mokhesi, Mr GJ Nkotsana, and Ms JB Mmope

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

QWAQWA CAMPUS
Senior Lecturer: Dr JP Mofokeng

Lecturers: Dr MA Malimabe, Dr NF Molefe, Dr M Mngomezulu, Mr K Mpitso (Subject Head), and Mr TA Tsotetsi

Junior Lecturer: Mr R Moji

Facilitator: M Mbongo

Officers – Professional Services: Mr MFT Mosoabisane, Mr MA Motsoeneng, Ms CE Clarke-Koni, and Ms P Leche

SOUTH CAMPUS
Lecturer: Ms R Meintjes

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATICS

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OVERVIEW OF 2018

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 of new developments in technology and industry.

On the Bloemfontein Campus, a total number of 178 first-year students registered for our Bachelor of Science in Information Technology – BSc (IT) – programme, while 2 953 students registered for the Computer Literacy module. For the Bachelor of Computer Information Systems (BCIS) programme, 114 first-year students registered. There were 45 first-year enrolments for the BSc on the Qwaqwa Campus, and 1 402 enrolments for the computer literacy module. The South Campus registered 474 first-year students for the Computer Literacy module.

In 2018, 20 students registered for the BSc Honours majoring in Information Technology for the first time, while eight students were in the process of completing their second year of study. Six research master's, one structured master's, and eight PhD students were registered. A number of students were conditionally accepted, awaiting the presentation of their research proposals.

Master's and PhD students may choose to do their research in any one of our four core research areas, namely human-computer interaction, computer science education, eye-tracking, and data warehousing/business intelligence. From 2018, the new research area of data science was introduced, focusing on natural language processing.

ACHIEVEMENTS

Staff Achievements

Mr Rouxan Fouché received the prestigious Vice-Rector: Institutional Change, Student Affairs, and Community Engagement Award in the category of 'Engaged Teaching and Learning (Service Learning – credit bearing)' at the Community Engagement Awards Ceremony.

Prof Pieter Blignaut is currently the Vice-President of the South African Institute of Computer Scientists and Information Technologists (SAICSIT).

Gavin Dollman and Adebola Musa were selected to participate in the University Staff Doctorate Programme (USDP).

Suezette Opperman received the award for the Best Support Staff at the prize-giving ceremony of the Faculty of Natural and Agricultural Sciences.

Student Achievements

The University of the Free State (UFS) participated in the Standard Bank Information Technology Competition (SBITC) for the first time in 2018. Four teams from the university participated. Our top team was placed 12th out of approximately 100 teams in the first round and qualified for the finals in Johannesburg. Although our team did not win a prize in the HashBlock competition (similar to the first round), two of our students won prizes in the IdeaChain competition. For the IdeaChain, all the students are randomly placed in teams of four; the teams have to code an application to solve a specific problem and then present their solution to a panel of judges. Helgard Meyer and Jaco Minnaar, both second-year students, were in the winning team and the runner-up team respectively.

Ms Mapule Madzena, Best Female Student at the 2018 CHPC Student Cluster Competition

The Centre for High Performance Computing (CHPC) Student Cluster Competition gives undergraduate students at South African universities exposure to the High-Performance Computing (HPC) Industry. At the CHPC's 2018 National Meeting, teams built small HPC clusters on the exhibition floor with hardware provided by the CHPC and industrial partners. The winning team will be entered into the International Supercomputing Conference (ISC) Student Cluster Competition, which will form part of the 2019 ISC in Germany. One of our second-year students, Ms Mapule Madzena, won the award for the Best Female Student in December 2018, and also qualified to be a reserve for the winning teams who will commence training on 25 January 2019 in Texas, USA. Mr Jean-Pierre du Plessis mentored the four teams of students, while Mr Fanie Riekert and Mr Albert van Eck also assisted and mentored the teams and set up the High-Performance Computing Unit.

RESEARCH

Master's and PhD students on the Bloemfontein Campus may choose to do their research in any of our four core research areas, namely human-computer interaction, computer-science education, eye-tracking and databases, data warehousing and business intelligence.

Brain-Computer Interfaces

Brain-Computer Interface (BCI) devices are widely used as physiological measuring tools to monitor the cognitive and affective states of individuals. The electroencephalogram (EEG) signals are captured in real-time and can be used for a variety of applications. Some of the common applications of BCIs include education and self-regulation, human-computer interaction, information security, neuro-marketing, games/entertainment, neuro-ergonomics, smart environments and medicine (e.g. diagnosis and neurorehabilitation).

In 2018, two new BCI devices were acquired by the department, namely the Neurosky Mindwave and the Emotiv Insight. Both the Mindwave and the Insight are non-invasive EEG devices that record brain signals from the scalp. The Mindwave uses a single dry sensor to capture brain signals from the forehead over the pre-frontal cortex and transmits the signals to a computer, using radio frequencies. Signals captured with the Mindwave range from 0 to 100 Hz and are easily converted to different brainwave power bands (i.e. Alpha, Beta, Theta, and Gama). In addition to capturing raw EEG data, the Mindwave is designed with a custom algorithm that automatically converts the brain signals to attention and meditation scores.

Unlike the Mindwave with only one sensor, the Insight has five dry sensors that capture brain signals and transmit them to a computer or mobile device, using Bluetooth technology. The Insight is also able to provide both raw EEG data and processed brainwave power bands. The Insight's proprietary algorithm automatically calculates several metrics, such as excitement, engagement, interest, focus, relaxation, and stress while users are interacting with technology or performing tasks. Additionally, one can train up to four mental commands with the Insight, as well as record facial expressions, such as blinking, left/right winking, surprise, frowning, smiling, and clenching. Both devices provide the capability to better understand how human cognitive and affective states influence technology interaction, as well as various aspects of our daily lives.

The acquisition of these two devices bring the total of BCI devices in the department to five (existing ones include two Emotive EPOCs and one SmartBCI). These devices were mostly used by Dr Lizette de Wet (Senior Lecturer) and Dr Silas Verkijika (a postdoctoral research fellow) for research purposes in the department. In 2018, these researchers focused on evaluating the role that emotions played in users' interaction with mobile applications. Their research aimed at understanding key problems affecting mobile application use, including the continued use aspect, where many users increasingly abandon mobile applications after using it only once. The researchers realised that the emotional user experience during the first interaction with a mobile application could determine whether or not a user would decide to continue using the mobile application. The studies provided practical guidelines on how emotional design could be implemented on mobile apps to enhance user retention rates, as well as theoretical contributions on the application of the appraisal-tendency framework and the appraisal theory of emotions in human-computer interaction. This was accomplished while observing objective emotional states using the SmartBCI device, based on the circumplex model of emotion. Two papers from the project have been submitted for publication.

Computer Science Education

The Computer Science Education (CSE) research group, under the guidance of Prof Liezel Nel, continued its work on the 'decoding' of Computer Science education and the unique challenges experienced by students in mastering discipline-specific concepts. This long-term project focuses on the identification and evaluation of unique, discipline-specific strategies that could be utilised by instructors to improve the teaching and learning of various fundamental computer-science concepts. Three PhD students worked on decoding related projects.

The iPad Project, a sub-project of the CSE group, was also expanded in 2018 with the acquisition of an additional 25 iPad devices. The iPad Lab now consists of 50 devices, which are mostly used in selected first- and second-year modules during face-to-face contact sessions to enhance student engagement and address various challenges in the current UFS teaching and learning context.

Eye-Tracking Research

Eye-tracking involves the use of a camera and infrared illuminators to determine the locations, sequence, and duration of a user's fixations on a computer screen. Our research has a technical component looking at the technology and algorithms used to identify and record fixations, as well as an application part where the technology in specific application areas is utilised.

Using the 1200 Hz eye-tracker acquired in 2017, studies involving high speed and high precision were commenced in 2018, such as reading and cognitive research that entails the understanding of a person's thought processes while he or she inspects a stimulus.

We are also actively involved in a study to understand learners' thought processes while they are doing assessments in Mathematics. To this end, we have a computer laboratory with 24 computers with eye-trackers that are connected to our network. A teacher can follow the eye gaze of any learner or obtain an aggregate picture of learners' gaze behaviour in real time.

Human-Computer Interaction Focusing on Eye-Tracking

Prof Tanya Stott's research field is human-computer interaction (HCI), with a specific focus on eye-tracking and using the technology both as an interaction technique and as an evaluation tool. For example, the mouse could be replaced in a specific piece of software to make it more accessible. In terms of evaluation, various studies have been undertaken, such as comparing the usability of electronic devices for reading purposes, using gaze to evaluate reading behaviour of both language texts and snippets of programming code. Interdisciplinary research with the UFS Business School as well as with Open and Distant Learning on the South Campus is ongoing.

Natural Language Processing

The Data Warehousing and Business Intelligence research group, under the guidance of Dr Eduan Kotzé, reached an informal collaboration agreement with the Computational Linguistics and Psycholinguistics Research Center (CLiPS) associated with the Department of Linguistics in the Faculty of Arts at the University of Antwerp. One of the research projects investigated the linguistic aspects of online hate speech. A joint paper between the University of Antwerp, University of Hildesheim, University of the Free State, University of Leuven, and the University of Munich, titled *Multilingual Cross-Domain Perspectives on Online Hate Speech* was published in the Computational Linguistic and Psycholinguistics Technical Report Series in September 2018.

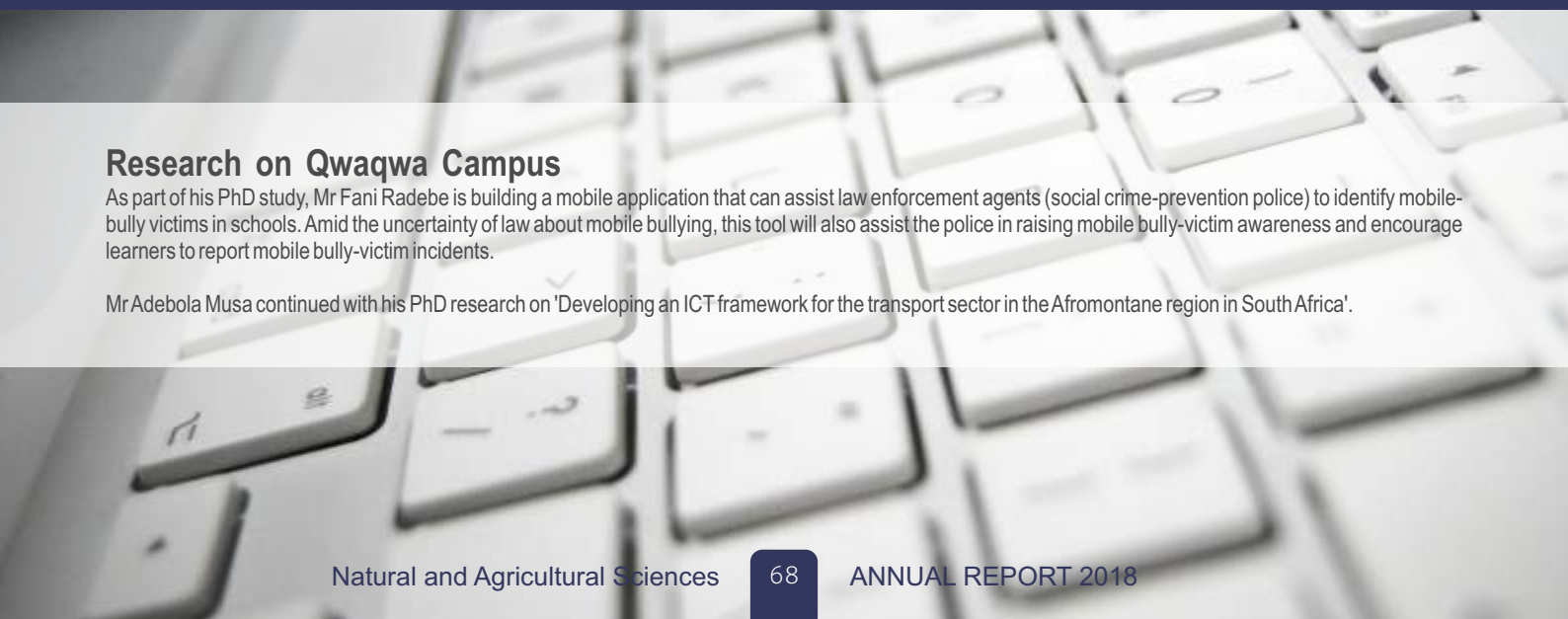
Collaboration with the Unit for Language Facilitation and Empowerment continued in 2018. The research focused on a study to predict the possibility of conflict from a big-data perspective. This study makes use of text classification, sentiment analysis, and topic-modelling techniques and relies on real-time data streams from several social-media data sources.

Virtual Reality

Dr Lizette de Wet and Mr Bennie Botha, a master's student in the department (and also a staff member at the UFS School of Nursing), initiated a virtual-reality research project in 2018, based on a research problem in the nursing application domain. The research will form the basis of Mr Botha's master's study.

The need for low-cost alternatives (e.g. to simulations) to assist in the bridging of nursing theory to nursing practice was identified, as well as for an alternative to assist in developing clinical reasoning skills. This is especially important, as nurses are recognised as the universal access point for approximately 90% of patients. The method being investigated in this research project is to design and implement innovative teaching and learning methods, using virtual reality (VR) to train nursing students and staff.

For this purpose, an Oculus Rift package was acquired by the department in 2018 and will be used in the research project to determine how helpful a VR environment could be in training the clinical skills of nursing students.



Research on Qwaqwa Campus

As part of his PhD study, Mr Fani Radebe is building a mobile application that can assist law enforcement agents (social crime-prevention police) to identify mobile-bully victims in schools. Amid the uncertainty of law about mobile bullying, this tool will also assist the police in raising mobile bully-victim awareness and encourage learners to report mobile bully-victim incidents.

Mr Adebola Musa continued with his PhD research on 'Developing an ICT framework for the transport sector in the Afromontane region in South Africa'.

COMMUNITY SERVICE

Tswellang Special Intermediate School

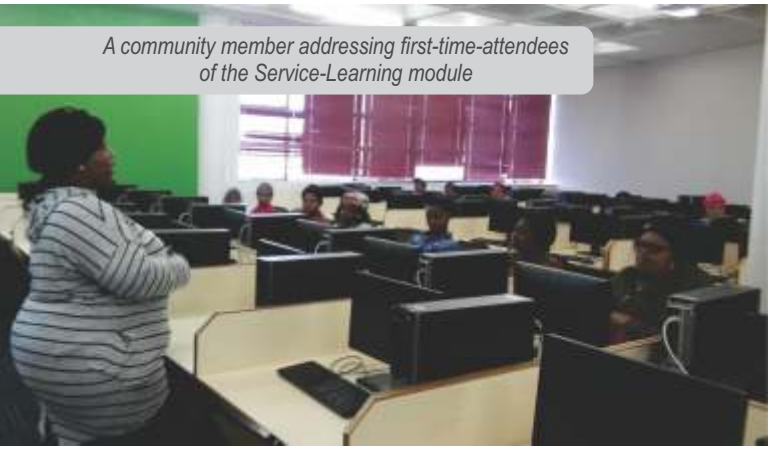
The department maintains a three-year rolling upgrade plan in its computer laboratories to ensure that our students have access to the latest and best technology. Computers that are replaced are donated to schools. In 2018, we donated 27 computers and 21 screens to Tswellang Special Intermediate School. We are also involved in a continuous project to maintain the computers.

Python Project

A total of 15 learners from schools in Bloemfontein participated in the annual Talent Search. All 15 were awarded certificates. Eight learners were awarded Gold (top 9% nationally), four were awarded Silver (top 23% nationally), and three received Bronze (top 54% nationally). Two learners, Marco Gomes and Jana van Rooyen, qualified for the second round of the Programming Olympiad. Marco was considered for a provincial certificate.

For the first time in 2018, the UFS Python Project included a LEGO Robotics Challenge. Learners teamed up to build and program LEGO robots that had to navigate an obstacle course built from bricks.

Mr Daniël Wium, presenter of the Python Project and a member of the winning team



A community member addressing first-time-attendees of the Service-Learning module

Service Learning

Mr Rouxan Fouche presents the Service-Learning module on the Bloemfontein Campus. This module requires students to present computer-literacy training sessions for members of the community over a nine-week period in the second semester. The department also provides transport for community members to and from the university. Between 2013 and 2018, the service-learning module on the Bloemfontein Campus helped more than 460 community members (ranging from school leavers to those facing retirement) to become computer literate.

The Service-Learning module on the Qwaqwa Campus is presented by Mr Benedict Sebastian. In the photo below, a community member who previously completed the module and benefited from it, is addressing current community members on their first day of class.

In support of this initiative, we have two community partners, namely the Mangaung Concerned Residents (MCR) Organisation and the South African Red Cross Society. The MCR, which entails a seven-year partnership, assists the department in identifying individuals from the community who will benefit most from the training offered. The Red Cross Society was identified as a new partner in 2018. The department provides computer-literacy training to a number of their volunteers from Bloemfontein. In 2018, we identified 125 individuals from the community who successfully completed the community training.

NATIONAL AND INTERNATIONAL COLLABORATION

Ms Maren Poettker from the Ostwestfalen-Lippe University of Applied Sciences visited the department as part of a student-exchange programme facilitated by the UFS International Office. She worked on the Agri-Pedia project, a joint IT-Agriculture research project on the meaning of applied Informatics, which forms part of her studies in Environmental Informatics. She successfully completed her internship period (February to May 2018) in the department. As a follow-up, the university plans to send two more exchange students in 2019.

Mr Gavin Dollman participated in fossil excavation at the Qhemegha Dino Bone Bed site, working alongside the Wits University Evolution Studies Institute (ESI). The dig team was led by Prof Jonah Choiniere and Prof Roger Benson and comprised members of the palaeontology lab from the University of the Witwatersrand, the University of Oxford, the University of Birmingham, and the University of Zurich. The site is situated within the Eastern Cape, which is known for its large range of vertebrate fossils from the Late Triassic to the Early Jurassic. Using a drone known as a DJI Phantom 3 Pro, Mr Dollman performed a detailed survey of the sites and surrounding area for later analysis.

Fossil excavation at the Qhemegha Dino Bone Bed site

The research team were assisted by the local community from within the Palmietfontein area. Mr Dollman presented a workshop to Geology students on palaeontology, GIS, and drone-technology approaches.

Palmietfontein school children learning about fossils

OTHER ACTIVITIES

Electronic Computer Literacy Assessment (ECLA)

With more than 3 000 students per semester enrolled for the computer-literacy modules across the three campuses, manual marking of practical assessments and tests is time-consuming. The tools that we used in the past did not sufficiently fulfil our needs and with the rising exchange rate, licence fees amounted to more than one million rand per year. Furthermore, in line with the Protection of Personal Information (PoPI) Act, we were not allowed to save student data on cloud-based storage. Using international systems meant that we had no access to immediate support in case of problems.

In 2015, we embarked on a programme to develop our own assessment system, tailor-made to our needs. The system was developed in a phased process and the assessment tool has been in use for two years. We are currently developing a module that will assist with the scheduling of students and student assistants to attend the multitude of practical and test sessions per assessment. Biometric access control is also included in the scheduling module in an effort to provide secure access to assessments.

Many assessment applications provide only rigid testing of the methods that students use to complete tasks. Through ECLA, we provide the only outcome-based assessment application in the country. A good relationship with the developer provides all the support we need.

Office Space

The office of the Computer Science and Informatics Literacy (CSIL) administrative staff was relocated to the SASOL lab, where students do all their practical sessions for the module. A new office was built for the Technical Assistant and the other office was upgraded. The CSIL administrative office in the Mathematical Sciences Building was divided into two to increase office capacity, and now accommodates Dr Ayo Akinyelu, a Postdoctoral Research Fellow, and Mr Lerotholi Thite, a PhD student.

Information Technology Students' Association (ITSA)

The Information Technology Students' Association (ITSA) is an association for Information Technology (IT) students aimed at equipping them with additional skills, academic or otherwise, that could prove useful beyond their years at university. In addition to academic events, ITSA hosts social events for its 137 members, creating an environment to get to know one another and possibly establish connections that could be beneficial in future.

The 2018 ITSA Committee comprised 12 IT students, ranging from first-year to honours students. The committee hosted a 'Meet, Greet and Eat Event' towards the end of the 2018 academic year. The day was a success and ITSA hopes to host many more such events, starting with a First-Year Welcoming Event in 2019.

Staff and students at the ITSA Meet, Greet and Eat Event

Presenters, students, and staff at the BBD Software workshop

Software Development Workshops

In an effort to expose our students to the latest technology and developments in industry, we invited BBD Software Development, one of the largest software-development houses in the country, to present workshops in the department. During February, about 40 students and staff members attended the series of workshops which covered topics on ASP.Net fundamentals, Spring Boot basics, Angular applications, and the testing of software.

A successful community event was also held to involve local IT specialists. In July, a follow-up series of workshops was held during which topics on service design and Docker were discussed.

Participants in the City Relay: Mr Wikus du Toit, Prof Pieter Blignaut, Dr Andries Burger, and Mr Rouxan Fouche

City Relay

Members of the department participated in the City Relay, organised by the Health and Wellness Division on the Bloemfontein Campus.

POSTGRADUATE STUDENTS

At the April 2018 graduation, seven students graduated with the BScHons majoring in Computer Information Systems, while five graduated with the BScHons majoring in Computer Science and Informatics, and Lehlohonolo Nkala graduated with an Msc.

Two postgraduate students, Riaan Bezuidenhout and Christiaan du Plooy, presented their honours projects at the South African Academy for Science and Art/Suid-Afrikaanse Akademie vir Wetenskap en Kuns 2018 Student Symposium. Mr Bezuidenhout's project was titled 'Trouelose oorsprong-verifikasie van elektroniese intellektuele eiendom deur middel van Blokskakel-Tegnologie (Blockchain Technology)', while Mr Du Plooy's project was titled 'Applying named entity recognition on the dictionary of Southern African place names'.

Mrs Pauline Phoobane, a master's student supervised by Dr Eduan Kotzé, presented a paper, titled *The role of quality in information and intention to use in mobile business intelligence*, at the 2018 International Conference on Advances in Big Data, Computing and Data Communication Systems.

POSTDOCTORAL RESEARCH FELLOWS

The department hosted four Postdoctoral Research Fellows in 2018 – two of whom were appointed on the Bloemfontein Campus and two on the Qwaqwa Campus. They were:

Dr Silas Verkijika (Cameroon).
Dr Ayobami Akinyela (Nigeria).
Dr Moses Agana (Nigeria).
Dr George Musumba (Kenya).

STAFF MATTERS

Two new staff members were appointed during 2018 – Mr Siyabonga Radebe joined us as the Technical Assistant in the Sasol PC Lab, and Mrs Ronel Smith was appointed as the Assistant Officer for the Computer Literacy module. Mr Charl Cilliers resigned as Technical Assistant at the Sasol PC Lab and was appointed as Junior Lecturer for Computer Literacy.

Jean-Pierre du Plessis, Wikus du Toit, and Ronnie Brown left the service of the UFS.

Dr Eduan Kotzé was appointed acting Academic Head of Department when Prof Pieter Blignaut's term came to an end in July 2018.

Dr Ruth Wario's term as Subject Head on the Qwaqwa Campus ended, and Mr Fani Radebe was elected as the new Subject Head.

Prof Kenneth Holmqvist from Sweden was appointed as a Research Fellow in the department.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Agana, M and Wario, RD. 2018. A multi-level evidence-based cybercrime prosecution information system. *International Journal of Engineering and Technology* 7(3.19): 39-48.

Agana, M and Wario, RD. 2018. A Fuzzy skill predictor for early childhood educators. *International Journal of Engineering and Technology* 7(3.19): 49-58.

Blignaut, PJ. 2018. The effect of real-time headbox adjustments on data quality. *Journal of Eye Movement Research* 11(1): 1-18.

Blignaut, PJ. 2018. Using smooth pursuit calibration for difficult-to-calibrate participants. *Journal of Eye Movement Research* 10(4): 1-14.

Brown, RW and Blignaut, PJ. 2018. The importance of applying established website design principles on an online performance management system. *International Journal of Industrial and Systems Engineering* 12(6).

De Smedt, T, Jaki, S, Kotzé, JE, Saoud, L, Gwozdz, M, De Pauyw, G and Daelemans, W. 2018. Multilingual cross-domain perspectives on online hate speech. *Computational Linguistics and Psycholinguistics Technical Report* Series 8: 1-24.

Kotzé, JE and Senekal, BA. 2018. Employing sentiment analysis for gauging perceptions of minorities in multicultural societies: An analysis of Twitter feeds on the Afrikaner community of Orania in South Africa. *The Journal for Transdisciplinary Research in Southern Africa* 14(1): 1-11.

Opperman, S, Van Rooyen, M and Marais, K. 2018. An inter-semiotic approach to translation: Leonard Cohen in Afri-Kaans. *Literator* 39(1): a1458.

Potgieter, P and Blignaut, PJ. 2018. The effect of learners' knowledge of the divisibility rules on their gaze behaviour. *African Journal of Research in Mathematics, Science and Technology Education* 22(3): 351-362.

Senekal, BA and Kotzé, JE. 2018. Die ontwikkeling van 'n koste-effektiewe en byderwetse multimedia digitale argief by EPOG in Orania. *Litnet Akademies* 15(3): 239-275.

Verkijika, SF and De Wet, L. 2018. A usability assessment of e-government websites in Sub-Saharan Africa. *International Journal of Information Management* 39: 20-29.

Verkijika, SF and De Wet, L. 2018. E-government adoption in sub-Saharan Africa. *Electronic Commerce Research and Applications* 30: 83-93.

Verkijika, SF and De Wet, L. 2018. Quality assessment of e-government websites in sub-Saharan Africa: A public values perspective. *Electronic Journal of Information Systems in Developing Countries* 84(2): e12015.

Verkijika, SF and De Wet, L. 2018. Accessibility of South African university websites. *Universal Access in the Information Society* (UAIS) 2018: 1-10.

Verkijika, SF. 2018. Factors influencing the adoption of mobile commerce applications in Cameroon. *Telematics and Informatics* 35(6): 1665-1674.

Verkijika, SF. 2018. Understanding smartphone security behaviours: An extension of the protection motivation theory with anticipated regret. *Computers & Security* 7: 860-870

BOOKS

Ahishakiye, EO and Wario, RD. 2018. *Low cost business intelligence systems using open source tools.* 1st Ed. Mauritius: Lambert Academic Publishing.

CHAPTERS IN BOOKS

Beelders, TR and Stott, A. 2018. *Eye movements during barking at print.* [Online First], IntechOpen, DOI: 10.5772/intechopen.81898. Available from: https://www.intechopen.com/online-first/eye-movements-during-barking-at-print.

CONFERENCE CONTRIBUTIONS

Agana, M, Wario, RD and Onyeke, I. 2018. *Shared wireless access point security in a hybrid star topology using primary host authentication: a case study of NAITES wi-fi.* Paper delivered at Information Systems Technology (IST)-Africa 2018, Gaborone, Botswana. 9-11 May.

Beelders, TR and Du Plessis, JL. 2018. *Reading usability of e-readers and e-books for Information Technology students.* Paper delivered at the South African Institute of Computer Scientists and Information Technologists (SAICSIT) 2018, Port Elizabeth, South Africa. 26-28 September.

Holmqvist, K, Niehorster, D and Blignaut, PJ. 2018. *Data quality in eye trackers: signal resolution.* Paper delivered at the Scandinavian Workshop on Applied eye tracking (SWAET 2018), Frederiksberg, Denmark. 23-24 August.

Janse van Rensburg, E, Blignaut, PJ and Oberholzer, M. 2018. *Computerised assessment of eye tracking to enhance clinical observations in Occupational Therapy.* Paper delivered at the World Federation of Occupational Therapists Congress (WFOT), Cape Town, South Africa. 21-25 May.

Kebande, VR, Kigwana, I, Venter, HS, Karie, NM and Wario, RD. 2018. *CVSS Metric-based analysis, classification and assessment of Comp. Network threats and vulnerabilities.* Paper delivered at the International Conference on Advances in Big Data, Computing and Data Communication Systems (icABCD), Durban, South Africa. 6-7 August.

Mabanza, N and De Wet, L. 2018. *Influence of previous computer experience on adult learners' satisfaction levels with pedagogical interface agents.* Paper delivered at the International Conference on Advances in Big Data, Computing and Data Communication Systems (icABCD), Durban, South Africa. 6-7 August.

Musumba, GW and Wario, RD. 2018. *Towards group fuzzy analytical hierarchy process.* Paper delivered at Information and Communication Technology for Development for Africa, Bahir Dai, Ethiopia.

Nel, G and Nel, E. 2018. *Motivational value of code.org's code studio tutorials in an undergraduate programming course.* Paper delivered at the 47th Annual Conference of the South African Computer Lecturers' Association, Gordon's Bay, South Africa. 18-20 June.

Nyaga, C and Wario, RD. 2018. *Sign language gesture recognition through computer vision.* Paper delivered at Information Systems Technology (IST)-Africa 2018, Gaborone, Botswana. 9-11 May.

Phoobane, MP and Kotzé, JE. 2018. *The role of quality of information and intention to use in mobile business intelligence.* Paper delivered at the International Conference on Advances in Big Data, Computing and Data Communication Systems (icABCD), Durban, South Africa. 6-7 August.

Potgieter, P and Blignaut, PJ. 2018. *A system to determine if learners know the divisibility rules and apply them correctly.* Paper delivered at the Eye-tracking Research and Applications Symposium (ETRA 2018), Warsaw, Poland. 14-17 June.

Potgieter, P and Blignaut, PJ. 2018. *Setting heuristics for eye tracking assessment on divisibility rules.* Paper delivered at the 2018 International conference on Intelligent and Innovative Computing Applications (ICONIC 2018), Plaine Magnien, Mauritius. 6-7 December.

Wario, RD and Ngari, B. 2018. *A framework for mobile learning technology usability testing.* Paper delivered at the International conference on Human-Computer Interaction (HCI), Las Vegas, Nevada, USA. 15-20 July.

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATICS

STAFF (2018)

Head of Department: Prof PJ Blignaut (until July) and Dr JE Kotzé (from August)

BLOEMFONTEIN CAMPUS
Professor: Prof PJ Blignaut

Associate Professor: Prof TR Stott

Adjunct Professor: Prof E Nel

Research Fellow: Prof K Holmqvist

Senior Lecturers: Dr L de Wet and Dr JE Kotzé

Lecturers: Mr RW Brown, Dr AJ Burger, Mr JL du Plessis, Mr R Fouché, Mr WSJ Marais, Dr W Nel, Ms TS Nkalai, and Mr DJ Wium

Junior Lecturer: Mr CA Cilliers

Senior Officer: Mrs S Opperman

Senior Assistant Officers: Mr S Radebe and Mr V van der Bank

Assistant Officers: Mrs MS Mocwana and Mrs R Smith

QWAQWA CAMPUS
Senior Lecturer: Dr RD Wario

Lecturers: Mr GJ Dollman, Mr MB Mase, Mr A Musa, and Mr F Radebe (Subject Head)

Junior Lecturers: Mr T Lesesa and Mr B Sebastian

Senior Assistant Officer: Ms P van der Merwe

Assistant Officer: Mrs M Mahakoe and Mr M Makhanya

SOUTH CAMPUS
Junior Lecturer: Ms Thakaso

Senior Assistant Officer: Mr W du Toit

Assistant Officer: Mrs S de Klerk

DEPARTMENT OF CONSUMER SCIENCE

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OVERVIEW OF 2018

The Department of Consumer Science seeks to equip its 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.

The department also strives 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.

The department offers a three-year Bachelor of Consumer Science degree (BConsumer Science), a four-year Bachelor of Science in Consumer Science (BSc [Consumer Science]), a Bachelor of Science Honours majoring in Consumer Science (BScHons [Consumer Science]), a Master of Science in Consumer Science (MSc [Consumer Science]), and a PhD degree.

ACHIEVEMENTS

Staff Achievements

Mrs Petro Swart completed the MSc (Consumer Science), which was conferred *cum laude*.

Prof Hester Steyn attended the International Federation for Home Economics (IFHE) Council meeting in Khartoum, Sudan, in her capacity as Vice-President of the IFHE responsible for region Africa. She is Committee Chair for the IFHE Consumer and Sustainability Work Group and chaired the activities of this group at the Khartoum meeting.

Dr Ismari van der Merwe and Dr Elzmari Oosthuizen attended a course, titled 'Learning, action research and outreach' with the International Centre for Development Oriented Research in Agriculture (ICRA) team in the Netherlands from 26 October to 17 November. On completion of the on-line course, they will receive certification.

Student Achievements

Ms Malessa Louw won the Free State Women's Agricultural Union Award for the best performance through all the study years. She also won the Beth Erlank prize for the best student in Clothing.

RESEARCH

Research in the Department of Consumer Science focused primarily on the following areas:

Food Security

A large research project focused on 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 of food wasted annually; however, of the 112 municipalities in our country, only two report food-waste figures. The greater scope of the sub-projects in this category aim 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 offered as a result of the research, is culture and location specific. The fieldwork for the project on food waste in Mangaung has been completed, and the results are currently being written up. The project on food waste in Parys was completed in December 2018, and the project on retail food waste in Kuruman was also completed in December 2018. Similar studies are also being undertaken in Lesotho, where rural and urban areas are being compared. Half of the fieldwork for this project has been completed.

A pilot study in Swaziland is currently underway to investigate the level of food insecurity and vulnerability of households. Policies are also being evaluated to determine whether they are realistically helping the household to become less food insecure. Possible loopholes will then be identified to assist with the development of intervention programmes or solutions to help households gain a food-secure status. Fieldwork has been completed.

It is estimated that approximately 14 million South Africans are malnourished. A project has been launched that is aimed at understanding the link between food insecurity and malnourishment and identifying possible contributing factors that 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.

Consumer Awareness of Sustainability Practices

Consumers have to become more aware of the negative environmental impact of the meat industry, and the need to find other alternatives in order to not exploit all the natural resources. The focus of this research project 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 source, but this is inadequate when unusual and culturally inappropriate foods are involved. It will be necessary to introduce unusual novel foods such as insects to consumers. An understanding of consumer expectations regarding the consumption of edible insects will also be considered.

The aim of this research is thus to find acceptable sensory ways of using crickets and meal worms as protein alternatives and as sources of sustainable protein. The development of various products using insect protein will test the willingness of consumers to use 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 protein source will be acceptable to consumers.

Carien Denner (left) and Jana Vermaas (right) with Francine Baker from the University of Cambridge at the Waste Management 2018 Conference, Seville, Spain

Recycling

A further cluster of research projects focuses on recycling. A project investigating barriers and pitfalls preventing eateries and bars from recycling has shown that a lack of knowledge remains the largest barrier to recycling in Bloemfontein. The next stage of the project will entail establishing collaboration with the local municipality. In addition, the role that buy-back centres and waste-pickers in the city can play in the collection of recyclable items, will be investigated.

A second project investigates aspects related to the recycling of clothing articles. It has been found that very few consumers recycle their unused clothing items and that they also do not have adequate knowledge of the process or how it can make a difference. However, many of those interviewed indicated a willingness to donate items if they were aware of opportunities. Further research will investigate donation needs and the possibility of creating a collaboration between those in need and consumer donations.

Other projects in this focus include buying behaviour and barriers preventing consumers from purchasing so-called 'green' products, as well as textile recycling (reclaiming the fibres from e.g. school uniforms) and creating new items. A further project will investigate how wool from Dorper sheep (which is unsuitable for the wool market, can be used to create window covers to provide insulation from extreme winter weather conditions. If successful, the project could be used to empower communities.

Clothing and Culture

Dress is an important aspect in all societies. In it is embedded the history, culture, and societal values of a people. In many African cultures, the traditional dress has been influenced by assimilation and acculturation. The current study seeks to address this and to interpret information carried in either the original traditional dress or the modern traditional dress.

Product Development

- **Vegetable Chips**

Mrs Petro Swart successfully completed a project titled 'Development and consumer acceptability of a potato-based vegetable chip for pre-schoolers in South Africa'. The research was the basis of her MSc (Consumer Science) degree.

- **Cactus-pear Project**

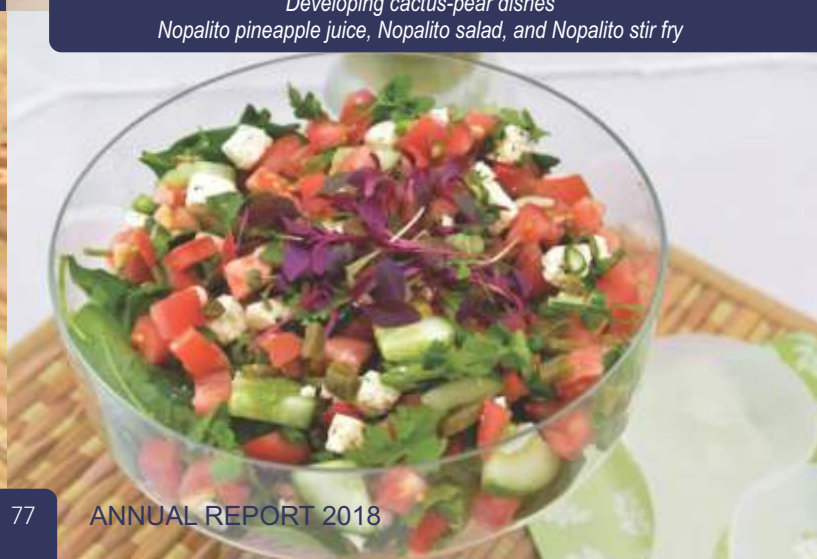
South Africa is vulnerable to food insecurity as a result of environmental issues such as global warming and population growth. The cactus pear has enormous potential in the Free State and Northern Cape (and other dry areas) to broaden the food base and be introduced as a food source in the form of nopalitos (young cladodes).

Cactus-pear plants have been cultivated for many years in South Africa for commercial fruit production and animal fodder. However, the cladodes (modified stems) are a healthy, yet unknown food source for both humans and animals. The cladodes of the cactus pear can serve many purposes; the young cladodes (nopalitos) can be used for human food consumption and the mature cladodes as fodder for animals, therapeutic and cosmetics purposes.

Research on nopalitos as a food source was led by Dr Alba du Toit, a Postdoctoral Research Fellow in the department. One master's project focused on finding the ideal cactus-pear cultivar for the production of nopalitos in human food applications. Another master's project focused on identifying the ideal harvest, post-harvest, pre-cooking, and cooking conditions for the best eating quality of nopalitos.

A project on the development of a health drink containing the cactus-pear fruit, nopalitos, and mucilage was also initiated. The student concerned has made progress with the project as part of her honours studies and will continue the development, nutrient analysis, and consumer-attitude research in her master's project.

Developing cactus-pear dishes
Nopalito pineapple juice, Nopalito salad, and Nopalito stir fry



Two honours students worked on the development of recipes to fit the South African palate in order to introduce this food source to the consumer. A large number of cactus-pear recipes, including recipes of fresh and processed fruits and nopalitos that can be used in meals, baked products, sweets, and beverages, have been developed. In 2019, the recipes will be published on a newly created website under the banner of the University of the Free State (UFS) Faculty of Natural and Agricultural Sciences and the ARC, with the aim of reaching the South African consumer.

Students Yo-Chia Huang and Taylon Colbert preparing recipes

COMMUNITY SERVICE

The department hosted and managed the Consumer Studies Olympiad for Grade 11 and 12 learners. The department also hosted and managed the Hospitality Studies Olympiad for Grade 12 learners. Mrs Fransie van Tonder managed both olympiads, which established valuable links between the Department of Consumer Science and the teachers, facilitators, and learners in these two school subjects. The department raised sponsorships from industry to reward the successful candidates for their hard work at the award ceremony on 9 October 2018.

The third-year Community Development module requires students to participate in one of the community projects as their practical for the semester. The projects for 2018 were undertaken at the Kopano Care Centre and the Free State Residential Care Centre, which involved various activities such as crafts, needlework, organisation of the work area, recycling, as well as assisting them to use resources optimally and in a sustainable manner. The students were required to teach and develop appropriate practical skills, knowledge, values, and attitudes. The students ended the semester by hosting a function for all the participants.

POSTGRADUATE STUDENTS

Five students graduated with the BScHons (Consumer Science) and a further two with the BSc (Home Economics). Liezl du Toit and Petro Swart obtained the MSc in Home Economics with distinction.

POSTDOCTORAL RESEARCH FELLOWS

In 2018, the department hosted Postdoctoral Research Fellow, Dr Alba du Toit, with the support of Dr Maryna de Wit from the Department of Microbial, Biochemical and Food Biotechnology, who served as her supervisor.

STAFF MATTERS

Mrs Sonia van Zyl retired as Lecturer from the Department of Consumer Science after many years of successful teaching and guidance to students, as well as being a pillar of support to the Head of Department and her other colleagues. She mostly taught Clothing and Pattern Design, Textile Construction and Embroidery, and Interior Business.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Cronje, N, Van der Merwe, I and Müller, I-M. 2018. Household food waste: A case study in Kimberley, South Africa. *Journal of Consumer Sciences* 46(1): 1-9.

Du Toit, A, De Wit, M, Osthoff, G and Hugo, A. 2018. Antioxidant properties of fresh and processed cactus pear cladodes from selected *Opuntia ficus-indica* and *O. robusta cultivars*. *South African Journal of Botany* 118: 44-51.

Du Toit, A, De Wit, M and Hugo, A. 2018. Cultivar and harvest month influence the nutrient content of Opuntia spp. cactus pear cladode mucilage extracts. *Molecules* 23(4): 1-12.

Du Toit, A, De Wit, M, Osthoff, G and Hugo, A. 2018. Relationship and correlation between antioxidant content and capacity, processing method and fruit colour of cactus pear fruit. *Food and Bioprocess Technology* 11(8):1527–1535.

Pheto-Moeti, B, Riekert, DM and Pelser, AJ. The popularity of Seshoeshoe dress for Basotho women. *Journal of Consumer Sciences* Special Edition 3: 14-25.

CONFERENCE CONTRIBUTIONS

Denner, C and Vermaas, JF. 2018. *Assessment of barriers preventing recycling practices among bars and eateries in central South Africa.* Poster presented at the 13th International SAAFECS Conference, Saint George Hotel and Conference Centre, Pretoria, South Africa. 5-8 March.

Denner, C and Vermaas, J. 2018 *Assessment of barriers preventing recycling practices among bars and eateries in Central Southern Africa.* Paper delivered at the Wessex Institute Conference, 'Waste Management', Seville, Spain. 17–19 September.

Denner, C and Vermaas, J. 2018. *Recycling behaviour and practices among bars and eateries in Bloemfontein.* Paper delivered at The Institute of Waste Management of Southern Africa, WasteCon™ Conference, Johannesburg, South Africa. 15–19 October.

Denner, C and Vermaas, JF. 2018. *Recycling opportunities and pitfalls of eateries and bars in Central South Africa.* Poster presented at the 13th International SAAFECS Conference, Saint George Hotel and Conference Centre, Pretoria, South Africa. 5-8 March.

Vermaas, J. 2018. *The influence of social media marketing on South African consumer's online purchase intentions and behaviour.* Paper presented at the 13th International SAAFECS Conference, Saint George Hotel and Conference Centre, Pretoria, South Africa. 5–8 March.

DEPARTMENT OF CONSUMER SCIENCE

STAFF (2018)

Head of Department: Prof HJH Steyn

Associate Professor: Prof HJH Steyn

Lecturers: Dr JF Vermaas, Dr I van der Merwe, Dr N Cronjé, and Mrs S van Zyl (retired)

Junior Lecturers: Ms PZ Swart and Ms N Tinta

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

Senior Officer – Professional Services: Mrs D Jacobs

Officer – Professional Services: Ms C Denner

Senior Assistant Officer: Mrs W van der Walt

DEPARTMENT OF ENGINEERING SCIENCES

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W: www.ufs.ac.za

OVERVIEW OF 2018

The successful establishment of the academic programme in Engineering Sciences was confirmed by student numbers reaching 85, distributed over the three-year degree. A total of 233 teachers attended the U-Teach workshops on Engineering. The existing Green Building Index (GBI) research project progressed well, and as a result, Engineering Sciences published its first research paper. Funding was secured for several new research projects, including the development of a Green Manufacturing Index, as well as projects on testing and developing new energy-efficient materials, and training workshops on the results of the GBI for industry.

ACHIEVEMENTS

Staff Achievements

Louis Lagrange, Jaco Homann, and Jacques Maritz have become Accredited Professionals for existing buildings with the Green Building Council of South Africa.

Jaco Homann received the higher certificate in the Business Development Programme from the University of the Free State (UFS), and Louis Lagrange received the international Legend in Energy award from the international Association of Energy Engineers (AEE) in October 2018.

Foster Lubbe and Jacques Maritz will be responsible for energy monitoring as part of team Mahali, that will be competing in the Solar Decathlon Africa in Morocco in 2019.

Student Achievements

Four second-year students, Abel Abraha, Ruan Labuschagne, Thubalethu Ndwandwe (Engineering Sciences), and Helena le Roux (Computer Science) – under the mentorship of the Engineering Sciences tutor, Zirke le Roux - progressed to the second round of the Council for Scientific and Industrial Research (CSIR) Centre for High Performance Computing (CHPC) Student Cluster Competition 2018. Their design and implementation of a cluster ('super-computer') provided them with a well-deserved sixth place in the competition.

ACTIVITIES

Engineering Sciences adjusted its curriculum to enable graduates to also articulate into Aeronautical and Industrial Engineering at the University of the Witwatersrand.

RESEARCH

2018 saw the birth of the energy data analysis and application interface for the GBI project, that will assist communities and industry to move towards more efficient resource management. The GBI is scheduled to be commissioned during the second half of 2019 and will be embedded within the UFS resource-management strategy in the future. The GBI's dyad, the Green Manufacturing Index, is due to start in January 2019, and aspires to tackle energy-data analysis of manufacturing processes within the era of the Internet of Things (IoT) and the Fourth Industrial Revolution (IR4).

NATIONAL AND INTERNATIONAL COLLABORATION

Representatives from Engineering Sciences attended and presented at the World Energy Engineering Congress (WEEC) in Charlotte, USA, and the South African Energy Efficiency Conference (SAEEC).

STAFF MATTERS

Three temporary staff members, Dr Jacques Maritz, Ms Zanele Mngomezulu, and Mr Foster Lubbe, joined Engineering Sciences during 2018.

Louis Lagrange

Hendrik Marx

Jaco Homann

Nathan Bernstein

Jacques Maritz

DeWet Lubbe

Christine du Toit

Zanele Mngomezulu

RESEARCH OUTPUTS

RESEARCH ARTICLES

Maritz, JM, Lubbe, JF and Lagrange, LF. 2018. A practical guide to Gaussian process regression for energy measurement and verification within the Bayesian framework. *Energies* 11(4): 935.

CONFERENCES CONTRIBUTIONS

Lagrange, LF. 2018. *The effect of short-term fluctuations in Point-of-use energy costs on the South African agricultural economy.* Paper delivered at the World Energy Engineering Congress (WEEC), Charlotte, USA. 17-19 October.

DEPARTMENT OF ENGINEERING SCIENCES

STAFF (2018)

Head of Department: Mr LF Lagrange

Professor: Prof HJ Marx

Senior Lecturer: Mr LF Lagrange

Lecturers: Mr RJ Homann, Mr NC Bernstein, Dr JM Maritz, and Mr JF Lubbe

Chief Technician: Mr HJ Lubbe

Senior Assistant Officer: Ms C du Toit

Secretary: Ms Z Mngomezulu

External specialist lecturers: Mr CJB Bezuidenhout, Mr E Boje, Mr JA Deacon, Mr J Haefele, Dr E Maritz, Mr HC Oosthuizen, and Mr IP Scott

DEPARTMENT OF GENETICS

CONTACT DETAILS

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OVERVIEW OF 2018

In 2018, activities in the department were dominated by two significant events which involved all members of staff – the five-year Departmental Review, and our hosting of the annual symposium of the South African Genetics Society (SAGS).

A highlight in teaching, learning, and research was the awarding of four MSc and two PhD degrees – the highest annual number yet for the department. Teaching and learning, as well as research, continued in our specialisation fields of Behavioural Genetics, Conservation and Population Genetics, Human Genetics, Molecular Systematics and Plant Molecular Genetics and Genomics, Forensic Genetics, and Forensic Science. To improve research capacity and procedures in the department, we have launched a formal Research Committee, chaired by Dr Gerda Marx. All postgraduate projects, including honours projects, must now be approved by the Departmental Research Committee, which advises on scientific content and also ensures compliance to ethical, biosafety, and legal requirements. The mandate of the committee also includes a directive to stimulate the growth of research by creating an environment characterised by inquiry and discussion (including public presentations).

International collaboration was strengthened by visits from Prof Trudy Turner from the University of Wisconsin-Milwaukee (USA), Dr Frank Zachos from the Natural History Museum in Vienna (Austria), and Mr Stephan Kutranov from Promega in the UK.

ACHIEVEMENTS

Staff Achievements

Dr Gerda Marx served on the programme organising committee of the 18th International Congress of Endocrinology (ICE), held in Cape Town from 1 to 4 December 2018.

Over 2 000 delegates representing 53 countries globally attended the congress. She also presented her latest work on *Genetic variants associated with Type 2 Diabetes.*

Organising Committee of the 18th International Congress of Endocrinology

The Department of Genetics hosted the annual joint symposium of SAGS and the South African Society for Bioinformatics (SASBi) at Golden Gate from 16 to 18 October 2018. Mr Frank Maleka acted as the main organiser, supported by Mrs Sue-Rica Schneider, with several other staff members and a significant number of students also providing support and attending the conference. The conference was attended by over 150 delegates representing genetics and bioinformatics researchers from the RSA, and a few internationals. Mr Maleka completed his term of two years (2016–2018) as an additional member on the Executive Committee.

South African Society for Genetics Symposium hosted by the Department of Genetics

Prof Paul Grobler completed his two-year term as President of the Southern African Wildlife Management Association (SAWMA) and moved to a new position on Council as Immediate Past President. He also represented Genetics staff as a participant in the final round of the Faculty Flash Fact competition.

Prof Antoinette Kotzé was invited by Prof Fred Allendorf from the University of Montana, USA, to strengthen collaboration and in recognition of South African expertise in Conservation Genetics. During the visit, she was also invited by the Faculty of Science and the Wildlife Biology Program as a PL Wright speaker, to share knowledge based on a career spanning many years in conservation genetics.

Dr Marieka Gryzenhout received a C2-rating from the National Research Foundation (NRF), raising the number of NRF-rated scientists in the department to two. She was also elected as a member of the SAGS Executive Committee.

Dr Karen Ehlers, as a member of the National Forensic Oversight and Ethics Board, attended Parliament with Judge Yvonne Mokgoro and Mrs Vanessa Lynch, to discuss the current functioning of the DNA Board with the Portfolio Committee of Police.

Student Achievements

During the 2018 annual meeting of SAWMA, two of our students (Elmarie Blom and Ruan Jacobs) were part of a University of the Free State (UFS) team that received second prize during the annual Student Quiz.

Antonie Klopper represented the department in the final round of the Faculty of Natural and Agricultural Sciences Flash Fact competition on campus.

During the 2018 SAGS meeting, Lerato Diseko was selected as a student member on the committee.

Kyla Dooley (BScHons majoring in Forensic Genetics) was the recipient of the Dean's Medal, awarded to the final-year student who achieved the best results in respect of an honours degree in the faculty.

RESEARCH

Profs Grobler and Kotze, together with Dr Dalton, provided scientific input at a workshop aimed at the management of hybridisation in wildebeest populations. The workshop was organised by the Free State Department of Economic Development, Tourism and Environment (DESTEA), and brought together conservation professionals from several provinces to design a management strategy based on recently completed research by the aforementioned three staff members.

The zebrafish research unit in the Department of Genetics, under the supervision of Dr Riël Coetzer, Mrs Sue-Rica Schneider, and Prof Paul Grobler, has been in operation since late 2017. The project produced its first graduate (BScHons) in 2018.

The unit is still in its infancy and we were therefore very proud of our first offspring, which hatched during the third term of 2018.

First zebrafish offspring

These new additions to the unit will act as test subjects in three new MSc projects, which include drug-doping analyses and a population genetics study looking at the effects of climate change on population genetic structure. More projects will be developed as the unit grows. The zebrafish in the unit will also be used for undergraduate and postgraduate course modules as examples of model organisms in research.

Mrs Letecia Wessels and Dr Karen Ehlers visited the Forensic Entomology section in the Victim Identification Centre of the South African Police Service (SAPS) in Pretoria, to learn more about their laboratory practices. Members from SAPS involved with crime-scene investigations also assisted with practical sessions for the honours students in Forensics and Forensic Genetics. This enabled the learners to get more practical experience in the field of crime-scene investigations.

Forensic honours students attending practical, assisted by SAPS

Prof Eugenia D'Amato presented a lecture in the Department of Genetics on the research activities she has conducted in her Forensic DNA Laboratory at the University of the Western Cape. The lecture focused on research topics she has piloted, including the use of forensic markers in South Africa and the forensic use of Y-chromosome-based information.

Dr Marx (centre) with team for the diabetic outreach programme

COMMUNITY SERVICE

A group of postgraduate students, together with a qualified nurse and Dr Gerda Marx, spent two Saturdays at Twin City Mall, Heidedal, doing community service. The aim of the outreach was to promote public awareness of diabetes.

Blood glucose levels of interested community members were tested, together with basic anthropometric tests. Based on the results, participants were educated on lifestyle and diet choices or referred to local clinics for further tests.

NATIONAL AND INTERNATIONAL COLLABORATION

Dr Frank Zachos from Vienna, Austria, visited the department in October. Dr Zachos is the curator of the Mammal Collection at the Natural History Museum in Vienna and is also the Editor of the Elsevier journal *Mammalian Biology*. He presented a paper in the department and also accompanied staff to the annual meeting of the SAGS, where he presented a keynote lecture.

Prof Trudy Turner from the Department of Physical Anthropology, University of Wisconsin-Milwaukee, visited the department in July as part of her ongoing commitment to her role as Affiliated Professor in the department. Prof Turner collaborates with Prof Grobler on aspects of the genetics of vervet monkeys.

On 23 August, Mr Stephan Kutranov, a Senior Researcher for the Forensic Department at Promega in the UK, gave a presentation on the latest research and development at the company. He is experienced in all phases of forensic deoxyribonucleic acid (DNA) profiling, quality control, and experimental design. Mr Kutranov also used the opportunity to advise our postgraduate Forensic Genetic students on their research projects in our laboratories.

OTHER ACTIVITIES

The department underwent its five-year review during October 2018. This involved a substantial period of preparation, followed by an on-site visit by three reviewers. The review outcome was generally favourable, with implementation of the recommendations a high priority for 2019.

POSTGRADUATE STUDENTS

At the 2018 graduations, three students graduated with the BScHons majoring in Behavioural Genetics, 11 majoring in Forensic Genetics, nine majoring in Forensic Sciences, and 20 majoring in Genetics.

Five students graduated with an MSc, namely Conrad Achilonu, Nadia Breytenbach, Lerato Diseko, Kimberly Peta, and Khanyisani Nxumalo.

The following students graduated with a PhD from the department:

Fouché, Nadia.
Thesis: *Putative genetic and environmental factors influencing attention-deficit / hyperactivity disorder (ADHD) in a South African sample.*
Promoter: *Prof JJ Spies.*

Musara, Collen.
Thesis: *Studies on South African and New Zealand species of bulbinella using nuclear and chloroplast sequence data.*
Promoter: Dr P Spies.

POSTDOCTORAL RESEARCH FELLOWS

The Department of Genetics hosted Dr Riël Coetzer as a Postdoctoral Research Fellow during 2018.

STAFF MATTERS

On the personnel front, we welcomed two new staff members, Miss Bontle Radise (as Laboratory Manager for the Genetics Building) and Mr Thabang Madisha (as Senior Professional Officer). Dr Riël Coetzer, a Postdoctoral Research Fellow, was also permanently appointed as a Senior Professional Officer. Unfortunately, we also had to say goodbye to Mrs V Nuttall, who was responsible for several student matters, including administration of marks and applications. At the end of 2018, the department had 16 permanent members of staff and six affiliated personnel, with the appointment of another affiliated Associate Professor in progress.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Ahmed S, Abdel-Rahman SM, Grobler PJ and Kotzé, A. 2018. Allelic diversity of DQA2 exon 2 gene in Egyptian goat populations. *Indian Journal of Animal Research* 52: 1101-1106.

Ahmed, S, Kropff, AS, Jonker, T and Kotzé, A. 2018. Can we source the origin of the feral Tankwa goat of South Africa? *Journal of Phylogenetics and Evolutionary Biology* 6: 1000206.

Baiyewu, AO, Boakye, MK, Kotzé, A, Dalton, DL and Jansen, R. 2018. Ethnozoological survey of the traditional uses of Temminck's ground pangolin (Smutsia temminckii, Smuts 1832) within South African tribal communities. *Society & Animals* 26: 1-20.

Coetzer, WG, Turner, TR, Schmitt, CA and Grobler, JP. 2018. Adaptive genetic variation at three loci in South African vervet monkeys (Chlorocebus pygerythrus) and the role of selection within primates. *PeerJ* 6:e4953.

Coetzer, WG and Grobler, JP. 2018. Identifying Rhabdomys museum specimens following taxonomic changes: Use of short COI sequences. *Vertebrate Zoology* 68(3):191 – 197.

Dalton, DL, Kotzé, A, McEwing, R, De Bruyn, M, Mnisi, C and Mwale, M. 2018. A tale of the traded cat: Development of a rapid real-time PCR diagnostic test to distinguish between lion and tiger bone. *Conservation Genetics Resources.* [Online] DOI 10.1007/s12686-018-1060-x.

Grobler, JP, Van Wyk, AM, Dalton, DL, Janse van Vuuren, B and Kotzé, A. 2018. Assessing introgressive hybridization between Blue wildebeest (Connochaetes taurinus) and Black wildebeest (Connochaetes gnou) from South Africa. *Conservation Genetics.* [Online].

Loots, A, Mitchell, E, Kotzé, A, Venter, E., Cardoso-Vermaak, E and Dalton, DL. 2018. Investigating the role of Toll-like receptor polymorphisms in susceptibility to canine distemper virus. *Mammalian Biology* 88: 94-99.

Loots, A, Mitchell, E, Mokgokong, P, Venter, E, Kotzé, A and Dalton, DL. 2018. Phylogenetic analyses of Canine Distemper Virus (CDV) in South African carnivores. *PLoS ONE* 13(7): e0199993.

Minkner, MMl, Young, C, Amici, F, McFarland, R, Barrett, L, Grobler, JP, Henzi, SP and Widdig A. 2018. Assessment of male reproductive skew via highly polymorphic STR markers in wild vervet monkeys, Chlorocebus pygerythrus. *Journal of Heredity 109*(7): 780–790.

Moodley, Y, Russo, I-R., Robovský, J, Dalton, DL, Kotzé, A, Smith, S, Ryder, OA, Hermes, R, Walzer, C and Bruford, MW. 2018. Contrasting evolutionary history, anthropogenic declines and genetic contact in the northern and southern white rhinoceros (Ceratotherium simum). *Proceedings of the Royal Society B.* 285: 20181567.

Pienaar, L, Grobler, JP, Scholtz, MM, Swart, H, Ehlers, K, Marx, M, MacNeil, MD and Neser, FWC. 2018. Genetic diversity of Afrikaner cattle in southern Africa. *Tropical Animal Health and Production* 50:399–404.

Ramukhithi, FV, Nephawe, KA, Lehloenya, KC, Seshoka, MM, Jonker, T, Kotzé, A, Chokoe, TC and Nedambale, TL. 2018. Characterization of seminal plasma constituents of unimproved indigenous and Tankwa goats. *South African Journal of Animal Science* 48(5).

Russo, IM, Hoban, S, Bloomer, P, Kotzé, A, Segelbacher, G, Rushworth, I, Birss, C and Bruford, MW. 2018. Intentional genetic manipulation as a conservation threat. *Conservation Genetics Resources.* [Online] doi.org/10.1007/s12686-018-0983-6.

Spies, JJ and Spies, P. 2018. Assessing Clivia taxonomy using the core DNA barcode regions, matK and rbcLa. Bothalia - *African Biodiversity & Conservation* 48(1): a2025.

Swanepoel, J, Westcott, M and Gryzenhout, M. 2018. First report of a new malformation disease of common karee *(Searsia lancea)* in South Africa. *South African Journal of Botany* 119: 307 – 317.

Van Wyk, A, Labuschagne, C, Kropff, AS, Kotzé, A, Grobler, JP, Janse van Vuuren, B and Dalton, DL. 2018. A targeted gene approach to SNP discovery in the blue *(Connochaetes taurinus)* and black wildebeest *(C. gnou)*. *Conservation Genetics Resources.* [Online] doi.org/10.1007/s12686-017-0959-y.

Van Wyk, AM, Kotzé, A, Grobler, JP, Janse van Vuuren, B, Burrow, L and Dalton, DL. 2018. Isolation and characterization of species-specific microsatellite markers for blue- and black wildebeest (Connochaetes taurinus and C. gnou). *Journal of Genetics* 97: e1-9.

Vermeulen, M, Louw, SvdM, Marais GJ, Weeks, WJ, Swart, WJ and Gryzenhout, M. 2018. Fungi associated with disease and weevil damage of Amaranthus cruentus in South Africa. *African Entomology* 26(1): 174-188.

CONFERENCES CONTRIBUTIONS

Blom, E, Grobler, JP, Schneider, S-R and Coetzer, W. 2018. *The genetic position of ornamental zebrafish (Danio rerio) sold in South African pet shops.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Diseko, L and Marx, G. 2018. *Screening for the presence of single nucleotide polymorphisms associated with Type 2 Diabetes in a black South African population.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Gryzenhout, M. 2018. *Checklist of fungi from a semi-arid region of South Africa established through environmental and Sanger sequencing approaches.* Paper delivered at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

Jacobs, R, Coetzer, W and Grobler, JP. 2018. *Genetic variation within and between selected South African greater kudu Tragelaphus strepsiceros populations.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Kloppers, GAE, Cason, E, Portal, AV, Weldon, C and Gryzenhout, M. 2018. *Frog skin microbial diversity of Amietia hymenopus (Phofung River Frog) on Mount-aux-source in the Drakensberg mountain range.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Marx GM, Diseko, L and Bester, PA. 2018. *Genetic variants associated with Type 2 Diabetes in a central South African population.* Paper delivered at the International Congress of Endocrinology (ICE), Cape Town, South Africa. 1-4 December.

Mokgakala, M, Coetzer, GM and Maleka, MF. 2018. *Exploring DNA methylation in the genome of cactus pear (Opuntia ficus-indica) cultivars.* Paper delivered at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Mokgakala, K, Allen, A, Coetzer, G and Maleka, MF. 2018. *Illumina sequencing and characterization of methylated regions in the cactus pear (Opuntia ficus-indica) genome.* Paper delivered at the African combined congress, Ratanga Junction, Cape Town, South Africa. 15-18 January.

Motsamai, J, Marx, G and Schneider, S-R. 2018. *Association of selected genetic polymorphisms and bipolar disorder-susceptibility in South Africa.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Mqeku, M, Cason, E, Tonjock Kinge, R and Gryzenhout, M. 2018. *The mycobiome of Karee Malformation Disease symptoms on Searsia lancea (karee) trees in South Africa.* Poster presented at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

Mqeku, M, Cason, E, Tonjock Kinge, R and Gryzenhout, M. 2018. *The mycobiome of Karee Malformation Disease symptoms on Searsia lancea (karee) trees in South Africa.* Paper delivered at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Pambuka, G, Tonjock Kinge, R, Cason ED, Nyaga, M and Gryzenhout, M. 2018. *Characterization of the fungal phytobiome of sorghum (Sorghum bicolor) using environmental sequencing.* Poster presented at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

Pambuka, G, Tonjock Kinge, R, Cason, ED, Nyaga, M and Gryzenhout, M. 2018. *Characterization of the fungal phytobiome of sorghum (Sorghum bicolor) using environmental sequencing.* Paper delivered at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Peni, ES, Coetzer, GM and Maleka, MF. 2018. *Chloroplast SNP identification and PCR-RFLP assays in cactus pear (Opuntia ficus-indica) cultivars.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Rothmann, C, Cason, ED, Tonjock, R, Gryzenhout, M and Viljoen, BC. 2018. *Discovery of a new thermotolerant Ganoderma species from the South African deep subsurface.* Poster presented at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

Susmak, C and Schneider, S-R. 2018. *Bipolar Disorder: genetic analysis of the circadian rhythm associated gene and metabolic disorder.* Poster presented at the Joint Congress of the South African Society for Bioinformatics (SASBi) and the South African Genetics Society (SAGS), Golden Gate Highlands Hotel, Golden Gate National Park, South Africa. 16-18 October.

Tonjock Kinge, R, Cason, E and Gryzenhout, M. 2018. *Differentiation of fungal communities between different crops and substrates in an intercropping trial.* Poster presented at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

Vermeulen, M, Jacobs, A and Gryzenhout, M. 2018. *Several new species in the Fusarium fujikuroi species complex discovered in one location.* Poster presented at the 11th International Mycological Congress, San Juan, Puerto Rico. 16-21 July.

DEPARTMENT OF GENETICS

STAFF (2018)

Head of Department: Prof JP Grobler

Professor: Prof JP Grobler

Senior Lecturers: Dr K Ehlers, Dr M Gryzenhout, and Dr G Marx

Lecturers: Dr S Brink, Mrs H Bindeman, Mr MF Maleka, Mrs Z Murray, Mrs S Schneider, Mr JA Viljoen, and Mrs L Wessels

Junior Lecturer: Miss Z Raffie

Affiliated Research Associates: Prof A Kotzé, Prof TE Turner, Lt-Col A Lucassen, Prof JJ Spies, and Dr P Spies

Laboratory Manager: Miss BPD Radise

Senior Professional Officers: Dr WG Coetzer and Mr T Madisha

Secretary: Mrs B Henn

DEPARTMENT OF GEOGRAPHY

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OVERVIEW OF 2018

The department celebrated its 100th year in 2018 by hosting the Society of South African Geographers (SSAG) 11th Biennial Academic Conference and the 49th Student Conference from 30 September to 5 October. The conferences hosted 250 academics, practitioners, teachers, government officials, and students from across the country on the Bloemfontein and Qwaqwa Campuses. Proceedings of the academic conference were published.

ACHIEVEMENTS

Staff Achievements

Ms Ntebohiseng Sekhele, who is based on the Qwaqwa Campus, was selected to participate in the University Staff Doctorate Programme (USDP) – a US-SA Higher Education Network programme. Her research, focusing on addressing conservation conflicts between communities and protected areas, will be done in collaboration with the Colorado State University.

Student Achievements

Mr Marius Müller (BScHons student) won the prize for the best poster presented at the SSAG Student Conference in 2018. His research investigated the effects of veld fire on vegetation composition and soil physical properties in the Golden Gate Highlands National Park.

Marius Müller (right) receiving the prize for best poster at the SSAG Student Conference 2018

RESEARCH

Afromontane Research Unit

The Department of Geography on the Qwaqwa Campus is extensively involved in research activities contributing to the primary focus of the Afromontane Research Unit (ARU), namely the sustainable development of the Maloti-Drakensberg Afromontane area.

Physical Geography, GIS/Remote Sensing

The physical geography research in the department addresses issues from spatio-temporal assessments of fire, rain, and drought, to water-erosion risk assessment and effective environmental management, as well as reconstruction of paleoclimates through Geographic Information Systems (GIS)/Remote Sensing techniques.

Human Geography

Within human geography, the department's research activities are primarily related to analyses of public spaces and people's relationships with it and within it. Other research attempts to contribute to the understanding of rural livelihoods and factors that might enhance it.

COMMUNITY SERVICE

The department successfully hosted SSAG 2018 from 1 to 5 October 2018, welcoming over 100 delegates across our two campuses, and publishing 48 peer-reviewed papers in the proceedings.

Delegates at the 11th SSAG Biennial Conference on the Qwaqwa Campus

Delegates at the 11th SSAG Biennial Conference on the Bloemfontein Campus

The 49th SSAG Student Conference was also hosted in Bloemfontein, during which more than 100 student delegates shared their research.

Student delegates at the 49th SSAG Student Conference

NATIONAL AND INTERNATIONAL COLLABORATION

Ms Mischka Jacobus is part of an international collaborative project funded by the Economic and Social Research Council (ESRC)-National Research Foundation (NRF), based on the Planning Education and Research fraternity in South Africa. Researchers from the Department of Geography and the University of the Free State (UFS) Department of Urban and Regional Planning, together with researchers at the University of Birmingham, UK, are investigating the appropriateness, usefulness, and impact of the current Planning curriculum in South African higher education. Among the objectives of the project are to investigate the social and economic value of planning education, to evaluate how the urban and regional planning curriculum addresses issues in a post-colonial context, to determine what the implications are for planning education in the UK, to create a platform for sharing ideas across the world, and to inform higher-education Urban and Regional Planning strategies in order to address the challenges facing South Africa and other countries of the Global South. In June 2018, the team attended a writing retreat in Milton Keynes, England. To date, the team has conducted one of the largest ever survey databases undertaken with Planners in South Africa, including 110 interviews.

Ms Liezel Rudolph's research focused on dating the deglaciation of Marion Island. For this research, rock samples were collected from the Island during the 74th Relief Expedition in April/May 2017 and again in 2018, as part of a multi-institutional geomorphology team. The annual expedition is funded by the South African National Antarctic Programme (SANAP)-NRF: Sub-Antarctic Landscape-Climate Interactions (SLCi). In November 2018, she travelled to Scotland to start the analyses of the rocks at the Scottish Universities Environmental Research Centre (SUERC).

Prof Geofrey Mukwada and Ms Anneri Pretorius jointly collaborate with the Department of Civil Engineering at the Central University of Technology in exploring and understanding the transportation needs of rural dwellers within the context of sustainable transportation. By tuning into community voices, the project intends to contribute to planning for sustainable transportation in rural areas, using the Maluti-a-Phofung Local Municipality as a case study.

POSTGRADUATE STUDENTS

At the April 2018 graduation on the Bloemfontein Campus, nine students graduated with the BScHons majoring in Geography, and a further two students majoring in Environmental Sciences, while two students on the Qwaqwa Campus received their BScHons majoring in Geography.

The Geography Honours class was jointly responsible for organising the SSAG Student Conference, hosted on the Bloemfontein Campus.

UFS Geography Honours Class of 2018

Three students on the Qwawa Campus graduated with the MSc majoring in Environmental Geography. They were Dipuo O Mofokeng (with distinction), Cynthia Mokubung, and Khetiwe E Dlamini.

The following PhDs were conferred in 2018:

Mutana, Sarudzai.
Thesis: *Sustainability of montane-route tourism: The case of the Maluti Route in the Drakensberg Mountains of South Africa.*
Promoter: Prof G Mukwada.

Makwara, Enock Comrence.
Thesis: *Institutional reform and participation in integrated water resource management: The case of Turwi River Basin, Zimbabwe.*
Promoter: Prof G Mukwada.

POSTDOCTORAL RESEARCH FELLOWS

Two Postdoctoral Research Fellows, Dr Kayode Adepoje (from Nigeria) and Dr Ahmed Abdelmoneim (from Sudan), were hosted on the Qwaqwa Campus in 2018. Both researchers were active in the ARU.

STAFF MATTERS

Dr Ruth Massey left the department at the beginning of 2018, and Ms Mischka Jacobus was appointed as a Lecturer in June.

Ms Nthabiseng Mokhethi left the department to join Housing and Residence Affairs on the Qwaqwa Campus. Her administrative position was filled by Ms Meiki Lebeko from the second semester of 2018.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Adelabu SA, Adepoju, KA and Mofokeng OD. 2018. Estimation of fire potential index in mountainous protected region using remote sensing. *Geocarto International.* [Online]:1-18.

Akpan, GE, Adepoju, KA, Oladosu, OR and Adelabu, SA. 2018. Dominant malaria vector species in Nigeria: Modelling potential distribution of Anopheles gambiae sensu lato and its siblings with MaxEnt. *Public Library of Science One* 13(10): 1-15.

Le Roux, A, Mukwada, G and Lombard, C. 2018. The Afromontane Research Unit – Growing as a hub of transdisciplinary research. *Mountain Research and Development* 38(1): 85-87.

Mbiriri, M, Mukwada, G and Manatsa, D. 2018. About surface temperature and their shifts in the Free State Province, South Africa (1960–2013). *Applied Geography* 97: 142-151.

Mbiriri, M, Mukwada, G and Manatsa, D. 2018. Influence of altitude on the spatiotemporal variations of meteorological droughts in mountain regions of the Free State Province, South Africa (1960–2013). *Advances in Meteorology* 2018: 1-11.

Mbiriri, M, Mukwada, G and Manatsa, D. 2018. Spatiotemporal characteristics of severe dry and wet conditions in the Free State Province, South Africa. *Theoretical and Applied Climatology*. [Online].

Molaudzi, DO and Adelabu, SA. 2018. Review of the use of remote sensing for monitoring wildfire risk conditions to support fire risk assessment in protected areas. *South African Journal of Geomatics* 7(3): 222-242.

Mutana, S and Mukwada, G. 2018. Can mountain route tourism work for the poor? Exploring worldviews from Maluti Route in the Drakensberg Region of South Africa. *Tourism and Hospitality Research*: 1–13.

Mutana, S and Mukwada, G. 2018. Mountain-route tourism and sustainability. A discourse analysis of literature and possible future research. *Journal of Outdoor Recreation and Tourism* 24: 59-65.

Nkooe, ES. 2018. A Lefebvrian analysis of public spaces in Mangaung, South Africa. *Urban Planning* 3(3): 26-39.

Rudolph, EM, Meiklejohn, KI, Hansen, CD, Hedding, DW and Nel, W. 2018: Observations of rock glaciers in the Jutulsessen, Dronning Maud Land, East Antarctica. *Polish Polar Research* 39(1): 1-17.

CONFERENCE CONTRIBUTIONS

Adagbasa, E, Adelabu, S and Okello, TW. 2018. *Spatio-temporal assessment of fire severity in a protected and mountainous ecosystem.* Paper delivered at the International Geoscience and Remote Sensing Symposium 2018, Valencia, Spain. 22-27 July.

Adagbasa, GE, Adelabu, SA and Okello, TW. 2018. *Assessment of short term inter-annual post fire vegetation recovery using land surface temperature (LST) derived from NDVI.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Adepoju, KA and Adelabu, SA. 2018. *Classification analysis of Sentinel-2 and Landsat-8 images integrated with ancillary data using machine learning algorithms in a mountainous terrain.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Ahmed, AAM and Mukwada, G. 2018. *Trend detection of long-term temperature data using Mann-Kendall Trend Test: the case of the Maloti-Drakensberg Region.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Chimvuramahwe, J and Mukwada, G. 2018. *Villagers' perceptions regarding the effectiveness of methods used to protect wildlife resources and the availability of non-timber forest products in Gonarezhou National Park.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Hansen, M. 2018. *The production of space in the MDTFCA.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Letimela, O and Van der Walt, AJ. 2018. *An investigation of seasonal maximum and minimum temperature patterns in the Free State:* 1969-1999. Poster presented at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Mbiriri, M, Mukwada, G and Manatsa, D. 2018. *Surface air temperature variability in the mountain regions of the Free State Province, South Africa* (1960-2013). Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Mehlomakhulu, T. 2018. *Land lost: An assessment of its equivalence to monetary value.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Mofokeng, DO and Adelabu, SA. 2018. *Mapping lightning distribution for fire danger assessment of the Golden Gate Highlands National Park using geospatial technology.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Mutana, S and Mukwada, G. 2018. *Contested sustainability of montane route tourism: A case study of the Maluti Route in the Drakensberg Mountains of South Africa.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Okello, TW. 2018. *Human-Wildlife conflict among the rural Maasai population in the Amboseli Ecosystem, Kenya.* Paper delivered at the 1st Pan-African International Research Congress on Knowledge Generation and Dissemination (PAIRC), Kisumu, Kenya. 18-23 June.

Okello, TW. 2018. *Community perceptions on the effects of climate change and human-wildlife conflicts in the Amboseli Ecosystem, Kenya.* Paper delivered at the 1st Pan-African International Research Congress on Knowledge Generation and Dissemination (PAIRC), Kisumu, Kenya. 18-23 June.

Okello, TW. 2018. *Climate change impacts on arable farming in the savannah grassland within the Afromontane Region of Southern Africa.* Paper delivered at the 1st Pan-African International Research Congress on Knowledge Generation and Dissemination (PAIRC), Kisumu, Kenya. 18-23 June.

Okello, TW. 2018. *Impact of demographic changes on small scale agricultural development in Maluti-a-Phofung Local Municipality.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Okello, TW. 2018. *Sustainable community tourism in South Africa: A perspective from Phuthaditjhaba.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Okello, NO, Camminga, S and Okello, TW. 2018. *The status and trends of key air quality pollutants in Richards Bay, South Africa – Is it worsening or Improving and why?* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Okello, NO, Camminga, S, Okello, TW and Zunckel, M. *Spatial and temporal trends of PM_{10} and SO_2 in the Richards Bay Area.* Paper delivered at the Conference of the National Association for Clean Air, Johannesburg, South Africa. 30 October to 1 November 2018.

Pretorius, A, Mostafa, MMH and Mukwada, G. 2018. *Community voice in planning for sustainable transportation: Maluti-a-Phofung Local Municipality.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Pretorius, A and Jacobus, M. 2018. *Reflective writing as a learning tool in Geography: An example from a third-year Urban Geography module.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Pretorius, A and Rudolph, E.M. 2018. *Conference checklists, challenges & costs.* Poster presented at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Rudolph, EM, Hedding, DW and Nel, W. 2018. *Rock hardness as a relative-age indicator of glacially striated surfaces on Marion Island.* Paper delivered at the 5th NRF-SANAP PI Symposium. Hermanus, South Africa. 13-16 August.

Sekhele, S and Okello, TW. 2018. *Assessing vegetation change and socio-economic impacts of livestock grazing in the Clarens Nature Reserve, Free State in South Africa.* Paper delivered at the 1st Pan-African International Research Congress on Knowledge Generation and Dissemination (PAIRC), Kisumu, Kenya. 18-23 June.

Van der Walt, AJ, Fitchett, JM and Curtis, CJ. 2018. *Statistical classification of South African seasonal divisions on the basis of daily temperature data.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

Zondo, M and Mukwada G. 2018. *Assessing the impact of seasonal grazing systems on the mountain vegetation under the changing climate.* Paper delivered at the 11th Society of South African Geographers' Biennial Academic Conference, Bloemfontein, South Africa. 1-5 October.

CONFERENCE PROCEEDINGS

Adagbasa, E, Adelabu, S and Okello, T. 2018. Spatio-temporal assessment of fire severity in a protected and mountainous ecosystem. In: *IEEE Xplore IGARSS 2018. Proceedings of the 2018 IEEE International Geoscience and Remote Sensing Symposium*. Valencia, Spain. 22-27 July 2018. pp. 6572-6575.

Akinmolayan, AV, Adepoju, K, Adelabu, S and Osunmadewa, A. 2018. Estimating potential annual Soil Loss of Watershed in Nigeria Using RULSE in a GIS and Remote Sensing Environment. In: *IEEE Xplore IGARSS 2018. Proceedings of the 2018 IEEE International Geoscience and Remote Sensing Symposium*. Valencia, Spain. 22-27 July 2018. pp. 7504-7507.

Pretorius, A and Jacobus, M. 2018. Reflective writing as a learning tool in Geography: An example from a third-year Urban Geography module. In: *Proceedings of the Biennial Conference of the Society of African Geographers. University of the Free State, Bloemfontein, South Africa. 1-5 October 2018.*

DEPARTMENT OF GEOGRAPHY

STAFF (2018)

Head of Department: Dr CH Barker

BLOEMFONTEIN CAMPUS
Senior Lecturers: Dr CH Barker and Dr JJ le Roux

Lecturers: Ms M Jacobus, Ms E Kruger, Mrs TC Mehlomakhulu, Ms A Pretorius, Ms ES Nkooe, Ms EM Rudolph, and Mr AJ van der Walt

Senior Officers – Professional Services: Mrs S Brits and Ms N van Dyk

QWAQWA CAMPUS
Associate Professor: Prof G Mukwada

Senior Lecturers: Dr SA Adelabu (Subject Head) and Dr TW Okello

Lecturers: Mr A Adjei, Dr M Hansen, Mr P Mahasa, and Ms M Naidoo

Junior Lecturer: Ms N Sekhele

Senior Officer – Professional Services: Ms M Lebeko

DEPARTMENT OF GEOLOGY

CONTACT DETAILS

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OVERVIEW OF 2018

A total of 70 degrees were awarded by the department over the course of the year, with 41 students receiving BSc degrees, 23 honours degrees, and 6 MSc degrees. The department was responsible for presenting six undergraduate and three honours programmes, as well as the MSc (Mineral Resource Management) degree, and supervised the continued research of 27 students in Mineral Resource Management, 15 MSc candidates, and 5 PhD candidates over the course of the year.

ACHIEVEMENTS

The department's centenary was celebrated with a mini-conference and celebratory dinner that took place on 12 and 13 April 2018 on the Bloemfontein Campus. The conference was attended by 64 delegates. Twenty talks were presented on a variety of topics, some scientific and some reflecting back on the history of the department. The guests of honour at the conference were past heads of department, Profs Willem van Biljon, Johan Visser, and Willem van der Westhuizen. The department's centenary was also celebrated by means of a special issue of the *South African Journal of Geology*, guest edited by Profs Frederick Roelofse and Aylva Schoch, and Dr Matthew Huber.

Delegates at the department's centenary conference

The Department of Geology centenary logo

Staff Achievements

Prof Marian Tredoux was invited to present a two-day course on the 'Economic Geology of the Kaapvaal Craton' at the University of Rome in May 2018. She also attended a workshop that was held in celebration of the naming of three new minerals by staff members of the Eugen F Stumpfl Electron Microprobe Laboratory at the University of Leoben in June 2018. The manuscript by one of her colleagues at the University of Leoben, describing the new mineral tredouxite – that was named in her honour – appeared online in the *European Journal of Mineralogy* on 10 January 2018.

Prof Frederick Roelofse served on the organising committee for the 13th International Platinum Symposium, and Prof Marian Tredoux, Dr Robert Hansen, and Ms Justine Magson served on the organising committee for the Iphakade Conference 2018.

RESEARCH

The department acquired a DJI Mavic 2 Pro drone that will be used for research, teaching, and outreach. Specific applications will include the development of techniques for the extraction of geological information from aerial imagery, primarily for mining and groundwater exploration. The development of this technology is the responsibility of Dr Martin Clark.

Researchers in the department managed to secure R255 000 from the Iphakade Programme to support the research of postgraduate students in the department. A generous financial contribution was made to the department by the Exxaro Chairman's Fund in order to support the expansion of our master's programme in Mineral Resource Management. The department also received extensive donations of drill core, totalling more than 8 km, from Impala and Marula Platinum. The core will be used for research and student training. A donation of a drill core was also received from Anglo American Kumba Iron Ore. Staff and students attended and presented their work at eight national and international conferences.

Part of the drill core donated by Marula Platinum being loaded for transportation to Bloemfontein

Staff members were also successful in obtaining a variety of grants in support of their research over the course of the year, including:

- NRF Freestanding Postdoctoral Fellowship (Dr Elizaveta Kovaleva).
- NRF Knowledge Interchange and Collaboration Local Travel Grant (Dr Elizaveta Kovaleva).
- NRF Incentive Funding for Rated Researchers (Profs Chris Gauert and Frederick Roelofse).
- Geological Society of South Africa Research, Education and Investment Funding (Dr Gerhard Meintjes).

Prof Frederick Roelofse attended a three-day training course on the planning, management, and execution of continental scientific drilling projects in Windischeschenbach (Germany). The course was presented and funded by the International Continental Scientific Drilling Programme (ICDP).

COMMUNITY SERVICE

The department, in particular Ms Rinae Makhadi, again hosted the Free State leg of the Minquiz National Science Competition that was held on 17 May 2018. Several schools, mostly from the Free State – each represented by three learners – took part in the competition. The learners were also afforded the opportunity to visit the Naval Hill Planetarium as part of the competition.

NATIONAL AND INTERNATIONAL COLLABORATION

Following negotiations between the UFS and the University of Johannesburg (UJ), the Department of Geology became a collaborating partner of the DST-NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis (CIMERA), jointly hosted by the Department of Geology at UJ and the School of Earth Sciences at the University of the Witwatersrand. This partnership will allow access to postgraduate student-funding opportunities in years to come.

Dr Matthew Huber concluded a collaborative agreement with De Beers that will see the company assisting with the analytical work necessary for several postgraduate research projects in the coming years.

Staff in the department actively collaborated with researchers at the following national and international academic and research institutions during 2018:

- Institute of Geology and Geochemistry, Ural Branch of Russian Academy of Sciences (Russia).
- Institute of Physics and Technology, Ural Federal University (Russia).
- University of Leoben (Austria).
- Department of Terrestrial Magnetism (Carnegie Institution for Science, USA).
- Deutsches GeoForschungsZentrum (GFZ - Germany).
- University of Vienna (Austria).
- Institute of Geological Sciences, Polish Academy of Sciences (Poland).
- University of Liverpool (UK).
- University of Lille (France).
- Martin-Luther University of Halle-Wittenberg (Germany).
- University of Saskatchewan (Canada).
- University of Extremadura (Spain).
- University of Hamburg (Germany).
- University of Gothenburg (Sweden).
- University of Oslo (Norway).
- University of Florence (Università degli Studi di Firenze – Italy).
- University of Manitoba (Canada).
- Ludwig Maximilian University (Germany).
- Vrije Universiteit Brussel (Belgium).
- Rieskrater Museum (Germany).
- Bavarian State Collection of Zoology (Zoologische Staatssammlung München – Germany).
- Institute of Geology, Czech Academy of Sciences (Czech Republic).
- Charles University (Czech Republic).
- Czech Geological Survey (Czech Republic).
- Eberhard Karls University (Germany).
- University of Johannesburg.
- University of the Western Cape.
- University of the Witwatersrand.
- University of Pretoria.
- University of Cape Town.

OTHER ACTIVITIES

Student Field Trips

A number of field trips were undertaken during the course of the year.

At undergraduate level, the first-year students visited Musgrave Koppie to study aspects of the local geology as part of Introductory Geology. Second-year students went on several day trips to Austin's Post southwest of Bloemfontein as part of their Geological Field Techniques module. They also visited landfill sites around Bloemfontein to study the impact of geology on waste disposal activities as part of the module Environmental Geology and Environmental Management. During the October recess, students enrolled for the Field School had the opportunity to study a variety of aspects regarding the geology around Bloemfontein on a series of visits to study rocks of the Ventersdorp Supergroup, glacial pavements, rocks of the Dwyka and Beaufort Groups, Lystrosaurus fossils and the Quaternary deposits, fossils and salt deposits at Florisbad.

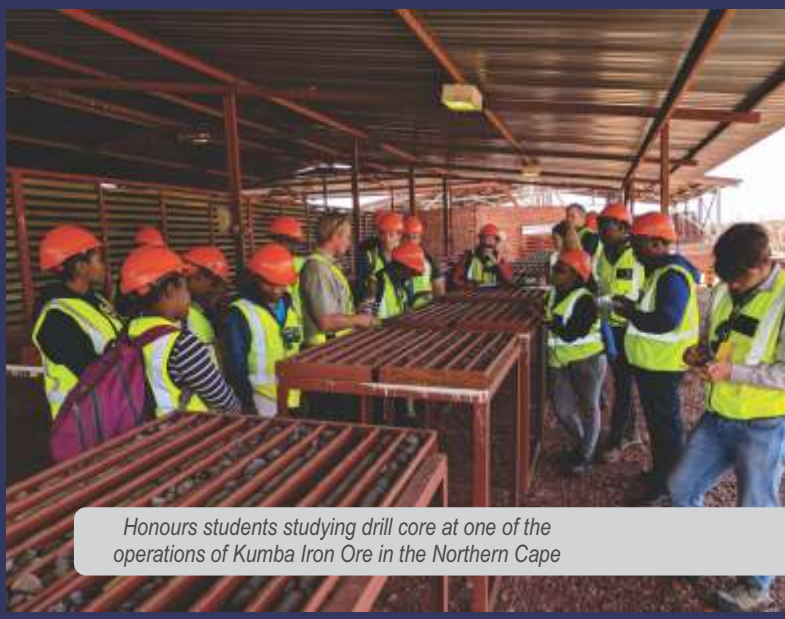
Third-year students visited the Big Hole Museum in Kimberley to learn more about the geology of diamonds and the rocks in which they occur as part of the Igneous Petrology module. The third-year students enrolled for Economic Geology spent several days in the field in the Vredefort Dome, followed by underground visits to the Tshepong, Phakisa, Masimong and Joel gold mines of Harmony Gold.

Third-year students studying an exposure of pseudotachylite

A group of third-year students on a field trip to Masimong mine

Honours students enrolled for Advanced and Applied Mineralogy went on a four-day excursion to study the mineral wealth of the Northern Cape, while those enrolled for Advanced Structural Geology undertook a five-day trip to Namaqualand where they conducted structural mapping. The Advanced Sedimentology students undertook a five-day fieldtrip to the Vanderkloof area, where they mapped and compiled sedimentary profiles. Honours students enrolled for Advanced Economic Geology visited the Northern Cape to learn more about its geology and the exploitation and exploration of Fe-ore, diamonds, and industrial minerals.

Honours students on the Advanced Economic Geology field trip in front of a drill



Honours students studying drill core at one of the operations of Kumba Iron Ore in the Northern Cape

Kovsie GeoTalks

The following Kovsie GeoTalks were presented during the course of the year:

- 'Tredouxite, another new mineral from the Bon Accord oxide body' presented by Prof Marian Tredoux.
- 'Tectonic versus impact deformation in zircon: Implications for the Vredefort impact structure and for lunar zircon from Apollo 17' presented by Dr Elizaveta Kovaleva.
- 'The wave power potential of the South African coastline' presented by Dr Stoffel Fourie from Walter Sisulu University.
- 'The role of the Minerals Education Trust Fund in promoting quality education and minerals industry outlook' presented by Mr Anre Vorster from De Beers.
- 'Lowermost termination of Vredefort Granophyre Dyke results in unusual features' presented by Dr Matthew Huber.
- 'Geochemistry of U and Th in the Witwatersrand gold tailings – Where is all the Th?' presented by Dr Robert Hansen.
- 'Analytical geochemistry as an enabler of diamond exploration' presented by Dr Louise Coney from De Beers.
- 'Assessment of the applicability of South African waste classification legislation on mineral waste with special reference to gold mine tailings on the Witwatersrand basin – A geochemical perspective' presented by Mr Marvin Nicholas (MSc student of Dr Robert Hansen).
- 'Pegmatites in the Namaqua Metamorphic Province' presented by Dr Hendrik Minnaar.
- 'Geology for societal benefit' presented by Ms Tshiamo Legoale from Mintek.
- 'The tectonic evolution of the East Range of the Sudbury Basin, Ontario, Canada' presented by Dr Martin Clark.
- 'The Platreef – nothing is set in stone' presented by Ms Jarlen Beukes.
- 'Distributive fluvial systems' presented by Mr Adriaan Odendaal.
- 'Assessment of groundwater quality in the vicinity of two municipal solid waste disposal sites' presented by Ms Rinae Makhadi.

Alex du Toit Memorial Lecture

The department also hosted Prof Lewis Ashwal, from University of the Witwatersrand, who presented the 2018 Alex du Toit Memorial Lecture, held under the auspices of the Geological Society of South Africa. The lecture was titled 'Wandering continents of the Indian Ocean'.

Prof Marian Tredoux, Prof Lewis Ashwal, and honours student, Snegugu Ziqubu, at the Alex du Toit Memorial Lecture presented by Prof Ashwal

POSTDOCTORAL RESEARCH FELLOWS

The Department of Geology hosted two Postdoctoral Research Fellows during 2018 – Dr Elizaveta Kovaleva from Russia, and Dr Martin Clark from Canada.

Dr Kovaleva undertook a short research visit to the Laboratory for Scanning Electron Microscopy and Focused Ion Beam Applications at the Faculty of Earth Sciences, Geography and Astronomy at the University of Vienna. She received a travel grant for early-career scientists from the Meteoritical Society Travel Award Committee to attend the 81st Annual Meeting of the Meteoritical Society in Moscow, as well as a travel grant from the open-access journal of mining and mineral processing, Minerals, to attend the European Geosciences Union General Assembly in Vienna.

STAFF MATTERS

Ms Jarlen Beukes joined the department in January as Lecturer on the nGAP (next Generation of Academics Programme) scheme funded by the Department of Higher Education and Training, while Mr Justin Nel was appointed as Junior Lecturer in Structural Geology.

Mr Raimund Rentel, Junior Lecturer in Mineralogy, tendered his resignation in mid-2018 in order to pursue greener pastures in Namibia.

Mr Jonas Choane, Assistant Officer responsible for sample preparation, announced his early retirement from the university, having been in the employ of the university since 1975. He was replaced by Mr Pelele Lehloenya, an *alumnus* of the department.

The post-retirement contracts of Profs Marian Tredoux and Willem van der Westhuizen concluded in December 2018. Application has been made to retain both as Research Fellows.

Dr Frederick Roelofse was promoted to Associate Professor in January 2018.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Bindi, L, Zaccarini, F, Miller, DE and Garuti, G. 2018. Tredouxite, NiSb2O6: Another new Ni-bearing mineral from the Bon Accord oxide body, South Africa. *European Journal of Mineralogy* 30: 393-398.

Buatois, LA, Almond, J, Gabriela Mangano, M, Jensen, S and Germs, GJB. 2018. Sediment disturbance by Ediacaran bulldozers and the roots of the Cambrian explosion. *Nature Scientific Reports* 8: 4514.

Burron, I, Da Costa, G, Sharpe, R, Fayek, M, Gauert, C and Hofmann, A. 2018. 3.2 Ga detrital uraninite in the Witwatersrand Basin, South Africa: Evidence of a reducing Archean atmosphere. *Geology* 46: 295-298.

Clark, MD and Riller, U. 2018. 3-D kinematic restoration of the eastern Sudbury Igneous Complex, Canada, and its importance for Cu-Ni-PGE sulphide exploration. *Ore Geology Reviews* 101: 199-210.

Cornell, DH, Minnaar, H, Frei, D and Kristofferson, M. 2018. Precise microbeam dating defines three Archaean granitoid suites at the southwestern margin of the Kaapvaal Craton. *Precambrian Research* 304: 21-38.

Hansen, RN. 2018. An assessment of the geochemical impacts of greenfields mining projects in South Africa on both sides of the mine drainage pH divide – A geochemical modelling approach. *South African Journal of Geology* 121: 487-494.

Hansen, RN. 2018. Inter-comparison geochemical modelling approaches and implications for environmental risk assessments: A Witwatersrand gold tailings source term characterisation study. *Applied Geochemistry* 95: 71-84.

Huber, MS and Byerly, GR. 2018. Volcanological and petrogenetic characteristics of komatiites of the 3.3 Ga Saw Mill Complex, Weltevreden Formation, Barberton Greenstone Belt, South Africa. *South African Journal of Geology* 121: 463-486.

Jacobson, L and Noli, D. 2018. New finds of engraved whole ostrich eggs from southern Namibia and the Northern Cape Province of South Africa. *Southern African Humanities* 31: 55-61.

Kovaleva, E, Huber, MS, Fourie, F and Pittarello, L. 2018. Comparative study of pseudotachylite microstructures in felsic and mafic rocks from the Vredefort impact structure, South Africa. Implications for the experimental studies. *South African Journal of Geology* 121: 403-420.

Kovaleva, E, Huber, MS, Roelofse, F, Tredoux, M and Praekelt, H. 2018. Pseudotachylite vein hosted by a clast in the Vredefort Granophyre: characterization, origin and relevance. *South African Journal of Geology* 121: 51-68.

Kovaleva, E, Huber, MS and Zaccarini, F. 2018. Petrography and geochemistry of coarse-crystalline veins within Vredefort Granophyre, Vredefort Impact Structure, South Africa. *South African Journal of Geology* 121: 383-402.

Kovaleva, E, Klötzli, U, Wheeler, J and Habler, G. 2018. Mechanisms of strain accommodation in plastically-deformed zircon under simple shear deformation conditions during amphibolite-facies metamorphism. *Journal of Structural Geology* 107: 12-24.

Magson, J, Tredoux, M and Roelofse, F. 2018. Association of platinum-group elements with chromitite within the Merensky reef, Western Limb, Bushveld Complex: Results of a high-resolution mineralogical and geochemical study. *Journal of African Earth Sciences* 144: 161-175.

Mathee, HLM and Colliston, WP. 2018. Stratigraphy of the Koekoepkop thrust sheet in the Grünau Terrane, Mesoproterozoic Namaqua Province. *South African Journal of Geology* 121: 431-450.

Meintjes, PG and Van der Westhuizen, WA. 2018. Stratigraphy and geochemistry of the Goedgenoeg and Makwassie Formations, Ventersdorp Supergroup, in the Bothaville area of South Africa. *South African Journal of Geology* 121: 339-362.

Meintjes, PG and Van der Westhuizen, WA. 2018. Borehole LLE1 – an intra-caldera succession of the Goedgenoeg and Makwassie Formations, Ventersdorp Supergroup. *South African Journal of Geology* 121: 363-382.

Mueller, SB, Kueppers, U, Huber, MS, Hess, K-U, Poesges, G, Ruthersteiner, B and Dingwell, DB. 2018. Aggregation in particle rich environments: a textural study of examples from volcanic eruptions, meteorite impacts, and fluidized bed processing. *Bulletin of Volcanology* 80: 32.

Nel, R, Germs, GJB, Praekelt, HE and Odendaal, AI. 2018. Re-examination and reinterpretation of the stratigraphy of the Matjies River Formation, Cango Caves Group, Neoproterozoic to early Palaeozoic Saldania Belt, South Africa. *South African Journal of Geology* 121: 451-462.

Schouwstra, R, Mocke, J, Duncan, M, Bramdeo, S and Scharneck, Y. 2018. An investigation into the theft of concentrates and their upgrading to saleable platinum-products. *Geosciences* 8: 411.

Steenekamp, JMA, Van der Westhuizen, WA, Bateman, MD, Jacobson, L and Nel, L. 2018. A Pleistocene thrust fault in anorthosite of the Rustenburg Layered Suite near Mooinooi, North West Province, South Africa: Neotectonic Implications. *South African Journal of Geology* 121: 421-430.

Trubac, J, Ackerman, K, Gauert, C, Durisova, J and Hrstka, T. 2018. Platinum-Group Elements and Gold in Base Metal Sulfides, Platinum-Group Minerals, and Re-Os Isotope Compositions of the Uitkomst Complex, South Africa. *Economic Geology* 113: 439-461.

CHAPTERS IN BOOKS

Borg, G, Gauert, C. 2018. The African Metallotects of Southwest Gondwana. *In: Geology of Southwest Gondwana.* Regional Geology Reviews, edited by S. Siegesmund *et al.* Springer International Publishing. pp. 615-676.

CONFERENCE CONTRIBUTIONS

Beukes, JJ, Roelofse, F, Gauert, CDK and Grobler, DF. 2018. *Petrochemical investigation of the Flatreef of the Northern Limb, Bushveld Complex.* Paper delivered at the 4th Iphakade Conference, Clarens, South Africa. 22-25 October.

Beukes, JJ, Roelofse, F, Gauert, CDK and Grobler, DF. 2018. *Petrographical, mineralogical and geochemical investigation of the Flatreef and its hanging wall and footwall at Turfspruit and Macalakaskop, Northern Limb, Bushveld Complex.* Paper delivered at the 13th International Platinum Symposium, Polokwane, South Africa. 30 June-6 July.

Clark, MD, 2018. *Harnessing the multidisciplinary value of Geospatial Data.* Paper delivered at the 176th Provincial Spatial Planning and Land-use Management (SPLUM) Forum for the Free State, Bloemfontein, South Africa. 23 November.

Hansen, RN. 2018. *An assessment of the geochemical impacts of greenfields mining projects on both sides of the mine drainage pH divide – A geochemical modelling approach.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Huber, MS and Byerly, GR. 2018. *Komatiites from the Saw Mill Complex, Barberton greenstone belt, South Africa.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Huber, MS and Kovaleva, E. 2018. *Clast distribution in the Daskop granophyre dyke, Vredefort impact structure.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Huber, MS, Kovaleva, E, Dixon, RD and Pittarello, L. 2018. *Impact-generated pseudotachylites do not necessarily have the composition of their host.* Paper delivered at the 49th Lunar and Planetary Science Conference, The Woodlands, Texas, United States of America. 19-23 March.

Huber, MS, Kovaleva, E and Fourie, F. 2018. *Lowermost termination of Vredefort granophyre dyke results in unusual features.* Paper delivered at the 81st Annual Meeting of the Meteoritical Society, Moscow, Russia. 22-27 July.

Huber, MS, Kovaleva, E and Zaccarini, F. 2018. *Analysis of unusual coarse-crystalline veins within the Vredefort granophyre.* Paper delivered at the 10th Igneous and Metamorphic Studies Group Meeting, Cape Town, South Africa. 14-17 January.

Huber, MS, Tredoux, M, Kovaleva, E and Roelofse, F. 2018. *Revisiting Bon Accord: New Field and petrographic data.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Klötzli, U, Kusiak, MA, Kovaleva, E, Wirth, R, Yi, K. 2018. *Pb nano-spheres in seismically deformed zircon from the Ivrea-Verbano Zone.* Paper delivered at Pangeo Austria 2018, Vienna, Austria. 24-26 September.

Kovaleva, E. 2018. *In situ granular zircon from the Vredefort impact structure.* Paper delivered at the 81st Annual Meeting of the Meteoritical Society, Moscow, Russia. 22-27 July.

Kovaleva, E, Huber, M and Habler, G. 2018. *Shock microtwins in zircon: An in situ EBSD study of pseudotachylites, Vredefort impact structure.* Paper delivered at the 10th Igneous and Metamorphic Studies Group Meeting, Cape Town, South Africa. 14-17 January.

Kovaleva, E, Huber, M, Habler, G and Pittarello, L. 2018. *Tectonic vs impact zircon deformation: from the Vredefort impact structure to the Moon tectonics, a possible key to understand different geological processes.* Paper delivered at the European Geosciences Union General Assembly, Vienna, Austria. 8-13 April.

Loock, JC. 2018. *History of the Department of Geology at the University of the Free State.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Mapholi, T and Hansen, RN. 2018. *Presence of PGEs in mine tailings, Western Bushveld: Implications for potential re-processing.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Minnaar, H. 2018. *The UFS Geology Department and its research on the Namaqua Metamophic Province.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Nel, J and Colliston, WP. 2018. *Geology and structure of an area south of Pofadder.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Nel, R, Germs, GJB, Praekelt, AE and Odendaal, AI. 2018. *Stratigraphy of the Cango Group north of Oudtshoorn.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Odendaal, AI, Nel, L, Van der Westhuizen, WA and Loock, JC. 2018. *Lungfish burrows in the lower Beaufort Group in the southwestern part of the Karoo basin.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Rentel, R. 2018. *Science at Sea – the importance of iron.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Tredoux, M. 2018. *The Bon Accord NiO body, Barberton: A remarkable source of new minerals.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Tredoux, M, Magson, J and Roelofse, F. 2018. *The chromitite layers of the Merensky Reef, Bushveld Complex: The Devil is in the Detail.* Paper delivered at the 13th International Platinum Symposium, Polokwane, South Africa. 30 June-6 July.

Van der Westhuizen, WA, Steenekamp, JMA, Nel, L and Jacobson, L. *2018. Neotectonics in the Bushveld Complex.* Paper delivered at the UFS Geology Centenary Conference, Bloemfontein, South Africa. 12-13 April.

Wheeler, J, Mariani, E, Tielke, J, Gardner, J, Prior, D, Piazolo, S, Hildyard, R, Trimby, P, Drury, M, Kovaleva, E, Montagnat, M, Journaux, B, Chauve, T, Mainprice, D, Tommassi, A and Barou, F. 2018. *Teasing new ideas out from EBSD data: a view from geoscience.* Paper delivered at the Electron Backscatter Diffraction Topical Conference 2018, Ann Arbor, Michigan, United States of America. 23-25 May.

DEPARTMENT OF GEOLOGY

STAFF (2018)

Head of Department: Prof F Roelofse

Professor: Prof WA van der Westhuizen

Affiliated Professors: Prof GJB Germs, Prof DE Miller, and Prof R Scheepers

Associate Professors: Prof F Roelofse and Prof M Tredoux

Affiliated Associate Professors: Prof CD Gauert and Prof RP Schouwstra

Senior Lecturers: Dr R Hansen, Dr M Huber, and Dr H Minnaar

Affiliated Senior Lecturer: Dr A Bisnath

Lecturers: Mr J Beukes, Ms J Magson, and Mr A Odendaal

Affiliated Lecturers: Mr AC Dunne, Mr PJ Grobler, Mr I Hunt, Mr PG Laurens, Dr H Prinsloo, Mr PJ Viljoen, and Mr MJAR Vrijens

Junior Lecturers: Mr J Nel, Ms R Makhadi, Ms T Mapholi, and Mr R Rentel

Research Fellows: Prof WP Colliston, Dr PG Meintjes, Dr L Nel, Dr HE Praekelt, and Prof AE Schoch

Affiliated Researchers: Dr JO Claassen, Ms HCF Pretorius, and Dr MJ van der Merwe

Administrative Officers: Mr A Felix, Ms R Immelman, Ms P Swart, and Ms C van der Vyver

Technical Officers: Mr J Choane, Mr P Lehloenya, Ms M Purchase, and Mr D Radikgomo

DEPARTMENT OF
MATHEMATICAL STATISTICS AND ACTUARIAL SCIENCE

CONTACT DETAILS

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OVERVIEW OF 2018

The Department of Mathematical Statistics and Actuarial Science experienced a successful year in 2018. Our department continues to grow, with research outputs in 2018 exceeding those of 2017. We lost one of our actuaries to Canada; he was replaced by another actuary, Mr Louwtjie Voges, a former Kovsie. The collaboration with Prof Jan Beirlant, from KU Leuven, continues to bear fruit, as can be seen from the publication output. Our staff without doctoral qualifications are making progress in this regard, with Sean van der Merwe receiving his PhD in 2018. Other staff members are studying towards becoming actuaries. Classes went smoothly, producing appropriate throughput rates.

ACHIEVEMENTS

Student Achievements

Enrico Scheltema (BSc majoring in Actuarial Science) won the Dean's Medal, awarded to the final-year student who achieved the best results in respect of a first bachelor's degree (three-year curriculum) in the faculty. Subsequently, at the June graduation, he was awarded the Senate's Medal for the student who achieved the best overall results in respect of undergraduate and postgraduate qualifications awarded in all faculties in 2017.

RESEARCH

Representatives from the department actively participated in various conferences, in particular the annual conference of the South African Statistical Association and the International Society for Bayesian Analysis.

Participants at the SAASA Conference – from the left: Dr Delson Chikobvu, Mr Sean van der Merwe, Dr Andrhrétte Verster, Ms Wallina Oosthuizen, Mr Mpendulo Mamba, and Dr Michael von Maltitz

UFS representatives at the International Society for Bayesian Analysis Conference – from the left: Sean van der Merwe, Abrie van der Merwe, Moletsane Moletsane, and Morné Sjölander

NATIONAL AND INTERNATIONAL COLLABORATION

Prof Robert Schall collaborated with Dr Divan Burger from the University of Pretoria. Their joint research project is on Bayesian nonlinear mixed effects regression models. Prof Schall also continued his collaboration with Prof Arne Ring, from Medac in Germany, on the analysis of subgroup effects in clinical trials.

Prof Maxim Finkelstein published seventeen papers and one book with his various collaborators in 2018, including Prof G Levitin (Israel), Prof JH Cha (Korea), Dr NK Hazra (India),) and Prof Y Dai (China). He also maintains ongoing collaborations with Dr M Shaffie (UK), Prof O Stepanov (Russia), and Dr T Missov (Germany).

POSTGRADUATE STUDENTS

At the 2018 graduations, twelve students graduated with the BScHons majoring in Actuarial Science, four in Applied Statistics, seven in Mathematical Statistics, seven in Risk Analysis, and three in Statistics.

Three students – Paul L Meades (with distinction), Chandré Teise, and Catherina van der Merwe graduated with the MSc specialising in Mathematical Statistics. In addition, Moletenyane Mokhele graduated with an MSc in Statistics.

The following PhD degrees were conferred:

Chifurira, Retius.
Thesis: *Modelling mean annual rainfall for Zimbabwe.*
Promoter: Dr D Chikobvu.

Iiyambo, Peter Tweuthigilwa.
Thesis: *Fiducial inference based on order statistics in location-scale and log-location-scale families.*
Promoter: Prof R Schall.

Van der Merwe, Sean.
Thesis: *Topics in the analysis of composition data.*
Promoter: Prof DJ de Waal.

POSTDOCTORAL RESEARCH FELLOWS

Prof Maxim Finkelstein hosted Postdoctoral Research Fellow, Dr Hazra from India, during 2018.

STAFF MATTERS

Sean van der Merwe obtained his PhD in December. Both Dr Delson Chikobvu and Ms Zani Ludick should soon qualify as actuaries. All other staff members are either working on PhDs or doing research and publishing.

Dr Sean van der Merwe took over responsibility for the Statistical Consultation Unit from Prof Robert Schall. The vacant lecturer position will be filled early in 2019.

Dr Von Maltitz was promoted to Senior Lecturer in the department.

Mr Jan-Paul Venter emigrated to Canada and was replaced by another actuary, Louwtjie Voges.

Sean van der Merwe

RESEARCH OUTPUTS

RESEARCH ARTICLES

Beirlant, J, Maribe, G and Verster, A. 2018. Penalised bias reduction in extreme value estimation for censored Pareto-type data, and long-tailed insurance applications. *Insurance: Mathematics and Economics* 78: 114-122.

Burger, D and Schall, R. 2018. Robust fit of Bayesian mixed effects regression models with application to colony forming unit count in tuberculosis research. *Statistics in Medicine* 37(4): 544-556.

Burger, D, Schall, R and Chen, DG. 2018. Robust Bayesian nonlinear mixed-effects modelling of time to positivity in tuberculosis trials. *Pharmaceutical Statistics* 17(5): 615-628.

Cha, JH and Finkelstein, M. 2018. On information-based residual lifetime in survival models with delayed failures. *Statistics and Probability Letters* 137: 209-216.

Cha, JH and Finkelstein, M. 2018. On preventive maintenance under different assumptions on the failure/repair processes. *Quality Reliability Engineering International* 34(138): 66-77.

Cha, JH and Finkelstein, M. 2018. On stochastic comparisons for population age and remaining lifetime. *Statistical Papers* 59(1): 199-213.

Cha, JH and Finkelstein, M. 2018. On a new shot noise process and the induced survival model. *Methodology Computer Applied Probability* 20(3): 897-917.

Cha, JH, Finkelstein, M and Levitin, G. 2018. Bivariate preventive maintenance of systems with lifetimes dependent on a random shock process. *European Journal of Operational Research* 266(1): 122-134.

Cha, JH, Finkelstein, M and Levitin, G. 2018. Optimal mission abort policy for partially repairable heterogeneous systems. *European Journal and Operational Research* 271(3): 818-825.

Finkelstein, M, Hazra, NK and Cha, JH. 2018. On optimal operational sequence of components in a warm standby system. *Journal Applied Probability* 55(04): 1014-1024.

Finkelstein, M and Levitin, G. 2018. Optimal mission duration for partially repairable systems operating in a random environment. *Methodol Computer Applications Probability* 20(2): 505-516.

Finkelstein, M and Levitin, G. 2018. Optimal mission duration for systems subject to shocks and internal failures. *Journal of Risk and Reliability* 232: 82-91.

Harvey, J and Van der Merwe, AJ. 2018. A Bayesian approach to inference on the variance of lognormal data. *South African Statistical Journal* 52(1): 29-55.

Hazra, NK and Finkelstein, M. 2018. On stochastic comparisons of finite mixtures for some semiparametric families of distributions. *TEST* 27(4): 988-1006.

Hazra, NK, Finkelstein, M and Cha, JH. 2018. Stochastic ordering for populations of manufactured items. *Springer* 27(1): 173-196.

Hazra, NK, Kuiti, MR, Finkelstein, M and Nanda, AK. 2018. On stochastic comparisons of minimum order statistics from the location-scale family of distributions. *Metrika* 81(2): 105-123.

Levitin, G and Finkelstein, M. 2018. Optimal mission abort policy for systems in a random environment with variable shock rate. *Reliability Engineering and System Safety* 169: 11-17.

Levitin, G and Finkelstein, M. 2018. Optimal mission abort policy for systems operating in a random environment. *Society for Risk Analysis* 38(4): 795-803.

Levitin, G, Finkelstein, M and Dai, Y. 2018. Heterogeneous standby systems with shocks-driven preventive replacements. *European Journal of Operational Research* 266(3): 1189-1197.

Levitin, G, Finkelstein, M and Dai, Y. 2018. Mission abort policy balancing the uncompleted mission penalty and system loss risk. *Reliability Engineering and System Safety* 176: 194-201.

Levitin, G, Finkelstein, M and Dai, Y. 2018. Optimizing availability of heterogeneous standby systems exposed to shocks. *Reliability Engineering and System Safety* 170: 137-145.

Makoni, T and Chikobvu, D. 2018. Modelling tourism demand volatility using a seasonal autoregressive integrated moving average autoregressive conditional heteroscedasticity model for Victoria Falls Rainforest arrivals in Zimbabwe. *Journal of Economic and Financial Sciences* 11(1): 1-9.

Ring, A and Breithaupt-Grögler, K. 2018. How publication guidelines for clinical pharmacology trials may help to accelerate knowledge transfer (editorial). *British Journal of Pharmacology* 84, 611–614.

Seedat, RY and Schall, R. 2018. Age of diagnosis, incidence and prevalence of recurrent respiratory papillomatosis – a South African perspective. *Clinical Otolaryngology* 43(2): 533-537.

Shoko, C and Chikobvu, D. 2018. Determinants of viral load rebound on HIV/AIDS patients receiving antiretroviral therapy: Results from South Africa. *Theoretical Biology and Medical Modelling* 15(10): 1-13.

Shoko, C and Chikobvu, D. 2018. Time-homogeneous Markov process for HIV/AIDS progression under a combination treatment therapy: Cohort study, South Africa. *Theoretical Biology and Medical Modelling* 15(3): 1-14.

Shoko, C, Chikobvu, D and Bessong, O. 2018. A Markov model to estimate mortality due to HIV/AIDS using CD4 cell counts based states and viral load: A principal component analysis approach. *Biomedical Research* 7(4): 457-471.

Tfwala, CM, Van Rensburg, LD, Schall, R and Dlamini, P. 2018. Drought dynamics and inter annual rainfall variability on the Ghaap plateau, South Africa, 1918 - 2014. *Physics and Chemistry of the Earth* 107: 1-7.

BOOKS

Cha, JH and Finkelstein, M. 2018. *Point processes for reliability analysis. Shocks and repairable systems.* Cham, Switzerland: Springer Nature (Springer International Publishing). pp. 419.

CHAPTERS IN BOOKS

Ring, A, Scharpenberg, M, Grill, S, Schall, R and Brannath, W. 2018. Equivalence tests in subgroup analyses. In: *New Frontiers of Biostatistics and Bioinformatics (ICSA Book Series in Statistics)* edited by Y Zao and DG Chen. Cham, Switzerland: Springer. pp. 201-238.

TECHNICAL REPORT

Van der Merwe, AJ, Groenewald, PCN, Sjölander, MR and Meyer, JH. 2018. *Outlier detection in a random effects model.* Technical Report number 452. Prepared for the Department of Mathematical Statistics and Actuarial Science, University of the Free State.

CONFERENCE CONTRIBUTIONS

Van der Merwe, AJ and Sjölander, MR. 2018. *Bayesian testing for process capability indices.* Paper delivered at the 5th African International Conference on Statistics, University of Botswana, Gaborone, Botswana. 19-22 March.

Van der Merwe, AJ, Groenewald, PCN and Sjölander, MR. 2018. *A Bayesian frequentist approach for detecting outliers in a one-way variance components model.* Poster presented at 2018 International Society for Bayesian Analysis Conference, Edinburgh, Scotland. 24-29 June.

Van der Merwe, AJ and Harvey, J. 2018. *Objective Bayesian analysis of the variance of lognormal data.* Poster presented at 2018 International Society for Bayesian Analysis Conference, Edinburgh, Scotland. 24-29 June.

Van der Merwe, S. 2018. *A method for Bayesian regression modelling of composition data.* Poster presented at 2018 International Society for Bayesian Analysis Conference, Edinburgh, Scotland. 24-29 June.

Van der Merwe, S. 2018. *Investigation comparing simulation methods for models with common constraints.* Paper delivered at the 60th Annual Conference of the South African Statistical Association, UNISA, South Africa. 26-29 November.

DEPARTMENT OF
MATHEMATICAL STATISTICS AND ACTUARIAL SCIENCE

STAFF (2018)

Head of Department: Mr FF Koning

Distinguished Professor: Prof MS Finkelstein

Professors: Prof JM van Zyl and Prof R Schall

Associate Professors: Prof R Coetzer, Prof A Ring, and Prof J Beirlant

Senior Lecturers: Dr D Chikobvu, Dr L van der Merwe, Dr A Verster, Dr A Neethling (Units), Mr FF Koning, Mr JM Blomerus, Mr MJ von Maltitz, and Mr JL Voges

Lecturers: Dr M Sjölander, Ms ME Girmay, Ms Z Ludick, Ms W Oosthuizen, Ms L da Silva, Mr AM Naude, and Mr S van der Merwe

Researchers: Prof PCN Groenewald, Prof AJ van der Merwe, and Prof DJ de Waal

Secretary: Ms ME Mathee

Messenger: Mr W Baranye

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

CONTACT DETAILS

Prof Johan Meyer
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OVERVIEW OF 2018

The Department of Mathematics and Applied Mathematics offers a variety of modules – some with an emphasis on the more abstract side of mathematics, and others more on the application side. Students who finish their undergraduate studies in our department typically obtain the degrees BSc, BCom, and sometimes even BA degrees. We also offer service modules to many students who study in other scientific directions, such as physical sciences, 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, combinatorics, algebra, and numerical analysis.

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. One of these projects is the popular Nautilus Mathematics project, designed to train, on a quarterly basis, talented learners from all over the Free State and Northern Cape to enhance their skills in problem solving.

ACHIEVEMENTS

Staff Achievements

As he has done for over 20 years, Prof Meyer continued his involvement with the setting of papers for various 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.

RESEARCH

Prof Johan Meyer continued his research collaboration with Prof W-F Ke from Tainan, Taiwan. During a research visit to the National Cheng Kung University in November, he was invited to give a talk on unique maximal rings of functions. A paper on bijective matrix maps has been submitted for publication.

He also visited the Johannes Kepler University in Linz, Austria, where he collaborated with Prof CJ Maxson from Texas, USA, in order to finish a project on congruence preserving functions. He also presented a talk on the embedding of Grassmann algebras into matrix algebras during his visit in Linz. A joint paper with Dr Ben-Eben de Klerk on the structure of automorphisms of certain abelian groups was accepted for publication.

Prof Tomas Vetrik visited his collaborators, Dr M Imran at the United Arab Emirates University, Prof M Alfuraidan from the King Fahd University of Petroleum and Minerals (in Dhahran, Saudi Arabia), Dr M Abas from the Slovak University of Technology (in Trnava, Slovakia), and Dr S Fufa from the Addis Ababa University (Ethiopia). During the visits, he presented lectures at research seminars at the King Fahd University of Petroleum and Minerals, and the United Arab Emirates University.

Mr Renier Jansen attended the Topology Seminar from the Algebra, Logic and Topology research group at the Centre for Mathematics, University of Coimbra, Portugal. He presented a talk on *Dual closure operators via constant subcategories.*

COMMUNITY SERVICE

Prof JH Meyer, Mr C Venter, Mr JB Smit, and Dr B-E de Klerk continued their involvement with olympiads by training learners from all over the country.

Dr S Dorfling was the main organiser of the annual open day for the prize winners of the Mathematics- and Science-in-Action programmes organised by the SA Academy for Science and Arts/SA Akademie vir Wetenskap en Kuns.

NATIONAL AND INTERNATIONAL COLLABORATION

Members of the department continued their international collaboration with researchers from Slovakia, Saudi Arabia, UAE, Ethiopia, Indonesia, Taiwan, and the USA.

POSTGRADUATE STUDENTS

The following candidates graduated with PhDs in 2018:

Bolton, Larisse.
Thesis: *Practical approaches to the application of mathematical modelling in oncology: From model investigation to data-driven model construction.*
Promoter: Prof C Hui.

Fasondine, Marco.
Thesis: *Computational methods and exploration of the multivalued Painlevé transcendents, with special emphasis on PIII.*
Promoter: Prof JAC Weideman.

Gnitchogna Batogna, Rodrique.
Thesis: *Analysis of option pricing within the scope of fractional calculus.*
Promoter: Prof A Atangana.

POSTDOCTORAL RESEARCH FELLOWS

The Department of Mathematics and Applied Mathematics hosted two Postdoctoral Research Fellows in 2018 – Dr Philippe Cara from Belgium (supervised by Prof Meyer) and Dr Selvaraj Balachandran from India (supervised by Prof Vetrik).

STAFF MATTERS

Dr Marco Fasondini, who completed his PhD degree in Applied Mathematics in 2018, is currently holding a postdoctoral fellowship at the University of Kent in England.

Marinda Venter – Administrative Officer in the department

Dr Albert Kriel, Lecturer in the department, who also assists with teaching the Engineering students

RESEARCH OUTPUTS

RESEARCH ARTICLES

Ali, P, Dankelmann, P, Morgan, MJ, Mukwembi, S, Swart, H and Vetrik, T. 2018. The average eccentricity, spanning trees of plane graphs, size and order. *Utilitas Mathematica* 107: 37-49.

Bataineh, MS, Vetrik, T, Jaradat, MMM and Rabaiah, AMM. 2018. The Ramsey number for two graphs of order 5. *Journal of Discrete Mathematical Sciences and Cryptography* 21: 1523-1528.

De Klerk, B-E, Meyer, JH, Szigeti, J and Van Wyk, L. 2018. Functions realising as abelian group automorphisms. *Communications in Algebra* 46(2): 467-479.

Jaradat, MMM, Bataineh, MS, Vetrik, T and Rabaiah, AMM. 2018. A note on the Ramsey numbers for theta graphs versus the wheel of order 5. *AKCE International Journal of Graphs and Combinatorics* 15(2): 187-189.

Maritz, E and Vetrik, T. 2018. The partition dimension of circulant graphs. *Quaestiones Mathematicae* 41(1): 49-63.

Vetrik, T. 2018. Degree-based topological indices of hexagonal nanotubes. *Journal of Applied Mathematics and Computing* 58(1): 111-124.

Vetrik, T. 2018. On bipartite Cayley graphs of small diameter. *Mathematical Reports* 20(70): 171-176.

Vetrik, T. 2018. The Randic index and the redefined Zagreb index of titania nanotubes TiO2 [m,n]. *U.P.B. Scientific Bulletin Series* B 80(1): 157-162.

Vetrik, T and Balachandran, S. 2018. General multiplicative Zagreb indices of trees. *Discrete Applied Mathematics* 247: 341-351.

CONFERENCE CONTRIBUTIONS

Vetrik, T, Balachandran, S. *General multiplicative Zagreb indices of trees.* Paper delivered at the 41st Australasian Conference on Combinatorial Mathematics and Combinatorial Computing, Rotorua, New Zealand. 10-14 December.

Vetrik, T. *Graphs of given degree and diameter.* Keynote lecture delivered at the International Conference on Discrete Mathematics and Data Sciences ICDMDS '18, Thanjavur, India. 28-29 September.

Meyer, JH, Maxson, CJ. *Congruence preserving functions on special p-groups.* Paper delivered at the Annual Congress of the South African Mathematical Society, Rhodes University, Grahamstown, South Africa. 2-4 December.

Meyer, JH. *On bijective matrices over a near-field.* Paper delivered at the International Congress of Mathematicians 2018, Riocentro Convention and Event Centre, Rio de Janeiro, Brazil. 1-9 August.

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

STAFF (2018)

Head of Department: Prof JH Meyer

BLOEMFONTEIN CAMPUS
Professor: Prof JH Meyer

Associate Professors: Prof TM Acho and Prof T Vetrik

Senior Lecturers: Dr S Dorfling and Ms JS van Niekerk

Lecturers: Dr E Ngounda, Dr A Kriel, Dr B-E de Klerk, and Mr C Venter

Junior Lecturers: Ms AE Swart and Ms MJF Botha

Temporary Lecturers: Ms H Oosthuizen, Mr JB Smit, and Mr RS Jansen

Administrative officer: Ms SM Venter

QWAQWA CAMPUS
Lecturers: Mr P Mbambo (Subject Head), Dr N Loufouma Makala, and Dr S Nkonkobe

Junior Lecturer: Ms C Faber

DEPARTMENT OF
MICROBIAL, BIOCHEMICAL AND FOOD BIOTECHNOLOGY

CONTACT DETAILS

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OVERVIEW OF 2018

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 University of the Free State (UFS). The department is responsible for undergraduate teaching and postgraduate training in three subjects, namely Biochemistry, Microbiology, and Food Science. Research conducted in the department finds application in three main areas - (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 2018, Prof Celia Hugo hosted Prof Jeff Newman from Lycoming College in Williamsport (United States), who has been awarded a Fulbright Scholarship to perform research and teaching in the department. Prof Carlien Pohl-Albertyn was awarded a Research Chair in Pathogenic Yeasts under the National Research Foundation (NRF) South African Research Chairs Initiative (SARChI).

ACHIEVEMENTS

Staff Achievements

Prof Jeffrey Newman from Lycoming College in Williamsport in the USA was awarded a scholarship in the Fulbright US Scholar Programme to spend 2018 in the department. The UFS was chosen as the site for his scholarship because he was familiar with Prof Celia Hugo's research and wanted to work with her on the taxonomy and significance of the cold-tolerant *Chryseobacterium* species isolated from food. Prof Newman is an expert on phylogenomics. During 2018, Prof Newman conducted phylogenomic research in collaboration with Prof Hugo, Prof Bragg, and Dr Boucher. He taught an honours first-semester course (Bioinformatics and Omics Sciences) and presented facets of a second-year course (Basic Principles of Microbiology). This collaboration has already resulted in several articles for the department, and more are anticipated.

Prof Jeff Newman (second from right, front row) and Prof Celia Hugo (second from right, back row) with students, mainly from the 2018 honours class

During 2018, Prof Carlien Pohl-Albertyn was awarded a Research Chair in Pathogenic Yeasts under the NRF SARChI programme.

Prof Carlien Pohl-Albertyn (right), SARChI Chair in Pathogenic Yeasts, with Dr Makobetsa Khati (Executive Director: Research Chairs and Centres of Excellence, NRF) and Prof Corli Witthuhn (Vice-Rector: Research, UFS) at the launch of the new NRF Research Chairs, hosted by Nedbank and the NRF on 6 July 2018

At the biannual conference of the South African Society for Microbiology (SASM) held in April 2018 at Muldersdrift, Prof Carlien Pohl-Albertyn was elected as the new president and Dr Olihile Sebolai as the new treasurer of SASM. The department was also elected as the host for the next SASM conference to be held in 2020.

Prof Angel Valverde was appointed for a three-year period to the Foundational Biodiversity Information Programme (FBIP) Steering Committee (1 May 2018–30 April 2021).

Dr Julio Castillo, from the Screening Applications and Exploring Novelty in Specialised Environments (SAENSE) Platform, was supported to visit the Brazilian Synchrotron Light Laboratory at Campinas in Brazil and to attend the laboratory's 28th Annual Users' Meeting. His presentation was titled 'Bacterial mutualism as a new strategy to survive extreme acidic and microaerophilic conditions'. Interaction took place with Dr Carlos Perez (responsible for X-ray Fluorescence/X-ray Near Edge Structure [XRF-XANES] beamline) at the synchrotron facilities, and new research questions were discussed.

The Synchrotron Techniques for African Research and Technology (START) project, which will provide significant funding for Prof Dirk Opperman's research from 2018 to 2021, started in earnest in 2018. Africa is the only continent that has no synchrotron, but researchers at Diamond Light Source, UK, have been awarded £3,7 million to develop synchrotron research in Africa. The Science and Technology Facilities Council (STFC) in the UK awarded the funding from the Global Challenges Research Fund (GCRF), which will allow African and UK investigators to work together to develop and characterise new materials of relevance to solar-energy conversion and catalysis, as well as to characterise proteins of relevance to better understand diseases and develop drugs. A kick-off meeting with the respective project teams involved in Structural Biology was held at the University of Cape Town (UCT) from 3 to 5 June 2018, and the first joint GCRF-START meeting for Structural Biology and Material Science was held from 18 to 19 September at the University of the Witwatersrand. Principal investigators, postdoctoral researchers, and postgraduate students from numerous groups in both disciplines attended and presented an overview of their research, and how their work ties in with the START initiative. Miss Carmien Tolmie (PhD student) presented an overview of the work of the UFS group at both the START meetings.

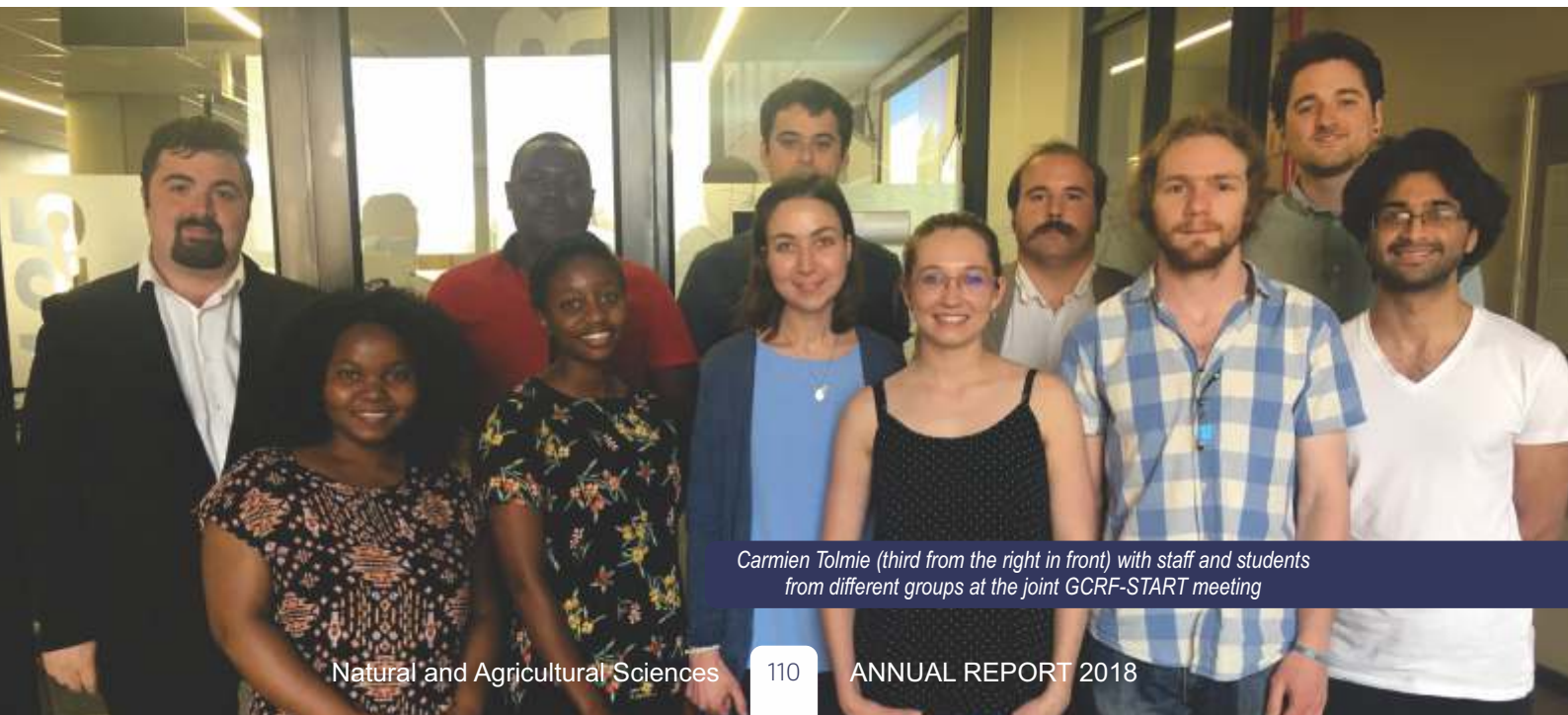
Prof Trudi O'Neill, in her role as Management Board Chair of the African Research Network for Neglected Tropical Diseases (ARNTD), was invited to attend the First Annual General Meeting of Tackling Infections to Benefit Africa (TIBA), hosted by the University of KwaZulu-Natal (UKZN) in Durban on 29 May 2018. Prof O'Neill and the ARNTD Executive Director, Dr John Amuasi, were subsequently invited by Dr Janet Byaruhanga, Senior Programme Officer for Public Health at the African Union-New Partnership for Africa's Development (AU-NEPAD), to discuss possible collaboration between ARNTD and NEPAD.

Student Achievements

Microbiology students from the department excelled at SASM by winning seven of the seventeen prizes for oral or poster presentations, and five of the twelve travel grants.

Miss Carmien Tolmie, a PhD student supervised by Prof Dirk Opperman, was sponsored through the University of Sao Carlos Institute of Physics, the Collaborative Computational Project Number 4 (CCP4), and the GCRF-START to attend the CCP4/MX2018 Macromolecular Crystallography School at the Institute of Physics in Sao Carlos, Brazil, from 14 to 24 November 2018, where she presented a poster titled *Structure and function of Baeyer-Villiger monooxygenases from Aspergillus flavus*. The workshop consisted of lectures by experts on protein crystallography and data processing, as well as hands-on tutorials, giving students the opportunity to work on their own data with the lecturers. Other institutions involved were the University of Sao Carlos Institute of Physics, as well as the CCP4 developers.

Miss Nkhasi Lekena, an Msc student supervised by Dr Dr Frans O'Neill, received the silver medal for best poster presentation during the joint conference of the South African Society of Biochemistry and Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, hosted by the North-West University (NWU) in Potchefstroom from 8 to 11 July 2018.



Carmien Tolmie (third from the right in front) with staff and students from different groups at the joint GCRF-START meeting

The research undertaken in the department can be clustered into three main themes, namely safe and novel food products and processes, biocatalysis and bioremediation, and improvement of human and animal health.

Safe and Novel Food Products and Processes

Prof Celia Hugo and her research group continued research on psychrotolerant bacteria in food, with emphasis on the genus *Chryseobacterium.* During 2018, the group worked actively with Prof Jeff Newman on taxonomic studies of novel *Chryseobacterium* species.

During 2018, Prof Arno Hugo and his research group worked on a project, which was funded by Red Meat Research and Development SA (RMRD SA), to reduce the sodium levels of traditional South African processed meat products. This research will ensure that these indigenous products stay relevant and meet the health requirements of the modern consumer. Biltong and dried sausage are also intermediate moisture meat products that are stable at room temperature and do not need refrigeration. Research on such products is important, since this technology is very relevant to consumers in rural Africa who do not always have refrigeration facilities.

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.

Maryna de Wit's research focused on the functional uses of cactus pears *(Opuntia ficus-indica* and *Opuntia robusta)* in food applications. Seed-oil content, composition, quality, and shelf life of 42 available cultivars were determined, while the extraction and application of the yellow and red colourants (betalains) from the fruit were investigated. The young cladodes (called nopalitos when used as vegetables) from 20 cultivars were compared in terms of morphological, nutritional, and sensory quality attributes. Research into the slimy hydrocolloid mucilage as functional ingredient in food is ongoing.

Prof Garry Osthoff continued his research on milk from 25 African non-dairy animals, while Dr Koos Myburgh and his students continued their work on the activation of plasminogen to plasmin, which plays a detrimental role during flocculation/gelation in milk.

Prof Bennie Viljoen continued his research on the medicinal and animal feed potential of edible mushrooms.

Biocatalysis and Bioremediation

Researchers from the Technology Innovation Agency (TIA)-funded SAENSE Platform, led by Prof Angel Valverde, continued to apply the knowledge gained from their work in extreme environments to develop remediation strategies for the treatment of polluted water for various industries. Research was also conducted on the feasibility of biogas production from various substrates and wastes, and the use of metal–mineral–microbe interactions for metal biorecovery.

The aim of the Biocatalysis and Structural Biology Group of Prof Dirk Opperman and Prof Martie Smit, 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. Prof Dirk Opperman received funding from SASOL for the biocatalytic production of diols.

Improvement of Human and Animal Health

The Molecular Virology Group of Prof Trudi O'Neill continued to investigate rotavirus-strain diversity, specifically focusing on whole genome constellations of human field strains originating from Mozambique. The study was expanded to include various animal strains. The development of a replication-deficient rotavirus vaccine through the production of rotavirus proteins in yeast is progressing well. A new project, using the rotavirus reverse genetics system, was initiated and aims to generate chimeric rotaviruses as antigens. The utilisation of lipids during rotavirus replication received much attention during the 13th dsRNA virus symposium held in Belgium in September 2018.

The work of the Clinical Biochemistry Group led by Dr Frans O'Neill, which focuses on human cellular detoxification and sterol metabolism, as well as the purification and heterologous expression of reproductive hormones, continued.

The Pathogenic Yeast Research Group of Prof Koos Albertyn, Prof Carlien Pohl-Albertyn, and Dr Olihile Sebolai, focuses on molecular mechanisms of virulence and the role of bioactive lipids in pathogenic yeasts, *Cryptococcus neoformans*, and several *Candida* species. In order to study the molecular mechanisms behind the virulence of these yeasts, they were successful in constructing several CRISPR-Cas9 gene-deletion systems to efficiently delete and modify genes to study their effects. One of their aims is to develop microbial growth-control strategies by identifying novel drug targets. This includes the re-purposing or re-positioning of medicines that are typically used to treat non-infectious conditions as anti-*Cryptococcus* drugs. They are also interested in the virulence of polymicrobial infections consisting of *C. albicans* and the bacterium *Pseudomonas aeruginosa*, and they have developed an invertebrate infection model to study this interaction.

The Veterinary Biotechnology Research Group of Prof Rob Bragg and Dr Charlotte Boucher continued their work on the development of sub-unit vaccines against *Avibacterium paragallinarum* and Infectious bronchitis virus. Full genome sequencing of the four important strains of *A. paragallinarum* was successfully completed and the data mining of these sequences can now start, with the aim of finding suitable antigens for the development of subunit vaccines. Work started on a new research area to make use of phage display libraries for the development of antibody fragments and antiviral peptides. Antibody fragments were found which neutralise Infectious bronchitis virus. This project is entering a possible commercialisation phase. Antivirus peptides against Newcastle disease virus have also been found and these might be developed further, depending on funding. In exciting research on resistance to disinfectants, a highly resistant bacterial strain isolated from dairy cows was sequenced and revealed around 600 novel genes, many of which can be found in clusters. There are some exciting possibilities from this work, which will enable us to gain important insight into resistance to disinfectants.

COMMUNITY SERVICE

Prof Arno Hugo presented a short course in meat processing on 21 June 2018. Attendees included teachers from agricultural schools in the Free State and potential entrepreneurs interested in starting meat-processing enterprises. The course included theoretical aspects, such as the effect from the conversion of muscle to meat on the quality of meat, as well as practical aspects such as meat-cutting techniques of beef, pork, and lamb carcasses. The attendees also learnt to manufacture whole-muscle meat products such as bacon and ham, emulsion-meat products such as polonies, viennas, Russian sausages, and ground-meat products such as fresh sausages and salami.

The SAENSE Platform hosted two open days for high school learners during 2018. The participating schools included a home-school group from Bloemfontein (March 2018) and the Vaalharts High School from Jan Kempdorp in the Northern Cape (May 2018).

Students were introduced to microorganisms and the positive roles they play in our everyday lives. Learners also participated in scientific experiments, including extracting DNA from strawberries, using common household items. The SAENSE Platform also presented a research workshop to five students from Eunice High School in Bloemfontein (June 2018).

Prof Arno Hugo presenting the short course on meat processing

NATIONAL AND INTERNATIONAL COLLABORATION

The Veterinary Biotechnology Group has several international collaborations. In a long-standing collaboration with Dr Patrick Blackall from the University of Queensland in Brisbane, Australia – widely regarded as the world expert on infectious coryza in chickens – the long-term storage of the very fastidious bacterium, *Avibacterium paragallinarum*, which is the causative agent of infectious coryza, is being investigated.

They also have collaborative projects with Dr Asgar, from Saife VetMed in India, on various potential commercial products, as well as with Dr Gavakar from 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.

During 2018, Prof Rob Bragg was invited to present workshops on biosecurity for major poultry producers in Colombia, Ecuador, Argentina, and Brazil.

Prof Arno Hugo collaborated with the Agricultural Research Council, the Sernick Group, NWU, the University of Fort Hare, and the University of Swaziland regarding research on the effect of dietary intervention on the lipid component of meat from monogastric and ruminant animals.

Prof Dirk Opperman continued two ongoing collaborative projects with groups in the Netherlands and Denmark – with Dr Frank Hollmann and Dr Caroline Paul (Delft University of Technology, the Netherlands), and with Dr Selin Kara from Aarhus University in Denmark. These three groups bring together different 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.

Dr Jacqueline van Marwijk, a Postdoctoral Research Fellow in the Biocatalysis Lab, visited the Cardiff University School of Chemistry from 2 to 18 April 2018. During the visit, experiments were conducted in an effort to bridge the gap between chemo- and biocatalysis. The experiments were undertaken in the Cardiff Catalysis Institute of Prof Graham Hutchings.

Two German students undertook internships in the Biocatalysis Lab in 2018. Mr Andreas Schäffler, an undergraduate student from the Eberhard Karls University of Tübingen, spent two months (August to October) working on the ADH-mediated lactonisation of 1,6-diols during his DAAD RISE internship (German Academic Exchange Service – Research Internship in Science and Engineering). He was later joined by Mr Leon Hennecke, an MSc student from Hamburg University of Technology, for two weeks during October, working on the same project. Dr Thandeka Moyo, START postdoctoral research associate from the National Institute for Communicable Diseases (NICD) in Johannesburg, visited the UFS from 28 to 30 November to perform crystallography experiments.

Prof Trudi O'Neill has active collaborations with several national and international groups. During 2018, she continued collaboration with Dr Nilsa de Deus at the National Institute of Health, Maputo, Mozambique, on rotavirus diversity in Mozambique. Ms Eva Dora da Cruz João, a PhD student, visited the UFS from June to July. Prof O'Neill also collaborates with Dr Martin Nyaga from the UFS Next-Generation Sequencing laboratory on this topic.

Another collaboration – with Prof Christiaan Potgieter of Deltamune in Pretoria – included the development of a Newcastle disease virus (NDV) replicon-based rotavirus vaccine for a veterinary application. During 2018, the collaboration was extended to also include rotavirus diversity studies.

During 2018, the German Research Foundation (DFG)-funded project, titled 'Antigens and reassortant strains for rotaviruses circulating in Africa (AfRota)', was initiated. The project utilises the rotavirus reverse-genetics system and aims to generate chimeric viruses that can be used in next-generation rotavirus vaccine development. The project is carried out by a team of collaborators, including Prof O'Neill, Prof Albie van Dijk (NWU), Prof Potgieter, Dr De Deus (National Institute of Health, Mozambique), and Prof Reimar Johne from the Federal Institute for Risk Assessment (BfR) in Berlin, Germany. In this context, Mrs Soveij van der Schyff, an MSc student in Prof O'Neill's group, visited Prof Van Dijk's group at NWU to receive training in reverse-genetics methodology. An AfRota annual project meeting was held from 20 to 22 September 2018 at BfR in Berlin with all participating members.

As part of the Argentina/South Africa Research Cooperation Programme, Dr Danilo Legisa, a postdoctoral fellow affiliated to Dr Martin Blasco at the Centre for Biotechnology of the Argentinean National Institute of Industrial Technology (INTI) in Buenos Aires, visited Prof O'Neill's laboratory during August 2018. In return, Mr Olufemi Folorunso, a PhD student in Prof O'Neill's group, visited the INTI.

Researchers in the SAENSE Platform collaborated with several national and international researchers. Their collaboration with researchers from the German Research Centre for Geoscience (Prof M Zimmer), Ritsumeikan University (Prof H Ogasawara), and Princeton University (TC Onstott), continued. The collaboration is funded by the International Continental Drilling Program, the National Science Foundation, and the NRF. The multidisciplinary research project, titled 'KASMS: Kinetically Activated Subsurface Microbial Sampler', aims to investigate the processes of hydrogen genesis during seismic cycles in active fault zones in order to better understand the correlation between seismicity and gas release and to geochemically characterise the extreme environment of life in the deep subsurface.

Dr Julio Castillo and Prof Angel Valverde collaborated with Prof Alfonso Corzo, from the University of Cádiz, on a project titled 'Bioprecipitation of metallic copper from acid mine drainage: Biogeochemical conditions and

bioengineering of the process'. Preliminary results showed the biotechnological potential of a specific consortium that could be applied for copper extraction in the mining industry (biomining) of South Africa.

The SAENSE Platform was awarded R100 000 for a UFS/Central University of Technology (CUT) joint research project, titled 'Unravelling the microbiome of Sesotho (sorghum beer) through targeted metagenomics', which is led by Prof Angel Valverde (UFS) and Dr Olga de Smidt (CUT). Other participating researchers are Dr Errol Cason, Dr Jan-G Vermeulen, Dr Marcele Vermeulen, Prof Bennie Viljoen, and Ms Laurinda Steyn (all from UFS), and Ms Mpho Malefane from CUT. The objective of this project is to better understand the microbial communities involved in the fermentation process of Sesotho. Understanding this diversity is vital if we aim to translate this knowledge into practical application, for example, to improve Sesotho fermentation, aroma, and style.

Dr Frans O'Neill continued his collaboration with Prof Albie van Dijk (from NWU) on the role of Glycine-N-acyltransferase (GLYAT) in cellular detoxification, with Prof David Marais (from UCT) on phytosterols in selected South African fauna, and with Dr Dee Blackhurst (from UCT) on reactive oxygen species in rotavirus-infected cells. He also collaborated with AniPharm Pty. Ltd on the production of equine chorionic gonadotropin.

Dr Gabré Kemp collaborated with Dr Tim Downing of the Department of Biochemistry and Microbiology at Nelson Mandela University (NMU) 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 collaborated on mass spectrometry analyses of milk proteins with Dr Stoychev from the Council for Scientific and Industrial Research (CSIR).

OTHER ACTIVITIES

The department hosted its annual Third-year Information Day on 31 May to promote postgraduate studies. Invited third-year students were informed about postgraduate study options and the main areas of research in the department.

On 12 June, the department held its annual Research Day, during which the Postdoctoral Research Fellows presented their results. The 2018 Research Day was again sponsored by Separations.

On 4 and 5 April, Progress Excellence presented a two-day Hazard Analysis and Critical Control Points (HACCP) workshop for students. In this workshop, students who are interested in working in the food industry, attained critical skills on ensuring food safety. Successful students received certificates.

POSTGRADUATE STUDENTS

At the April 2018 graduation, five students graduated with the BScHons majoring in Biochemistry, five students majoring in Food Science, and twelve students majoring in Microbiology.

Ten students graduated in 2018 with master's degrees:

- Elebert Mwanza with MSc (Agriculture) in Food Science.
- Valentia Motsamai with MSc (Agriculture) in Food Science.
- Choaro Dithugoe with MSc in Biochemistry.
- Reitumetse Molaoa with MSc in Biochemistry – with distinction.
- Matshepo Rakaki with MSc in Biochemistry.
- Bokang Mahlomaholo with MSc in Biotechnology.
- Cornelia Meyburgh with MSc in Microbiology.
- Lithabiso Motanyane with MSc in Microbiology.
- Nthabiseng Mokoena with MSc in Microbiology.
- Susanna Saaiman with MSc in Microbiology.

Three doctoral degrees were awarded:

Agunbiade, Mayowe Oladele.
Thesis: *Assessment of bioflocculant production by actinomycetes from rivers and dams of the Eastern Free State province of South Africa and their potential in wastewater treatment.*
Promoter: Dr AOT Ashafa.

Alayande, Kazeem Adekunle.
Thesis: *Evaluation of antimicrobial potential of the leaf and stem bark extracts of Eucla Crispa (Thunb.) and its possible synergism and standard antibiotics.*
Promoter: Dr AOT Ashafa.

Lee, Ji-Yun.
Thesis: *Investigating the potential of bacteriophage induction and phage-derived enzymes as alternative antibacterial approaches.*
Promoter: Prof RR Bragg.

Miss Cheri Jacobs and Miss Jasmin Aschenbrenner (both PhD students) attended the 5th European Crystallography School at Stellenbosch University from 8 to 14 July. The workshop was held by the European crystallographic Association, the International Union of Crystallography, and the South African Crystallographic Society.

Two MSc students, Mr Wico Sander and Mr Tshidiso Mogotsi, received full travel grants from the Bill and Melinda Gates Foundation to attend the 13th International dsRNA Virus Symposium in Houffalize, Belgium, from 24 to 28 September. Another MSc student, Miss Larise Oberholster, received a partial travel grant.s work to gain important insight into resistance to disinfectants.

PhD students Cheri Jacobs and Jasmin Aschenbrenner (seated on right) at the the 5th European Crystallography School

POSTDOCTORAL RESEARCH FELLOWS

The Department of Microbial, Biochemical and Food Biotechnology was privileged to host ten Postdoctoral Research Fellows during 2018. They were:

Dr Rodolpho Aldo Machado (Brazil).
Dr Errol Cason (South Africa).
Dr Moses Madende (Zimbabwe).
Dr Adepemi Ogundeji (South Africa).
Dr Saheed Sabiu (Nigeria).
Dr Amy Strydom (South Africa).
Dr Wouter van der Westhuizen (South Africa).
Dr Jacqueline van Marwijk (South Africa).
Dr Marcele Vermeulen (South Africa).
Dr Ana Ebrecht (Argentina).

Dr Saheed Sabiu was awarded a Gordon Research Conference travel grant on account of the quality of his presentation at the 2018 Gordon Research Conference on Human Genetic Variation and Disease, held at the University of New England, Biddeford, Maine, USA, from 9 to 15 June.

Dr Amy Strydom was successful with her application to the Small Grants Program of the ARNTD. She also received an outstanding poster award at the 13th International Rotavirus Symposium held in Minsk, Belarus from 29 to 31 August, as well as a full travel grant from the Bill and Melinda Gates Foundation in order to attend the 13th International dsRNA Virus Symposium, Houffalize, Belgium from 24 to 28 September.

Dr Ana Ebrecht attended the 5th European Crystallography School at Stellenbosch University from 8 to 14 July.

STAFF MATTERS

In June, Prof Angel Valverde was appointed as Associate Professor in Microbiology in the place of Prof Stephanus Killian who retired at the end of 2017. Before joining the UFS in 2017 as Lead Researcher of the SAENSE Platform, Prof Valverde was a researcher with Prof Don Cowan at the University of Pretoria.

Dr Frank Hollmann from the Delft University of Technology was appointed as an Affiliated Professor in the department.

RESEARCH OUTPUTS

RESEARCH ARTICLES

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Nkuekam, GK, Cowan, DA and Valverde, A. 2018. Arable agriculture changes soil microbial communities in the South African grassland biome. *South African Journal of Science* 114(5/6): art 2017-0288.

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CHAPTERS IN BOOKS

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CONFERENCE CONTRIBUTIONS

Bisschoff, E, Albertyn, J and Pohl, CH. 2018. *A wide range CRISPR-Cas9 (Clustered regularly interspaced short palindromic repeats-CRISPR associated systems9) system in yeasts.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Bisschoff, E, Albertyn, J and Pohl, CH. 2018. *A wide range CRIPR-Cas9 (Clustered regularly interspaced short palindromic repeats-CRISPR associated system 9) system in non-conventional yeasts.* Poster presented at the Conference on non-conventional yeasts: From basic research to application, Rzeszow, Poland. 15-18 May.

Brink, JTL, Sebolai, OM and Pohl, CH. 2018. *Cytological study of the effect of nordihydroguaiaretic acid (NDGA) and its derivative terameprocol (M4N) on Candida albicans.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Coetzee, JM, Boucher, CE, Van der Westhuizen, WA and Bragg, RR. 2018. *Detecting single chain variable fragments to potentially neutralise infectious bronchitis virus (IBV).* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Coetzer, M, Theron, CW and Boucher, CE. 2018. *Searching for immunomodulating proteins in the outer membrane protein fraction of Avibacterium paragallinarum.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Dithebe, K, Van Wyk, PWJ, Steyn, L and Pohl, CH. 2018. *Characterization of intracellular gas bubbles in Saccharomyces.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Du Plooy, LM, Sebolai, OM, Pohl, CH and Albertyn, J. 2018. *Functional characterisation of Cryptococcus genes: Then and now.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4–7 April.

Folorunso, OS, Rakaki, ME, Albertyn, J and O'Neill, HG. 2018. *Production of rotavirus VP6-based vaccine candidates in engineered yeast strains.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Fourie, R, Cason, ED, Ells, R, Sebolai, OM, Albertyn, J and Pohl CH. 2018. *Peeking behind the curtain: Transcriptomics of Candida albicans-Pseudomonas aeruginosa interaction.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Hugo, A. 2018. *The taste is in the fat.* Paper presented at the Wagyu Conference, Parys, South Africa. 8-11 August.

Hugo, A. 2018. *Important factors that affect meat quality.* Paper delivered at Stockman School Conference on Reproduction: The Foundation for Profitability, Ventersburg, South Africa. 17-19 October.

Jawallapersand, P, and Boucher, CE. 2018. *Immunomics: In silico mapping of the immune signalling pathways in chickens related to Avibacterium paragallinarum C-3 serovar infection.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Jawallapersand, P, Van der Westhuizen, WA, Jansen van Rensburg, WJ, and Boucher, CE. 2018. *Studying the regulation of immune signalling molecules related to immunity during Avibacterium paragalliarum infection.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Kgotle, EY, Pohl, CH, Albertyn, J and Sebolai, OM. 2018. *Investigating the production of 3-hydroxy fatty acids in Pseudomonas aeruginosa.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Kilian, L, Boucher, CE and Bragg, RR. 2018. *Diversity or perish: exploring new ways to prevent infectious bronchitis in poultry.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Kilian, L, Boucher, CE and Bragg, RR. 2018. *Evaluating a novel disinfecting treatment to combat QAC tolerance in the nosocomial pathogen Staphylococcus epidermidis utilizing a bacteriophage encoded enzyme.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Kuloyo, OO, Pohl, CH and Albertyn, J. 2018. *The influence of polyunsaturated fatty acids in Candida albicans biofilm susceptibility towards azoles.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Lekena, N, Opperman, DJ, O'Neill, HG and O'Neill, FH. 2018. *Recombinant expression of eCG in CHO-K1 cells.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Loureto, M, Oosthuizen, P, Roodt, E and Hugo, A. 2018. *Fatty acid composition of seven South African beef breeds.* Poster presented at the 64th International Congress on Meat Science and Technology, Melbourne, Australia. 12-17 August.

Lum Nde, A, Charimba, G, Steyn, L and Hugo, C. 2018. *Comparison of the growth kinetics of Chryseobacterium species isolated from poultry sources.* Poster presented at the 26th International Committee on Food Microbiology and Hygiene Conference. Biodiversity of Foodborne Microbes, Berlin, Germany. 3-6 September.

Madende, M, Albertyn, J and Pohl, CH. 2018. *Understanding the role of arachidonic acid in increasing the susceptibility of C. albicans in the presence of fluconazole.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Madu, UL, Ogundeji, AO, Pohl, CH, Albertyn, J and Sebolai, OM. 2018. *Elucidation of the role of 3-hydroxy fatty acids in Cryptococcus-amoeba interactions.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Marais, SS, Du Preez, LL, Opperman, DJ and O'Neill, HG. 2018. *An in silico investigation into the molecular basis of rotavirus reassortment.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Mochochoko, BM, Albertyn, J and Pohl, CH. 2018. *Iron at the interphase of Candida albicans prostaglandin production and virulence.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Mokoena, NZ, Pohl, CH and Albertyn, J. 2018. *Caenorhabditis elegans as model for Candida albicans and Pseudomonas aeruginosa infection and infection induced changes in fatty acid metabolism.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Ntoi, MA, Ogundeji, AO, Pohl, CH and Sebolai, OM. 2018. *The use of photodynamic treatment (PDT) as an alternative treatment for Cryptococcus infections.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Oberholster, L, Aschenbrenner, J, Potgieter, AC and O'Neill, HG. 2018. *Evaluation of recombinant Newcastle Disease Viruses (NDV) as candidate vaccine delivery vectors for rotavirus VP7 and NSP4 in mice.* Poster presented at 13th International dsRNA Virus Symposium, Houffalize, Belgium. 24-28 September.

Oberholster, L, Potgieter, AC and O'Neill, HG. 2018. *Removal of rotavirus VP7 signal peptide influences protein folding.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Ogundeji, AO, Pohl, CH and Sebolai, OM. 2018. *The repurposing of anti-psychotic drugs, quetiapine and olanzapine as anti-Cryptococcus drugs.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Ogunyinka, MI, Folorunso, OS, Albertyn, J and O'Neill, HG. 2018. *Removal of glycosylation motifs and constitutive expression of rotavirus VP6 in Arxula adeninivorans.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Pieterse, B, Pohl, CH and Albertyn, J. 2018. *HST6- a stress response gene of Candida albicans.* Poster presented at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Pilenyane, N, Madu, LU, Ogundeji, AO, Pohl, CH, Albertyn, J and Sebolai, OM. 2018. *The biological function of cryptococcal 3-hydroxy fatty acids.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Pohl, CH, Fourie, R, Mokoena, N, Kemp, G and Albertyn, J. 2018. *Eicosanoid production by Candida albicans in combination with Pseudomonas aeruginosa in vitro and in a Caenorhabditis elegans infection model.* Paper delivered at the 14th American Society for Microbiology Conference on Candida and candidiasis, Providence, USA. 15-19 April.

Porotloane, BF, Ogundeji, AO, Pohl, CH and Albertyn, J. 2018. *The re-purposing or re-positioning of copper acyl salicylate as an anti-Cryptococcus medicine.* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Sabiu, S, Gafane, L, Mthimkulu, L, Staat, N, Osthoff, G and O'Neill, FH. 2018. *Sterols in milk samples of ruminant and non-ruminant animals.* Paper delivered at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Sabiu, S, Madende, M and Ajiboye, T. 2018. *Diabetes and obesity in South Africa: Current status, burden and probable way forward.* Paper delivered at BRICS-Plus Conference on Water, Food and Health Nexus, Bloemfontein, South Africa. 2-5 September.

Sabiu, S, Mamokhosana, PM, O'Neill, HG, Van Dijk, AA and O'Neill, FH. 2018. *Detection of genetic variants in the GLYAT gene of South African individuals of African descent.* Poster presented at the 3rd Biennial Gordon Research Conference on Human Genetic Variation and Disease, Biddeford, United States of America. 8-15 June.

Sabiu, S and O'Neill, FH. 2018. *Biomembrane stabilization, in silico analysis and kinetics of inhibitory potential of epicathecin and procyanidin B from Chrysophyllum albidium seed cotyledon against key enzymes linked to carbohydrate metabolism.* Paper delivered at the 1st Southern African Postdoctoral Conference, Stellenbosch, South Africa. 3-5 October.

Sander, WJ, Pohl, CH and O'Neill, HG. 2018. *The effect of supplementation of fatty acids with varying degrees of saturation on rotavirus yield and replication in MA104 cells.* Poster presented at the Joint Conference of the Molecular Biology and the Federation of African Societies of Biochemistry and Molecular Biology, Potchefstroom, South Africa. 8-11 July.

Sander, WJ, Pohl, CH and O'Neill, HG. 2018. *The effect of gamma-linolenic acid supplementation on rotavirus yield and replication in MA104 cells.* Poster presented at 13th International dsRNA virus symposium, Houffalize, Belgium. 24-28 September.

Sigwela, VN, De Wit, M, Du Toit, A, Amoo, S and Hugo, A. 2018. *Extraction, characterization, and application of betalains from beetroot, cactus pear and amaranth for food safety.* Poster presented at the 2nd International Congress on Food Safety and Security, Pretoria, South Africa. 15-17 October.

Strydom, A, João, ED, De Deus, N and O'Neill, HG. 2018. *Comparison of Mozambican rotavirus genotyping and sequencing data suggests revision of the G12 and P[4] genotyping primers.* Poster presented at the 13th International Rotavirus Symposium, Minsk, Belarus. 29-31 August.

Strydom, A, João, ED, Nyaga, MM, Potgieter, Cuamba, A, Mandomando, I, Cassocera, M, De Deus, N and O'Neill, HG. 2018. Whole genome characterisation of Rotavirus A circulating in southern Mozambique during 2012-2013 reveals diverse strains and several reassortment events. Poster presented at the 13th International dsRNA Virus Symposium, Houffalize, Belgium. 24-28 September.

Van der Westhuizen, WA, Theron, CW, Boucher, CE and Bragg, RR. 2018. *Immunogenicity evaluation of full-length and truncated versions of a transmembrane virulence protein Iss from avian pathogenic Escherichia coli (APEC).* Paper delivered at the 20th Biennial Congress of the South African Society for Microbiology, Muldersdrift, South Africa. 4-7 April.

Van Wyngaard, BE, Strydom, PE, Pohl, C, Van Heerden, I, Kanengoni, A, De Witt, F-H and Hugo, A. 2018. *Effect of dietary Echium oil supplementation on the omega-3 fatty acid composition and sensory quality of pork.* Poster presented at the 64th International Congress of Meat Science and Technology, Melbourne, Australia. 12-17 August.

DEPARTMENT OF MICROBIAL, BIOCHEMICAL AND FOOD BIOTECHNOLOGY

STAFF (2018)

Head of Department: Prof M Smit

Professors: Prof J Albertyn, Prof R Bragg, Prof G Osthoff, Prof C Pohl-Albertyn, Prof M Smit, and Prof B Viljoen

Associate Professors: Prof A Hugo, Prof C Hugo, Prof T O'Neill, Prof D Opperman, and Prof A Valverde Portal

Affiliated Professor: Prof F Hollmann

Affiliated Associate Professor: Prof B Lodolo

Senior Lecturers: Dr F O'Neill, Dr C Boucher, Dr M de Wit, Dr K Myburgh, and Dr O Sebolai

Affiliated Senior Lecturer: Dr S Bareetseng

Lecturer: Dr C Bothma

Junior Lecturer: Ms L Steyn

Senior Researchers: Dr G Kemp and Dr J Castillo-Hernandez

Research Associates: Prof D Litthauer, Prof JC du Preez, and Dr R Ells

Secretaries: Ms OK Tshotetsi and Ms I Auld

Senior Officers – Professional Services: Mr S Marais and Ms N-M Agenbag

Officers – Professional Services: Ms Y Makaum, Ms C van Rooyen, Ms A van Wyk, and Ms E Roodt

Officer: Ms A van der Westhuizen

Senior Officer: Ms C Badenhorst

Senior Assistant Officer: Ms E van den Heever

Storeman: Ms M Mogopodi

Technical Help: Ms L Mazwi, Ms A de Bruin, Ms D Joseph, Mr P Mereko, Mr J Mvula, Mr K Mashuga, and Mr VJ Lamle

DEPARTMENT OF PHYSICS

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OVERVIEW OF 2018

The University of the Free State (UFS) Department of Physics is one of the leading Physics departments in South Africa and is recognised internationally, with two National Research Foundation (NRF) B-rated researchers. Researchers in the department have international collaborators in the USA, Europe, and China. The main research areas in the department are astrophysics, phosphor materials, and solid-state physics (diffusion, segregation, thin films, and theoretical calculations). The department is well equipped, with a nano-surface characterisation laboratory including a state-of-the-art AES nano-probe, XPS, ToF-SIMS, and an STM. It also has an observatory with six telescopes, the largest one being a 1,5 m telescope, and a fully robotic telescope. Most of our staff members are also involved with the Boyden Science Centre and the Naval Hill Planetarium, which is actively engaging with local, provincial, and national communities. The undergraduate and postgraduate programmes are challenging and well-balanced, ensuring that the students exiting these programmes are of high quality and sought-after by industry. The department hosted the 63rd Annual Conference of the South African Institute of Physics (SAIP 2018) from 25 to 29 June 2018. The department also underwent an audit during the year, with positive feedback on all levels.

ACHIEVEMENTS

SAIP 2018

The department hosted the 63rd Annual Conference of the South African Institute of Physics (SAIP 2018) from 25 to 29 June. The conference brought together 530 physicists from universities across South Africa, as well as physicists from research-oriented industries, as well as 12 international delegates.

Hosting the 63rd Annual Conference of the South African Institute of Physics

SARChI Chair

After the first successful five years, the Department of Science and Technology (DST) and the NRF approved a second term of funding for the Chair in Solid-state Luminescent and Advanced Materials. As in previous years, the research group continued to produce a high number of International Scientific Indexing (ISI)-accredited journal papers during 2018.

Staff Achievements

Prof Swart was again a much sought-after speaker, delivering a number of keynote and invited presentations at various conferences, workshops, and symposia, including:

- Advanced Materials World Congress (Singapore, 4-8 February).
- National Conference on Recent Trends in Advanced Materials and Applications (India, 11 April).
- National Conference on Recent Advances in Experimental and Theoretical Physics (RAETP-2018) (India, 17-18 April).
- International Symposium on Functional Materials (ISFM-2018): Energy and Biomedical Applications (India, 13-15 April).
- Applications of Luminescence, Winter School Workshop (South Africa, 25 June).
- 12th International Conference on Physics of Advanced Materials (ICPAM-12) (Greece, 22-28 September).
- 5thSMEOS (Sensors, MEMS and Electro-Optical Systems) (South Africa, 8-10 October).
- AVS 65th International Symposium and Exhibition (USA, 21 October).
- International Conference on Surfaces, Coatings and Nanostructured Materials (NANOSMAT-Africa) (South Africa, 19-23 November).

Student Achievements

A number of students won prizes at the SAIP 2018 Conference. These include:

- The Goodfellow PhD Publication Award won by DN Oosthuizen (supervisors: D Motaung and HC Swart).
- Wirsam MSc Publication 2 (Semiconductor) prize won by E Lee (supervisors: HC Swart and JJ Terblans).
- Frank Nabarro PhD Oral prize won by Z Tshabalala (supervisors: D Motaung and HC Swart).
- PhD Oral (Applied Physics) prize won by DN Oosthuizen (supervisors: D Motaung and HC Swart).
- MSc Oral (Semiconductor) prize won by E Lee (supervisors: HC Swart and JJ Terblans).
- MSc Oral (Condensed Matter/Materials Science) prize won by L Erasmus (supervisors: JJ Terblans and HC Swart).
- MSc Poster (Semiconductor) prize won by MJ Mphuthi (supervisors: HC Swart and JJ Terblans).

Helene Szegedi and Lucas Erasmus – presenters of the Physics Bowl at SAIP 2018

RESEARCH

Research activities in the department focus on astrophysics, phosphor materials, and solid-state physics (diffusion, segregation, thin films, and theoretical calculations).

The UFS Astrophysics Research Group had a productive year. The Observatory in the department hosts several research-class telescopes, of which the 1,5 m reflector is the largest. The mirror of the UFS-Boyden 1,5 m telescope was re-aluminised in February 2018 when it was sent to the South African Astronomical Observatory (SAAO) Sutherland site. The new coating of aluminium has dramatically increased the optical reflectivity and the performance of this telescope.

The group is in the final stages of negotiations with the Appalachian State University to install a sophisticated spectropolarimeter on the UFS-Boyden 1,5 m telescope during 2019. This will be a very significant addition to the observational capabilities of the UFS-Boyden Observatory, to supplement the spectroscopic capabilities of telescopes at the SAAO site in Sutherland. The proposed spectropolarimeter will enable simultaneous spectroscopy and polarimetry of astrophysical sources. The polarimetry will allow discrimination between radiation produced via non-thermal processes, such as synchrotron radiation and thermal radiation. The installation of the spectropolarimeter will result in the 1,5 m telescope reaching its full scientific capabilities, enabling it to play an extremely important role in the follow-up observational studies of high-energy cosmic sources.

A new flow-reactor system for water purification studies and CEM microwave synthesiser for more advanced synthesis of phosphors were bought during 2018. The Pulsed Laser Deposition system was upgraded with a new laser from the National Laser Centre.

New aluminium coating on the UFS-Boyden 1,5 m telescope

COMMUNITY SERVICE

The Two Observatories Project

The Two Observatories Project includes the Boyden Observatory and Science Centre (approximately 25 km from Bloemfontein) and the old Lamont-Hussey Observatory on Naval Hill in the centre of Bloemfontein, which has been converted into a digital planetarium.

It is largely due to the relationships established through the Boyden Observatory that the UFS was mandated to develop and manage the second observatory – now a planetarium. There is a great synergy between the two facilities. The planetarium is often the first point of contact for learners and the public, whereas the Boyden Observatory is used for more intensive learning experiences. Furthermore, Boyden hosts an astronomy museum and offers 'real-sky' and 'telescope' experiences, all of which give 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. In 2018, more than 12 000 people visited the observatories.

Museum (Heritage) Project

The Boyden Museum has four curated exhibits; the fourth (the 'Glass Universe') opened in 2018. This consists of a display of the valuable glass plates recording the observations made at the Boyden Observatory.

NATIONAL AND INTERNATIONAL COLLABORATION

The bilateral research collaboration programmes with Belgium, Sweden, and Romania were strengthened in 2018 through exchange visits. Edward Lee and Lucas Erasmus, two MSc students in the department, spent time in the collaborating laboratories of Belgium, Sweden, and Romania.

A successful Joint South Africa-Sweden Research Collaboration Workshop on Improving Performance of Wide-Bandgap Materials, was held in Visby, Sweden from 13 to 15 August.

Prof Hendrik Swart (UFS) and Prof Valentin Craciun (National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania) visiting Qwaqwa Campus

POSTGRADUATE STUDENTS

At the 2018 graduations, three students graduated with the BScHons majoring in Astrophysics, and seven students majoring in Physics. Mr Lucas Johannes Bartel Erasmus (Bloemfontein Campus), and Ms Sharon Kiprotich (Qwaqwa Campus) graduated with the MSc degree.

At PhD level, the following students graduated:

Motloung, Selepe Joel.
Thesis: *Investigation of photoluminescent properties of rare-earth doped mixed multicomponent structures of phosphoranadates.*
Promoter: Prof OM Ntwaeaborwa.

Ogugua, Simon Nnalue.
Thesis: *Preparation and characterization of powders and pulsed laser deposited thin films of rare-earth doped oxyorthosilicates.*
Promoter: Prof OM Ntwaeaborwa.

Ungula, Jatani.
Thesis: *Formation and characterization of novel nanostructures un-doped and Ga-doped ZnO transparent conducting thin films for photoelectrode.*
Promoter: Prof FB Dejene.

POSTDOCTORAL RESEARCH FELLOWS

The research activities of the department were strengthened by the inclusion of 13 Postdoctoral Research Fellows (three based on the Qwaqwa Campus), who helped to build capacity in the research laboratory. They were:

Dr Iorkyaa Ahemen (Nigeria).
Dr Balakrishna Auvla (India).
Dr Obi Echendu (Nigeria).
Dr Fekadu Hone (Ethiopia).
Dr Promod Kumar (India).
Dr Arup Kunti (India).
Dr Samvit Menon (India).
Dr Shivaramu Nagarasanakote (India).
Dr Simon Ogugua (Nigeria).
Dr Fidy Ramamonjisoa (Madagascar).
Dr Aswin Sharma (India).
Dr Krishna Singh (India).
Dr Jatani Ungula (Kenya).

STAFF MATTERS

In 2018, Prof Kobus Terblans and Dr Kamohelo Tshabalala continued to serve as Academic Head of Department (based on the Bloemfontein Campus) and Subject Head on the Qwaqwa Campus, respectively.

Prof JJ Terblans, Academic Head of Department

Dr KG Tshabalala, Subject Head, Qwaqwa Campus

RESEARCH OUTPUTS

RESEARCH ARTICLES

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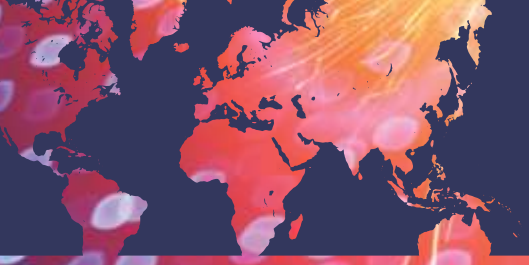

DEPARTMENT OF PHYSICS

STAFF (2018)

Head of Department: Prof JJ Terblans

BLOEMFONTEIN CAMPUS
Senior Professors: Prof HC Swart and Prof PJ Meintjes

Professors: Prof WD Roos and Prof JJ Terblans

Associate Professors: Prof E Coetzee-Hugo, Prof MHJ Hoffman, and Prof RE Kroon

Senior Lecturers: Dr RA Harris and Dr B van Soelen

Lecturers: Dr S Cronje, Dr A Odendaal, and Mr DP van Jaarsveldt

Junior Lecturer: Ms H Szegedi

Researcher: Dr M Duvenhage

Affiliated Associate Professors: Prof KT Hillie, Prof G Mhlongo, and Prof DE Motaung

Research Associates: Prof JPK Hölsä, Dr V Kumar, and Dr J Prakash

Senior Officer – Professional Services: Dr HJ van Heerden

Officer: Ms K Cronje

Assistant Officers: Ms ML Lebeko, Ms Y Loots, and Ms D Mangope

QWAQWA CAMPUS
Professor: Prof BF Dejene

Senior Lecturer: Dr LF Koao

Lecturers: Dr KG Tshabalala (Subject Head), Mr RO Okaya, and Dr SJ Motloung

DEPARTMENT OF PLANT SCIENCES

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OVERVIEW OF 2018

The Department of Plant Sciences consists of three divisions: Botany (on both Bloemfontein and Qwaqwa Campuses), Plant Breeding, and Plant Pathology. Our dynamic staff teach and perform research in a diverse range of topics. The undergraduate (BSc and BSc [Agriculture]) and postgraduate training we offer are focused on relevant issues in our country and abroad and are globally competitive. Our collaboration with various national and international institutions, local councils, and associations is indicative of the relevance and applicability of plant science to industry. Our staff's competence and quality of work is reflected in the South African Research Chairs Initiative (SARChI) Chairs held since 2015, the number of staff with National Research Foundation (NRF) ratings, the increasing number of Postdoctoral Research Fellows, awards received, peer-reviewed publications, and qualifications conferred to students in 2018. Staff members in the department published 57 peer-reviewed articles in 2018 and hosted eight Postdoctoral Research Fellows.

ACHIEVEMENTS

Staff Achievements

Prof Louis Scott received a B1-rating from the NRF for 2018-2022.

Profs Botma Visser (Chairperson), Zakkie Pretorius and Liezel Herselman, Dr Willem Boshoff, and Cornél Bender organised the very successful International Cereal Rusts and Powdery Mildews Conference (ICRPMC) in Skukuza from 23 to 26 September 2018. A total of 93 international and national delegates attended the meeting. Prof Pretorius and Dr Boshoff, together with Ms Jianping Zhang (from CSIRO Agriculture and Food in Canberra), were the co-authors of the winning poster, with the title *Isolation of an immune receptor gene from tall wheat grass confers resistance to diverse races of stem rust in common wheat.*

The poster of Prof Zakkie Pretorius on *Innovative manufacturing of a cereal rust inoculation device* won the prize for best poster at the 9th Borlaug Global Rust Initiative (BGRI) Technical Workshop in Marrakech, Morocco, while Prof Botma Visser's poster, titled *Gone with the wind: Revisiting stem rust dispersal between southern Africa and Australia*, was the runner-up.

Prof Botma Visser, Dr Willem Boshoff, Prof Zakkie Pretorius, Prof Liezel Herselman (back row, from the left), and PhD students Howard Castelyn and Martin Chemonges (front row) visiting a field trial during the BGRI Technical Workshop in Morocco

Prof Maryke Labuschagne participated in the international Agriculture for Food Security (AgriFoSe) in Africa Programme in Sweden in 2018, where a project was undertaken on the impact of plant breeding on food security in Africa. The project concluded with a publication and policy documents for African countries on how to optimise breeding and extension activities for food security.

Members of the department were actively involved in the organisation of the international conference on Sorghum in the 21st Century held in Cape Town from 9 to 12 April. The conference was attended by 2 500 delegates from around the globe, and included more than 250 oral presentations and 200 poster presentations. Prof Maryke Labuschagne and Prof Neal McLaren jointly chaired the Local Scientific Programme Committee. Ms Lisa Rothmann served as chairperson of the Student Chapter of the Sorghum in the 21st Century Global Conference.

Prof Labuschagne also served on the scientific committee and as a session chair for the 13th International Gluten Workshop in Mexico City, in addition to which she was a plenary speaker. She continued as South African representative of the American Association of Cereal Chemists International, and as a member of the advisory committee to the South African government on genetically modified organisms. She was appointed to the editorial board of the *British Journal of Cereal Science* at the end of 2018.

Dr Lize Joubert obtained third prize during the first Flash Fact competition for staff members in the Faculty of Natural and Agricultural Sciences.

Dr Lize Joubert (third from left) winning third prize during the Flash Fact Competition

Prof Neal McLaren and Lisa Rothmann served on the Sorghum Trust Projects Evaluation Committee. Lisa Rothmann, in collaboration with Grain SA, received funding to expand the South African Sclerotinia Research Network (SASRN), which is aimed at generating a South African Virtual Centre of Excellence and Expertise for *Sclerotinia* research in an international arena. The network is aimed at developing practical management strategies for diseases caused by *Sclerotinia*, through a research consortium and network. At the International Society for Plant Pathology Sclerotinia Subject Matter Committee meeting in Boston, Ms Rothmann was elected to assist in publishing a collaborative article focusing on Sclerotinia diseases.

Dr Sandy-Lynn Steenhuisen received an award for the highest-impact paper (for staff) in 2018 in the research programme run by the Afromontane Research Unit (ARU) based on the Qwaqwa Campus. This was for a paper, titled *Saurian surprise: Lizards pollinate South Africa's enigmatic 'hidden flower'*, by R Cozien, T van der Niet, SD Johnson, and S-L Steenhuisen, accepted by *Ecology*.

The Department of Plant Sciences on the Qwaqwa Campus has been selected to host the annual conference of the South African Association of Botanists (SAAB) in January 2020. Dr Sandy-Lynn Steenhuisen will serve as chairperson of the local organising committee.

Dr Tom Ashafa received the Prolific Researcher Award in Natural and Agricultural Sciences during the 2018 Qwaqwa Campus Research Excellence Award Ceremony.

Student Achievements

Lisa Rothmann obtained third prize during the first Flash Fact competition for postgraduate students in the Faculty of Natural and Agricultural Sciences.

Lisa Rothmann being awarded third prize in the Flash Fact competition by Prof Francis Petersen (UFS Vice-Chancellor)

Five postgraduate students (Martin Chemonges, Ettienne Theron, Jacques van der Merwe, Danette Strauss, and Stephanie MacDonald) competed in the annual postgraduate symposium of the Department of Botany and Plant Biotechnology at the University of Johannesburg (UJ). While Mr Chemonges was announced as the runner-up in the PhD category, Ms Strauss and Ms MacDonald were announced as the winner and runner-up of the BSc Honours category, respectively.

Alex de Gouveia (supervised by Dr L Joubert and co-supervised by Dr M Jackson) won the EM van Zinderen Bakker prize for an outstanding MSc study in Botany.

Clausanne Esterhuizen won the Botanical Society of South Africa (Free State Branch) prize for best honours student in Botany (supervisor Dr M Jackson), and Gerna Maree won the prize for the best Plant Pathology postgraduate student (supervisor Prof ZA Pretorius, co-supervisor Dr R Prins).

Jacques van der Merwe won the Klein Karoo Seed Marketing prize for the best honours student in Plant Breeding (supervisor Dr R van der Merwe).

Nthabiseng Mashamba won the South African Plant Breeders' Association (SAPBA) prize for the best MSc student in Plant Breeding (supervisor Dr A van Biljon, co-supervisors Prof MT Labuschagne and Dr B Wentzel).

Ansori Maré won the Plant Breeding prize for the best PhD student in Plant Breeding (supervisor Prof L Herselman, co-supervisor Dr WHP Boshoff).

Lisa Rothmann was awarded the American Phytopathological Society (APS): Books for the World Prize, through which she is sponsored books from the APS Press to the value of $500. Ms Rothmann also wrote a popular article for the *Dry Bean Magazine*, titled 'Weather and water matters'.

PhD student Sajjad Akhtar was selected to make an oral presentation at the prestige Du Pont symposium during the 12th Southern African Plant Breeding Symposium in March 2018. During the same symposium, PhD student Julius Siwale won the best student poster award, while MSc student Ntombokulunga Mbuma received the award for the best oral student presentation.

Staff and students attending the Postgraduate Symposium of the UJ Department of Botany and Plant Biotechnology. Front row, from the left: Stephanie MacDonald and Jacques van der Merwe. Back row, from the left: Martin Chemonges, Danette Strauss, Dr Andri van Aardt, Ettienne Theron, and Prof Botma Visser

Dr Rudo Ngara's two students based on the Qwaqwa Campus, Mamosa Ngcala (MSc) and Tatenda Goche (PhD), presented their research at the Sorghum in the 21st Century Conference held in Cape Town in April 2018. Mamosa won the first prize for a 3-Minute Thesis competition at the conference.

SARChI Chair in Disease Resistance and Quality of Field Crops

The SARChI Chair, led by Prof Maryke Labuschagne, had many highlights in 2018. A study on the mixograph and Mixsmart software as predictors of wheat quality for the South African wheat industry was concluded, contributing useful data for all sectors of the wheat industry. In a separate study, solvent-retention capacity of South African wheat cultivars was determined for the first time. A project undertaken in collaboration with the International Centre for the Improvement of Wheat and Maize (CIMMYT) in Mexico, has led to a new study on gluten-protein expression under heat and drought stress conditions in international and South African bread and durum-wheat cultivars. Proteomics protocols for gluten-protein analysis were optimised and are now used as part of the gluten-protein research. Research on biofortification of maize with iron and zinc has continued in collaboration with CIMMYT. Research on biofortification of cassava and banana with provitamin A continued, in collaboration with the International Institute of Tropical Agriculture (IITA) in Nigeria.

The Cereal Rust Group collaborated on several local and international research projects. Locally, several new rust races were described and their potential risk towards grain production was determined through characterising cultivars and breeding lines for their resistance response. These findings were communicated at congresses as well as in popular and scientific papers. International collaboration included projects aimed at cloning and mapping resistance genes and transferring novel sources of resistance to wheat from *Thinopyrum ponticum*, a wild relative of wheat.

Botany: Palaeo-botany and ecology

Dr Andri van Aardt and Prof Louis Scott investigated the long-term changing patterns in vegetation by studying both fossil and present-day plant material. As part of ongoing research projects with international collaboration, they made progress in the reconstruction of the climate and vegetation of the Quaternary in the central and western parts of the Free State (Florisbad) and Northern Cape (Wonderwerk Cave and Kathu Pan). They also investigated the use of the leaf epidermis as a possible indicator for palaeo-environments at the Pretoria Saltpan (Tswaing Crater), Gauteng.

In addition, they obtained cores from Colbyn Valley Nature Reserve, Rustenburg, and Rietvlei Dam Nature Reserve with the help of Dr Piet-Louis Grundling (Working for Wetlands, Department of Environmental Affairs) for radiocarbon dating and pollen analysis, with the aim of gaining fine resolution samples for the reconstruction of the vegetation and climate of the Savanna and Grassland Biomes during the late Pleistocene and Holocene.

Research on fossil hyrax dung in Namibia was continued, and samples were submitted for radiocarbon dating, while previous palynological results were also processed.

Dr Sandy-Lynn Steenhuisen's research group, based on the Qwaqwa Campus, welcomed Mr Adams as a master's student in April 2018. He is funded by the ARU to work in collaboration with Dr Grant Martin from the Centre for Biological Control (CBC) at Rhodes University, and ARU Director, Dr Ralph Clark, on the invasive potential of *Pyracantha* species on high-altitude lands in the eastern Free State. This opened links with the Centre for Invasion Biology (CIB), an inter-institutional centre of excellence based at Stellenbosh University, and also resulted in an invitation for Dr Steenhuisen to participate in the annual meeting of the National Alien Grass Working Group, held at the South African National Biodiversity Institute (SANBI), Kirstenbosch Gardens, in September 2018. Mr Adams and Dr Steenhuisen participated in a workshop on 'Seed Dispersal by Native Ungulates from Southern Africa' held at the University of KwaZulu-Natal (UKZN), Pietermaritzburg, in July 2018. Collaborations are now being explored with Biological Sciences at UKZN to investigate the viability of *Pyracantha* seeds ingested by frugivorous birds.

Dr Steenhuisen's research on the genetic diversity of *Protea* species that employ different pollinators, is ongoing in collaboration with Prof Jeremy Midgley of the University of Cape Town (UCT), Megan Smith (master's student, UCT), and Dr Rachel Prunier of the Western Connecticut State University (WCSU), USA. In addition, in collaboration with researchers from UKZN, Ms Ruth Cozien (the project coordinator), Dr Timotheus van der Niet, and Prof Steven Johnson, she started exploring the scent and colour preferences of Drakensberg crag lizards as ongoing research on the lizard pollination system of *Guthriea capensis*, discovered during the 2017/2018 flowering season.

Pollination of Guthriea capensis by lizards
(Photo credit: Ms Ruth Cozien [UKZN])

Botany: Plant Physiology/biochemistry and molecular biology

Prof Botma Visser leads the molecular genetics laboratory within Botany, where the emphasis is on the genetic characterisation of different pests, rusts, and viruses of cereals. Included are rusts of wheat, sunflower, and oats, as well as viruses of wheat and their associated vectors, and the Russian wheat aphid.

Dr Lintle Mohase and her research team continued their research on plant-defence mechanisms in wheat during aphid (and rust) infestations. She collaborated with plant breeders (Dr Ntjapa Lebaka) and pathologists (Dr Willem Boshoff) from the University of the Free State (UFS), and entomologists from the Agricultural Research Council-Small Grain (ARC-SG) in Bethlehem (in particular Dr Astrid Jankielsohn). Dr Mohase's research concentrated 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 Gerhard Potgieter's research topics in the field of ecophysiology focus on plant health. Chlorophyll-a fluorescence for photosynthetic capacity, chlorophyll concentration and Normalised Difference Vegetation Index (NDVI) imaging are the base parameters used for plant health. The effect of different bio-stimulants, such as fish protein, kelp, and *Trichoderma* extracts on plant health and yield, were evaluated on hydroponically grown crops. Additionally, a new approach was developed to identify plants through aerial remote sensing, using both digital (RGB) and NDVI images to create vegetation indexes in support of traditional ecological survey techniques, and to identify early-stress conditions in plants.

Dr Makoena Joyce Moloi was appointed in March 2018 and is currently establishing her research, focusing on the physiology of large-seeded soybean under abiotic stress conditions (e.g. drought, temperature, and nutrients). Her research will be valuable for breeding plants with tolerance to such stressors. She is working closely with Dr Rouxléne van der Merwe, from Plant Breeding.

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, a PhD student is investigating the chemical composition and allelopathic influence of the underutilised crop, *Amaranthus cruentus*, under abiotic stress conditions. Another PhD study examines control strategies for silverleaf nightshade (*Solanum elaeagnifolium* Cav.), with emphasis on the impact of biological control. An MSc project focuses on the chemical composition and resistance of pecan-nut cultivars in South Africa.

Marlese Meiring (PhD student) conducting ratings for soybean cultivar evaluations of Sclerotinia stem rot, caused by Sclerotinia sclerotiorum

Dr Rudo Ngara's ongoing research, based on the Qwaqwa Campus, focuses on understanding the adaptive mechanisms of sorghum to drought, salinity, and heat stresses, using a range of 'omics' technologies. She has also started to functionally characterise some of the target genes in *Arabidopsis* plant systems, in collaboration with Dr Chivasa from Durham University, UK.

Botany: Phytomedicine and ethnobotany

This research is primarily undertaken on the Qwaqwa Campus. Dr Tom Ashafa continued with his research on medicinal plants used in the management of various diseases, particularly those used for diabetes mellitus and associated complications. The ultimate goal is to develop either ameliorative or curative remedies for these diseases. The research group also worked on parasitic (zoonotic) infections, biological materials for wastewater treatment, and antibiotics from plant sources.

Dr Lisa Komoreng continued her research on traditional medicinal plants used in the treatment of tuberculosis, elephantiasis, and ear, nose, and throat 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, antioxidant, anthelmintic and antifilarial, and cytotoxic properties. Active compounds are isolated from plants showing good pharmacological activities without any toxic properties.

Botany: Plant taxonomy and molecular systematics

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

The Molecular Systematics Research Group is headed by Dr Mariëtte Jackson. Various genera within the family Asteraceae are studied to assess the phylogenetic relationships among these groups. A new field of research is currently being investigated, involving the analysis of fossil pollen from the Prof Louis Scott Collection for its use within phylogenetic studies. A master's student is optimising various molecular techniques to be used to acquire DNA sequences from fossil pollen.

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 in South African wheat cultivars. New developments in her research were presented at two international conferences (the BGRI Workshop and the ICRPMC), and two local conferences (Southern African Plant Breeding Symposium and South African National Seed Organisation [SANSOR] Conference). The wheat-resistance breeding programme 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.

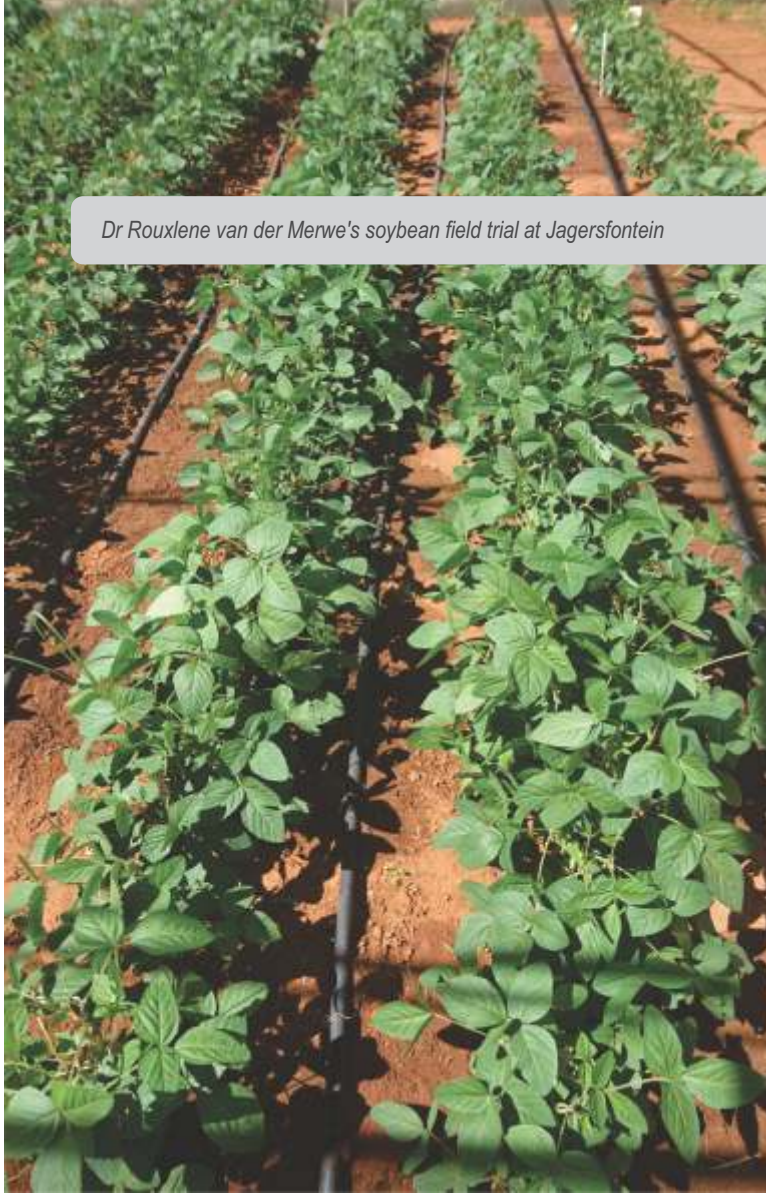
Postgraduate student projects included characterising and mapping a potential new source of wheat stem-rust resistance, genetic analysis of stem-rust resistance in South African winter wheats, genetics of stem-rust resistance in spring-wheat germplasm from Ethiopia, breeding for disease resistance in a South African context, and improving rust and FHB resistance in South African wheat lines. Progress was made with crosses to transfer one stem rust and three stripe-rust resistance genes into lines that already contain eight other rust and FHB-resistance genes. Research is also continuing to confirm the possible identification of novel stem-rust resistance genes, closely linked to known stem-rust resistance genes, in selected winter wheat varieties. Elite and synthetic spring wheat lines from Ethiopia were also phenotypically and genetically evaluated for resistance against Ug99 and non-Ug99 stem-rust races. Association mapping identified chromosome regions not previously linked to stem-rust resistance. Lines containing three to four stem-rust resistance genes were identified; these can be used in future breeding schemes to develop stem-rust resistant wheat cultivars in Ethiopia.

Dr Adré Minnaar-Ontong continued her research on the genetic variation of *Sclerotinia sclerotiorum* populations on different hosts in South Africa. The outcome of the project contributed towards another research project, which includes the development of resistant cultivars to Sclerotinia diseases in economically important oil crops. The NRF-Thuthuka (2019-2020) and Grain SA will fund the resistance-breeding project. South African sunflower and soybean cultivars are 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.

Plant Breeding: Conventional breeding

Dr Rouxléne van der Merwe's research focuses on analysing the stability of Edamame (*Glycine max* L.) in South African production conditions. The research is undertaken in collaboration with the Edamame Development Programme (EDP) project, funded by the Durban City Council and KwaZulu-Natal government). Her PhD student, Armand Smit, delivered a paper on his results during the 12th Southern African Plant Breeding Symposium held in Durban during March 2018.

Dr Van der Merwe breeds for resistance to pod dehiscence in vegetable-type soybean, in collaboration with the Northeast Institute of Geography and Agroecology at the Chinese Academy of Sciences. This research continued to make progress towards the development of an improved South African vegetable-type soybean cultivar that shows resistance to pod shattering. This project is also done in collaboration with Dr Adré Minnaar-Ontong, who is responsible for marker-assisted selection. Green pod yield, nutritional content, and selection for drought-stress tolerance in large-seeded (vegetable type) soybean are also investigated. The work is done in collaboration with the EDP, and the project is funded by the NRF-Thuthuka. This research continued to make progress towards the development of an improved South African vegetable-type soybean cultivar that shows high-yield potential and with improved nutritional value, as well as characterisation of vegetable-type soybean cultivars in terms of drought-stress tolerance. The project is done in collaboration with Dr Angeline van Biljon, who is responsible for amino-acid and sugar analyses.



Dr Rouxlene van der Merwe's soybean field trial at Jagersfontein

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

Dr Angeline van Biljon continued her research on the influence of abiotic stress on the nutritional profile and quality of crops, as this information can contribute to the improvement of specific crops and improved food security. Her research focuses on crop plants, including wheat, maize, soybeans, and alternative crops such as amaranth and cleome. The nutritional screening includes the study of storage proteins through size exclusion and reverse-phase high-performance liquid chromatography, as well as the determination of total starch, amylose, tryptophan, β-carotenoids, mineral content (especially iron and zinc), and the bioavailability of minerals.

Dr Ntjapa Lebaka continued his work on improving the nutritional value of indigenous grain legume crops, such as Bambara groundnuts and cowpeas. The study focuses on the evaluation of these crops for adaptation in selected South African environments, as well as evaluation of nutritional quality (protein, lipids, iron, and zinc content) under stress conditions.

Prof Maryke Labuschagne continued her research on wheat quality with a focus on gluten proteins and their expression, and how this affects bread-making quality. Three PhD students were involved in the research, and another completed her studies in 2018. They have optimised a protocol for proteomics analysis of durum and bread wheat. This project is done in collaboration with the CIMMYT in Mexico, and the ARC-SG in Bethlehem. In terms of crop nutritional value, a collaborative project with the IITA in Nigeria on the improvement of provitamin A content in cassava is continuing, with a PhD student leading the research. Research on the improvement of maize nutritional value, in collaboration with CIMMYT in Zimbabwe, has led to the completion of two MSc studies, while two PhD students are continuing their work on zinc, tryptophan, and lysine biofortification.

Dr Angeline van Biljon and postgraduate students from Plant Breeding planting amaranth seedlings in a field trial

Plant Pathology: Cereal-rust diseases

Together with Chinese collaborators, Prof Zakkie Pretorius and Dr Willem Boshoff's research in transferring rust resistance from a related grass species to wheat was expanded, and a scientific paper submitted. Three wheat-mapping populations for leaf- and stripe-rust resistance were screened in South Africa in collaboration with scientists from the University of Sydney, Australia. Collaborative projects with researchers from the USA include barley stem-rust resistance mapping (University of Minnesota) and stem-rust race nomenclature (Agricultural Research Service – United States Department of Agriculture [ARS-USDA]). A collaborative project, funded by King Abdullah University of Science and Technology (KAUST) – which will contribute to the understanding of durable disease resistance in wheat, and stem-rust screening of UK wheat cultivars against stem-rust race PTKST – continued in collaboration with scientists from the John Innes Centre. Satisfactory results were obtained from greenhouse and field work, including screening of commercial South African wheat cultivars and lines for rust resistance. The data from these trials is annually included in the national wheat-production guidelines of ARC-SG. Significant progress was made with projects on studying pathogenic variability in rust pathogens of oats, barley, and rye. One paper from this work has been accepted for publication.

Plant Pathology: Soil microbial ecology

Prof Wijnand Swart leads the Soil and Microbial Ecology Group (SMEG), whose focus falls on monitoring the rhizosphere microbiome as a bio-indicator of plant health. Research mainly concentrates on underutilised crops such as Bambara groundnuts, cowpeas, and various pseudo-grains such as quinoa, chia, and amaranth, although commercial crops such as soybean, sorghum, and maize are also studied. The genetic and functional diversity of the rhizosphere microbiome of diseased plants is compared with that of healthy plants, using various advanced biochemical and molecular tools. Research is primarily funded by the Ekhaga Foundation in Sweden, the ARC, Nulandis, and the Strategic Research Fund of the UFS.

Plant Pathology: Mycology

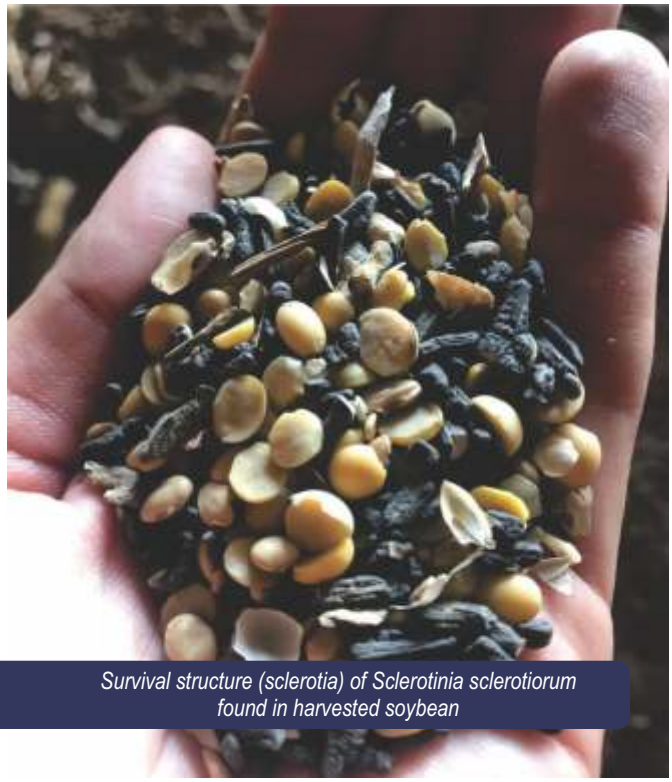
Dr Gert Marais leads the Mycology and Pecan Health Research Group that focuses on the biodiversity of fungi and their role in plant health, as well as their economic importance. A five-year contract was signed in 2017 between the UFS and the South African Pecan Nut Producers' Association (SAPPA) to study pecan diseases and their impact in South Africa. The Pecan Health Research Group, which includes plant pathologists, physiologists, geneticists, and plant breeders, was thus established at the UFS. Seven postgraduate projects are being undertaken, involving research in all nine major pecan-producing areas of South Africa. In addition, 12 farmers' days were held in the Free State, Northern Cape, Eastern Cape, North-West, Limpopo, Mpumalanga, and KwaZulu-Natal. First results reflect a number of fungal diseases associated with pecans, indicating the distribution of these diseases throughout South Africa.

Plant Pathology: Epidemiology

The field-crops epidemiology programme was led by Prof Neal McLaren and supported by Ms Lisa Rothmann. The programme focuses on epidemiology of Sclerotinia stem and head rot of soybean and sunflower, as well as sorghum pathology – including leaf blight, grain moulds, and root rots.

A legume rotation programme that integrates environmental diversity and edaphic variables in legume-rotation systems with sorghum on root health, was continued. This was funded by the ARC Collaborative Consortium: Broadening the Food Base Programme, in collaboration with Dr Maryke Craven at the ARC-Grain Crops (ARC-GC) in Potchefstroom. This research forms the basis of an MSc study and is associated with the ARC-Professional Development Programme.

Research support from the Sorghum Trust continued during 2018. This programme focuses on grain colonisation by grain-mould pathogens and mycotoxigenic *Fusarium* spp., risk-prediction modelling, and 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 initiated in 2017, that is 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 Sclerotinia stem rot of soybean and head rot of sunflower, and the quantification of genotype x environment interactions based on multi-environment responses.



Survival structure (sclerotia) of Sclerotinia sclerotiorum found in harvested soybean

COMMUNITY SERVICE

Dr Lize Joubert and her MSc student, Linde de Jager, presented talks on pollination biology at meetings of the Free State branch of the South African Botanical Society (BotSoc), held at the Free State National Botanical Garden in Bloemfontein. BotSoc members also paid a visit to the Geo Potts Herbarium for a talk on the role of the herbarium in society.

The Heidedal Kinderbond, led by Ds Deon Potgieter, visited the Geo Potts Herbarium for a fun day of exploring interesting plants, learning about plant science, and making their own mini-herbarium specimens.

Members of the Lesotho Ministry of Forestry and Land Reclamation, as well as community leaders who aim to establish a new botanical garden and herbarium on tribal land, visited the Geo Potts Herbarium. The aim of the visit was to learn about the contribution of herbaria to the community and how a new herbarium can be established and run.

Dr Andri van Aardt presented a talk at the Bloemfontein Central Gardening club, titled 'What can plant fossils tell us about climate change?'

NATIONAL AND INTERNATIONAL COLLABORATION

Members of the department collaborated widely during 2018, as part of ongoing collaborative initiatives.

Dr Lize Joubert collaborated with Dr Pieter Bester from SANBI on systematic and evolutionary research of *Nemesia*, a genus endemic to Southern Africa and of significant horticultural and conservational importance, and with Prof Beverley Glover from the University of Cambridge on floral evolution and development research.

Prof Liezel Herselman continued her collaborative research with researchers from the Pannar Seed Company, CenGen, and the ARC-SG.

Dr Andri van Aardt and Prof Louis Scott collaborated with Dr Piet-Louis Grundling (Working for Wetlands at the Department of Environmental Affairs) on palaeoenvironmental reconstructions of the Grassland-Savanna transition, with Dr Liora Horwitz (Jerusalem, Israel) and PhD student Magdalena Sobol (Toronto, Canada) on palaeoenvironments at archaeological sites in the Northern Cape, and with Dr Frank Neumann (University of the Witwatersrand) and Dr Friðgeir Grímsson (University of Vienna) on fossil African Loranthaceae pollen.

Prof Botma Visser collaborated with Mr Marcel Meyer from the University of Cambridge, Dr Dave Hodson from the CIMMYT in Ethiopia, and Prof Robert Park of the Plant Breeding Institute, University of Sydney, on the movement of stem rust from Africa. He also collaborated with Prof Melania Figueroa of the Department Plant Pathology, University of Minnesota, on the genetic characterisation of oat crown rust. At national level, he collaborated with Drs Tarekegn Terefe, Goddy Prinsloo, and Astrid Jankielsohn of the ARC-SG in Bethlehem on various projects.

Dr Adré Minnaar-Ontong collaborated with breeding companies from industry in South Africa and with researchers from the University of Manitoba, Canada, and the University of Nebraska, USA.

Dr Lintle Mohase collaborated with Dr Astrid Jankielsohn (ARC-SG, Bethlehem) on aphid diversity in South Africa and Lesotho, and with the Lesotho Agricultural Research on wheat germplasm in Lesotho.

Dr Rouxléne van der Merwe has continuing collaboration with Prof Qiuying Zhang from the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, and the EDP. She also collaborates with breeding companies from industry and with researchers from the University of Manitoba, Canada, and the University of Nebraska, USA.

Dr Willem Boshoff and Prof Zakkie Pretorius conducted research projects in collaboration with researchers from the Chinese Academy of Sciences (Beijing), KAUST (Kingdom of Saudi Arabia), John Innes Centre (UK), the University of Minnesota (USA), ARS-USDA, and the University of Sydney (Australia). They also conducted research with CenGen, ARC-SG, Sensako, Pannar, the Central University of Technology, and Stellenbosch University.

Dr Gert Marais collaborates with SAPPA and the Forestry and Agricultural Biotechnology Institute (FABI) at the University of Pretoria, to study diseases in the pecan industry in South Africa. He also worked with Prof Karen Jacobs from Stellenbosch University, studying mycotoxins in abalone feed and co-presenting a Mycology module for honours students at the UFS. Dr Marais, in collaboration with Technology Innovation Agency (TIA), the UFS, and Carbon Fertilizer Technologies (Pty) Ltd, is developing a plant-growth enhancer, which is in the commercialisation phase.

Prof Wijnand Swart collaborated with researchers from Stellenbosch University, the University of Pretoria, and Utrecht University on a project registered by the South African National Parks (SANParks) on resolving age-old problems with taxonomy and ecology of fungi described before the availability of contemporary molecular techniques, including the description of new species. The two-year project was initiated in November 2018, when all persons involved conducted an extensive fungi-collecting trip in the Knysna forests. Prof Swart visited the Kruger National Park in July 2018, with various researchers from the UFS, to collect data and also participate in a writing workshop as part of a collaboration between the UFS and SANParks, aimed at studying above- and below-ground ecological patterns, catenal processes, and biodiversity of the Granite Supersite ecosystem in the park.

A close working relationship was forged between SMEG and the company Nulandis in 2018. This resulted in Nulandis providing funding for an extensive master's project conducted by Alec Edwards, focusing on the rhizobiome of soybean after the application of salicylic acid to the crop.

Dr Angeline van Biljon's research is done in collaboration with the ARC-SG, ARC-GC, and ARC-Vegetable and Ornamental Plants (ARC-VOP), Roodeplaat, and CIMMYT in Zimbabwe. In 2018, she spent five weeks at the Wheat and Physiological Laboratory of Nanjing Agricultural University (NAU) in China, learning new techniques and giving lectures to postgraduate students. This visit was made possible by the collaboration between Prof Dong Jiang from the College of Agriculture at NAU, Prof Perry Ng from the Department of Food Science and Human Nutrition at Michigan State University, and the SARChI Chair of Prof Maryke Labuschagne.

Prof Neal McLaren and his students collaborated with AgriSeed in Delmas on the evaluation of inoculation techniques for Sclerotinia stem and head rot of soybean and sunflower respectively. Collaboration with the ARC-GC focused on root rot and leaf blight of maize and sorghum, and weather modelling of cob rots and concomitant mycotoxins of maize. This collaboration also included field screening of sorghum for risk analysis of leaf blight and disease-prediction modelling. Prof McLaren also collaborated with the Department of Plant Pathology at Stellenbosch University and the University of Pretoria. Courses were presented on the application of statistics in the analysis and interpretation of field data related to disease assessment.

Dr Tom Ashafa collaborates with various researchers from the Council for Scientific and Industrial Research (CSIR), Cape Peninsula University of Technology (CPUT), the University of Ilorin (UNILORIN) in Nigeria, Al-Hikmah University in Nigeria, Obafemi Awolowo University (OAU) in Nigeria, ARC-Animal Production, ARC-SG, ARC-VOP, and the Mexican Social Security Institute (Instituto Mexicano del Seguro Social – IMSS), Mexico.

Dr Lisa Komoreng collaborated 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 Mr Meshack Mofokeng (ARC-VOP).

Dr Rudo Ngara collaborates with Dr Nemera Shargie from ARC-GC and Dr Stephen Chivasa (Durham University, UK). Dr Ngara and two of her students, Mamosa Ngcala and Tatenda Goche, visited Dr Chivasa's laboratory on a Royal Society-funded collaborative project.

Dr Sandy-Lynn Steenhuisen collaborated with researchers from UCT, WSCU, UKZN, and CBC at Rhodes University.

OTHER ACTIVITIES

Geo Potts Herbarium (Bloemfontein)

Ms Annemarie van Heerden, from the McGregor Museum in Kimberley, visited the Geo Potts Herbarium to receive training from Ms Magdil Pienaar on the use of the BRAHMS herbarium database programme.

Dr Motlalepula Matsabisa, from the UFS Department of Pharmacology, negotiated an agreement with the herbarium to provide identification and data-basing services for his project which focuses on the pharmacological uses of South African indigenous plants.

Ms Sithandokuhle Jwara, NRF intern stationed at the Geo Potts Herbarium since April 2018, completed processing and data capture for all specimens in the Okavango Collection. This is now one of the most extensive collections of plant specimens from the Okavango Delta.

Undergraduate modules and excursions

A new third-year Botany undergraduate module in Ecophysiology (Ecophysiology: Plant-environment interactions) was successfully introduced in 2018.

A successful Bloemfontein Campus second-year field excursion in Ecophysiology was held during the October vacation at the Amanzi Private Game Reserve in the Brandfort district, Free Sate. Students had the opportunity to study adaptations and physiological events, such as transpiration and photosynthetic capacity responses of plants to environmental stress factors in their natural habitat.

The Vegetation Ecology third-year class from the Qwaqwa Campus conducted field surveys with Dr Steenhuisen on trips to Sentinel Peak, Drakensberg Mountain Retreat, and Monontsha Wetlands. The honours Restoration Ecology students were also hosted by Dr Nacelle Collins, from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA), on a trip to explore restoration projects in the wetlands of Monontsha, Qwaqwa.

Students and staff attending the second-year field excursion in Ecophysiology to the Amanzi Private Game Reserve

The Vegetation Ecology third-year students on a field survey with Dr Steenhuisen at the Drakensberg Mountain Retreat

POSTGRADUATE STUDENTS

At the 2018 graduations, six students graduated with the BScHons majoring in Botany (three from each campus), one student majoring in Plant Health Ecology, and a further four students graduated with the BScHons in Agriculture majoring in Plant Breeding, one majoring in Plant Pathology, and one in Environmental Rehabilitation.

Five students graduated with the MSc (Agriculture):

- Roean Wessels (with distinction).
- Gerrie Maree (with distinction).
- De Koning Fourie.
- Johannes Husselman.
- Nicolaas Landman.

A further five students graduated with an MSc:

- Almari van der Loo (Biochemistry and Plant Breeding).
- Johannes de Jager (Botany).
- Keneilwe Mmereki (Plant Breeding) – with distinction.
- Thumeka Tiwani (Botany).
- Bongani Tshabalala (Botany).

Nine candidates from the Department of Plant Sciences based on the Bloemfontein Campus graduated with the PhD in 2018:

Entiro, Berhanu Tadesse.
Thesis: *Prospects for marker assisted improvement of African tropical maize germplasm for low nitrogen tolerance.*
Promoter: Prof MT Labuschagne.

Miles, Christina Wilhemina.
Thesis: *Relationships between Mixsmart parameters and bread wheat quality characteristics in South African dry land cultivars.*
Promoter: Prof MT Labuschagne.

Mwenye, Obed John.
Thesis: *Root properties and proline as possible indicators for drought tolerance in soybean.*
Promoter: Dr R van der Merwe.

Tapera, Terence.
Thesis: *Expression of tolerance to drought and low nitrogen levels in maize inbred lines and hybrids in Southern Africa.*
Promoter: Prof MT Labuschagne.

Soko, Tegwe.
Thesis: *Stem rust resistance and yield performance of irrigated Zimbabwean spring wheat.*
Promoter: Prof ZA Pretorius.

Van Schalkwyk, Hester Josina.
Thesis: *A pathogenic approach towards characterising the South African population of Puccinia striiformis f. sp. tritici, the causal agent of wheat stripe rust.*
Promoter: Dr R Prins.

Adendorff, Joan.
Thesis: *AlexinTM-mediated defence responses in wheat during Russian wheat aphid (Diuraphis noxia) infestations.*
Promoter: Dr L Mohase.

Castelyn, Howard Dean.
Thesis: *Molecular and cellular analysis of adult plant resistance in wheat to Puccinia graminis f. sp. tritici.*
Promoter: Prof ZA Pretorius.

Vermeulen, Marcele.
Thesis: *The microbiome of cultivated Amaranthus cruentus in South Africa.*
Promoter: Dr M Gryzenhout.

A further two candidates in the Department of Botany based on the Qwaqwa Campus graduated with a PhD in 2018:

Adeniran, Lateef.
Thesis: *Biological and pharmacological activities of root extracts and isolated compounds of Hermannia geniculate.*
Promoter: Dr AOT Ashafa.

Mojau, Pheelo.
Thesis: *Isolation, characterisation and in vitro biological activity of bioactive principles in Hermannia geniculate leaf extracts.*
Promoter: Dr AOT Ashafa.

Mr Martin Chemonges, PhD student in Plant Breeding, received in-depth training at the CenGen laboratory on how to design, set up, and interpret results of a KASPTM SNP experiment, using the KASP SNPlineTM instruments housed at CenGen since 2013. He also represented the department at the BGRI Technical Workshop in Marrakech, Morocco, in March.

Fourteen MSc and PhD students, together with Dr Rouxléne van der Merwe, Prof Marvellous Zhou, and Dr Angeline van Biljon, attended the 12th Southern African Plant Breeding Symposium in Durban, KwaZulu-Natal, presenting 13 papers and four posters.

Marlese Bester, a Plant Pathology MSc student, represented the department at the International Conference of Plant Pathology in Boston from 29 July to 3 August 2018, where she shared her Sclerotinia stem and head rot of soybean and sunflower data with the international community.

POSTDOCTORAL RESEARCH FELLOWS

Five Postdoctoral Research Fellows were hosted by the Department of Plant Sciences on the Bloemfontein Campus during 2018:

Dr Alejandra López (Columbia).
Dr Ansori Maré (South Africa).
Dr Makomborero Nyoni (South Africa).
Dr Marcelo Sandoval-Denis (Columbia).
Dr Brigitta Toth (Hungary).

Three Fellows - Dr S Adebayo (Nigeria), Dr Fatai Balogun (Nigeria), and Dr Chella Palanisamy (India) - were hosted by Dr Ashafa on the Qwaqwa Campus.

Dr Ansori Maré received training on the KASP SNPlineTM instruments at the CenGen laboratory. He also attended the NOVA PhD course series, 'Phenotyping technologies in plant-environment interactions - Integrated analysis of omics data', at the Swedish University of Agricultural Sciences (SLU) Alnarp, during June 2018.

STAFF MATTERS

Dr Makoena Joyce Moloi was appointed as Senior Lecturer in Botany (Plant Physiology).

Dr Pheello Mojau, one of the Professional Officers at Qwaqwa Campus, graduated with a PhD in Botany in May 2018 under the supervision of Dr Tom Ashafa.

Mr Dirk Jansen received a 40-year service reward from the UFS, while both Prof Wijnand Swart and Ms Sadie Geldenhuys received 30-year service rewards.

Prof Neal McLaren retired in December 2018, while Dr Ntjapa Lebaka resigned during the same month.

Prof Pedro Crous, Director of the Westerdijk Fungal Biodiversity Institute in the Netherlands and Secretary General of the International Mycological Association, is an Affiliated Professor in the Department of Plant Sciences (Division of Plant Pathology). He is closely involved in research collaboration with Prof Swart and two postdoctoral fellows, Dr Marcelo Sandoval Denis and Dr Alejandra López.

RESEARCH OUTPUTS

RESEARCH ARTICLES

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OVERVIEW OF 2018

The Department of Zoology and Entomology focuses on a variety of research aspects and has long-standing collaborations with numerous government departments, as well as good relationships with various partners in the industry. Numerous courses, in both disciplines, were taught to the undergraduate students. In the case of the second- and third-year students, field excursions are part of the course. Dr Candice Jansen van Rensburg and her postgraduate students were instrumental in the successful completion of the third-year Zoology Ecology excursion to the Gariep Dam, while Dr Vaughn Swart and Mr De Villiers Fourie made sure that the Entomology excursion ran smoothly. Profs Liesl van As and Neil Heideman, as well as Dr Candice Jansen van Rensburg, presented new courses to the undergraduate students as a result of staff reshuffling in the department. Dr Mdu Ndlovu presented Conservation Ecology before he left the university at the end of 2018. Research trips were undertaken by staff and postgraduate students, and conferences of a variety of scientific societies were attended, where papers and posters were presented.

ACHIEVEMENTS

Staff Achievements

Prof Aliza le Roux improved her National Research Foundation (NRF) rating from Y2 to C2. She also won the award for Top Academic in the Afromontane Research Unit (ARU), in recognition of her research programme on mammals in the African mountains. She was elected to serve as Co-Chair for the South African Young Academy of Science (SAYAS), and was also awarded funding from from the Institutional Transformation Plan to boost mentorship for female academics on the Qwaqwa Campus. Prof Le Roux served as Session Co-Host of the Mountain Solutions World Café at the Adaptations Futures Conference, held in Cape Town in June, and as a Session Co-Host at the Mountains 2018 Conference held in Brazil in December.

Dr Vaughn Swart received the award for Learning and Teaching.

Student Achievements

Kristen Darker won the award for the best honours presentation at the annual postgraduate seminar day on the Qwaqwa Campus, while Gerard de Jager won the award for the best senior presentation. Mr De Jager also won the Junior Neitz Medal for the Best MSc in Parasitology in Southern Africa at the 47th Parasitological Society of South Africa Annual Conference, held at the University of Venda in September. The title of his dissertation was 'Taxonomic status of *Trichodina heterodentata* Duncan, 1977 (Ciliophora: Peritrichia) using standard morphology as well as molecular techniques'.

Serero Modise was elected to serve on the Council for the Golden Gate National Highland Park Forum.

Applied Agricultural Entomology

Mr De Villiers Fourie continued his collaborative work with the Stinkbug Research Group and the Agricultural Research Council (ARC) in Nelspruit. 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, among others.

A comprehensive study is being conducted on possible pyrethroid resistance developing in the two-spotted stinkbug on macadamia in the Nelspruit region. The aim of this study is to examine, in collaboration with the Stinkbug Research Group, whether multi-generational genetic resistance is developing towards synthetic pyrethroids and to aid in the development and establishment of a sustainable resistance-management programme to assist growers in the future.

The final research report on a collaborative study applying both entomology and plant pathology disciplines, was submitted. The study investigated the vector potential of various avocado pests, as well as the pathogen potential of various fungi pathogens. The study started in 2015 and was conducted in the Nelspruit region.

Arachnology

Research in arachnology is led by Prof Charles Haddad, whose research focused on systematics and phylogenetics of Salticidae, Corinnidae, Trachelidae, Clubionidae, Gallieniellidae and Gnaphosidae spiders, spider biodiversity and ecology, biology of predatory specialist spiders, and karyology of arachnids.

During November and December 2018, Prof Haddad hosted Prof Stano Pekár from the Masaryk University (Brno, Czech Republic) and two of his postgraduate students, Eva Liznarova and Ondrej Michalek. Together with MSc student Ruan Booysen and Jan-Andries Neethling of the National Museum (Bloemfontein), they undertook a ten-day field trip to Ndumo Game Reserve in northern KwaZulu-Natal to do research on spiders with specialised diets of termites and ants. The trip was a great success, and the data generated will contribute to at least four publications.

From the left: Ondrej Michalek, Eva Liznarova, Jan-Andries Neethling, Prof Stano Pekár, Prof Charles Haddad, and Ruan Booysen at the Ndumo Game Reserve

PhD candidate Zingisile Mbo spent a week in November 2018 visiting the State Museum in Windhoek, Namibia, to source specimens for his doctoral project and material for other members of the Arachnid Systematics and Ecology Group. Unfortunately, the collection is in disarray, which made finding the relevant material especially challenging. However, the specimens that were found will be particularly valuable in understanding the biogeography and biodiversity of *Clubiona* spiders in Southern Africa.

Aquatic Ecology

The Aquatic Ecology Research Group is led by Prof Linda Basson and Prof Liesl van As, studying various aspects of water ecology and parasitology.

During July 2018, Prof Liesl van As and two MSc students visited the Leseding Research Camp in Botswana to undertake follow-up surveys for Mr Tiaan le Roux's MSc project, titled 'Contracted treatment wetland located on a commercial crocodile farm'. Mr Luthando Bopheka assisted with fieldwork and general camp management activities.

Aquatic Ecology master's students Tiaan le Roux and Luthando Bopheka in the research laboratory at Leseding Camp, Botswana

During October, Prof Linda Basson, Prof Liesl van As, and Mr Gerhard de Jager (PhD student) undertook a week-long survey at the De Hoop Nature Reserve. This trip focused on the collection of selected invertebrate taxa in order to collect a variety of mobiline genera (Peritrichia) and specimens specific for molecular analysis. This forms part of Mr De Jager's PhD studies on the evolutionary assessment of the ciliophoran order Mobilida (Peritrichia) from a wide variety of hosts, both vertebrate and invertebrate (marine, freshwater, and terrestrial habitats). Material was also collected from the Jonkershoek Nature Reserve in Stellenbosch.

Gerhard de Jager collecting marine invertebrates at De Hoop Nature Reserve

Etho-ecology

The etho-ecology study group, headed by Mr Hennie Butler, focuses on various aspects of animal-behaviour ecology related to enzootic geophagy. During 2018 the group investigated inselbergs as refugia for animals, the taste preference of game species, as well as burrow occupancy among aardvarks and warthogs. Many of these studies are focused on investigating whether animals are influenced by man or cause damage to humankind.

Dr Johann van As and Michelle van As with colleagues from NWU doing fieldwork to investigate the life cycles of blood parasites in freshwater birds

Vertebrate Haemoparasite Biology

Dr Johann and Mrs Michelle van As joined colleagues from North-West University (NWU) for a one-week field trip on a project to elucidate the life cycles of blood parasites in freshwater birds. This was the first fieldwork dedicated to this project and delivered good preliminary results.

Dr Johann van As also conducted fieldwork in KwaZulu-Natal, collecting material for the project on biodiversity of water-bird parasites in Kwa-Zulu Natal, with collaborators from NWU, Dr Olena Kudlai and Dr Courtney Cook, and master's student Corette Hoogendoorn.

Nematology

Currently, research in this group is focused on plant-parasitic and free-living nematodes occurring in nature reserves in the Free State, in particular nematodes from the Willem Pretorius and Soetdoring Nature Reserves. Collection of nematodes from leaf litter has also taken place at Jonkershoek Nature Reserve in the Western Cape. The study group hopes to increase the current knowledge on free-living and plant-parasitic nematodes from wetland ecosystems and nature reserves in South Africa, as nematodes are important indicators of ecosystem health.

Dr Candice Jansen van Rensburg led four field trips to the Willem Pretorius Nature Reserve and four field trips to the Soetdoring Nature Reserve. A further field trip, to the Jonkershoek Nature Reserve in Stellenbosch, was undertaken with the Aquatic Ecology Research Group in December 2018.

Environmental Entomology and Dipterology

Research in this group, led by Dr Vaughn Swart, includes topics such as:

- Investigation of interspersed arboreal biotopes along different topographical conditions within Afromontane grasslands, and their potential as conservation hotspots.
- Soil biota as bioindicators of fire disturbances in montane grassland areas within the Golden Gate Highland National Park.
- Phylogenetic analysis of South African *Aedes Meigen, Anopheles Meigen, and Culex L*. (Culicidae) based on COI, ITS2, and ND4 sequences.
- Evaluation and comparison of various plant extracts for the management of *Lucilia* spp.
- Optimising Deoxyribonucleic Acid (DNA) profiling techniques for identification of mosquito species in the Free State.
- Ecological aspects of fruit flies (Diptera: Tephritidae) on table grapes along the lower Orange River, Northern Cape.

Applied Entomology

The Applied Entomology Research Group is led by Dr Emile Bredenhand and is based on the Qwaqwa Campus. Most of the research undertaken by the group falls within the ambit of the ARU.

Postdoctoral Research Fellow, Dr Akkinnuyoe-Adelabu's research focuses on utilising agricultural enhancements associated with invertebrates to improve the production of various crops grown in the Eastern Free State. Her research includes investigating the effect of earthworm extracts on *Fusarium* root rot during wheat emergence, improving pea quality with vermicompost tea and aqueous biochar, the effect of earthworm presence to the resistance of fungal infection in wheat production, the effect of pollinator's visitation between various levels of nitrogen-fertilised plantations of oilseed crops and soy bean under rain-fed conditions, as well as a comparative study of ground-dwelling invertebrate population dynamics between various levels of nitrogen-fertilised plantations on oilseed crops and soy bean under rain-fed conditions.

The research group also includes a number of postgraduate students. At PhD level, Mr Serero Modise is finalising his study on an ecological analysis of Afromontane grasslands in the Golden Gate Highlands National Park, using the Biotope Quality Index. Mr Jason Botham continued with data collection for his PhD, investigating interspersed forest patches along different conditions within Afromontane grasslands, and their potential as conservation hotspots, while Ms Sylvia van der Merwe is in the final field-data collection phase for her study on soil biota as bioindicators of erosion levels and fire disturbances in Afromontane grassland areas within the Golden Gate Highlands National Park. Mr Michel Kamdem started his research on DNA-barcoding of South African hoverfly species and their potential usefulness in environmental toxicology.

At master's level, Simon Mofokeng completed his MSc on 'Assessing Odonata association to riparian habitat status using Dragonfly Biotic Index (DBI) and Functional Diversity (FD) in Golden Gate Highlands National Park, South Africa', and Teboho Mofokeng completed his fieldwork and is writing up his dissertation on DNA barcoding of the dragonflies and damselflies (Order: Odonata) of the Golden Gate Highlands National Park. Similarly, Portia Mosolloane is in the process of writing up her final dissertation for her master's research on the rapid detection of *E. coli* in wastewater effluent and the impact of effluent discharge on riparian invertebrate diversity.

Herpetology

The Herpetology Research Group of Prof Neil Heideman and Ms Lindi Heyns continued work on aspects of the ecology, phylogeography, and population genetics of toads, semi-legless and legless skinks, as well as tortoises. A critical review of published phylogenetic papers on the Acontinae and on the Squamata as a whole, is currently underway, and includes a re-analysis of published sequence data.

Prof Neil Heideman (far right), Zhao Zhongning, Dr Joaquin Verdu-Ricoy, and Dr Martin Hendricks (UWC) searching for semi-legless skinks.

Tick Research Unit

The research, led by Ms Ellie van Dalen, includes evaluation of results from the tick collections sent in from various areas in South Africa, and testing for the presence of tick resistance against the commercially available acaricides, in order to monitor the spread of tick resistance over time.

In 2018, 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 specie, which causes Asiatic redwater in cattle. 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

Prof Linda Basson presented talks on aquatic biology to various groups of retired academics and professionals in Bloemfontein.

Hennie Butler accompanied the Eco 4 X 4 Club of Bloemfontein and presented talks on etho-ecology, as well as to the Nellie Swart Women's Association of Bloemfontein. He was also a guest speaker at the Bethlehem Wildlife Association in September 2018.

NATIONAL AND INTERNATIONAL COLLABORATION

Prof Neil Heideman and Ms Lindi Heyns continued their collaboration with Dr Mike Bates, herpetologist at the Bloemfontein National Museum, who was closely involved in the project on olive toad morphometrics. Collaboration with the Department of Biodiversity and Conservation at the University of the Western Cape (UWC) was strengthened through ongoing collaboration with Dr Martin Hendricks, Dr Brian Wilson, and Fadli Wagiet (on the ecology and conservation of semi-legless skinks along the Cape West Coast), and a new collaboration initiated with Prof Retha Hofmeyr, Professor Emeritus in the same department, who is a leading expert on African tortoises.

Various collaborations continued with researchers from the ARC. Furthering her research on nematology, Dr Candice Jansen van Rensburg collaborated with Dr Antoinette Swart of the ARC Biosystematics Division in Pretoria. Mr De Villiers Fourie collaborated with Dr Schalk Schoeman from the ARC in Nelspruit, while Dr Emile Bredenhand collaborated closely with the ARC Small Grain Institute in Bethlehem. Prof Charles Haddad collaborated with Dr Ansie Dippenaar-Schoeman and Ms Robin Lyle of the ARC Plant Protection Research Institute in Pretoria.

Prof Haddad also collaborated with Prof Stefan Foord from the University of Venda on spider ecology and the South African National Survey of Arachnida (SANSA), with Prof Stano Pekár and Dr Lenka Petrakova from Masaryk University in Prague on spider predation biology, with Dr Jiri Kral, Dr Franticek Stahlavky and Mr Pavel Just from Charles University in Prague on arachnid karyology, with Dr Martin Ramirez from Museo Argentino de Ciencias Naturales in Buenos Aires, and Prof Wanda Wesolowska from the University of Wrocław in Poland on spider systematics.

In the field of aquatic ecology, Prof Linda Basson and Prof Liesl van As collaborated with Dr Kevin Christison from the Department of Agriculture, Forestry and Fisheries, and Dr Leon Barkhuisen of the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA). They also collaborated with Prof Barbara Novak of Fisheries and Aquaculture at the University of Tasmania, and Prof Tomáš Scholz, Institute of Parasitology, Biology Centre of the Czech Academy of Sciences.

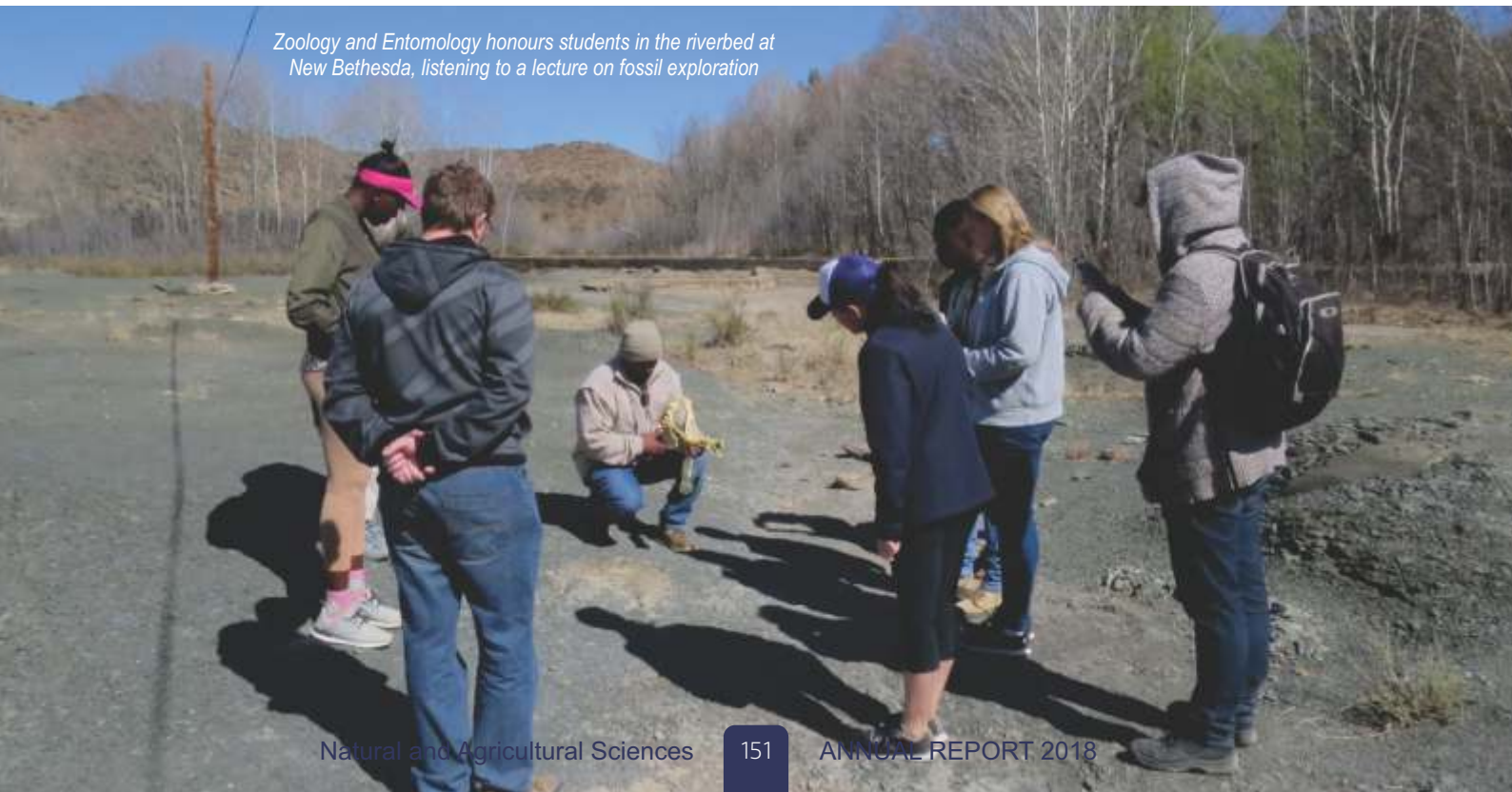
Dr Frank Chidawanyika, who focuses on global-change biology, collaborated with Dr Grant Martin (Rhodes University) on impacts of Robinia plant invasions in the Maluti range of the Free State, with Dr Casper Nyamukondiwa (Botswana International University of Science and Technology) on the thermal physiology of insects of economic importance, and with Dr Mduduzi Ndlovu (University of Mpumalanga) on bottom-up and top-down factors affecting arthropod assemblages in the Kruger National Park.

OTHER ACTIVITIES

Student Excursions

- **Biogeography (Biodiversity and Evolution) Excursion**

During September, the Zoology and Entomology honours class participated in the third honours excursion, which was initiated in 2016. The Ganora Fossil Farm and the Kitching Museum in the New Bethesda area were visited, where the students attended lectures by staff from Ganora and the museum and also had the opportunity to interact with them. The excursion ended at Reebok with intertidal activities at Reebok beach, ecological surveys of the Klein Brak and Groot Brak estuaries, visits to Botlier Wildlife Reserve, Seal Island, and the Dias Museum. Students attended lectures on oceanography and presented lectures on various biodiversity and evolutionary topics.



Zoology and Entomology honours students in the riverbed at New Bethesda, listening to a lecture on fossil exploration

- **Third-year Ecology Excursion**

During the week of 1 to 6 April, third-year Zoology students visited the South African Agricultural Technology Centre at Xhariep.They were tasked with collecting and identifying plankton from various hatchery dams at the centre, as well as collecting and dissecting fish from Xhariep Dam with Dr Leon Barkhuizen from the Free State DESTEA. Collected data was processed and presented at the end of the excursion.

- **Undergraduate Entomology Excursion**

During the October recess from 1 to 4 October, the second- and third-year Entomology students undertook an excursion to the biannual Entomology career exhibition in Pretoria, accompanied by Dr Vaughn Swart and Mr De Villiers Fourie. This excursion was of great value to all the students with Entomology as a main subject or as an additional subject, as students were exposed to various companies and institutions, such as the National Institute for Communicable Diseases (NICD), Association of Veterinary and Crop Associations of South Africa (AVCASA), Ditsong Museum, Syngenta, various facilities of the ARC (Vegetable and Ornamental Plants, Biosystematics Division, Plant Protection Research), and Onderstepoort Veterinary Research.

SEAmester Trip

Gerhard de Jager joined the SEAmester III and Agulhas System Climate Array (ASCA) again in 2018. His responsibilities included lectures on marine parasitology and conducting research on symbionts and/or parasites of zooplankton. This was done via the examination of material collected from benthic dredges up to 300 m deep.

Students on the biannual Entomology excursion, with their lecturers, Dr Vaughn Swart and Mr Div Fourie

POSTGRADUATE STUDENTS

At the April 2018 graduation on the Bloemfontein Campus, two students graduated with the BScHons majoring in Entomology, and a further five students graduated with the BScHons majoring in Zoology. Three students from the Qwaqwa Campus graduated with the BScHons.

Maria Esterhuyze graduated with the MSc in Entomology, as did Bianca Kay (with distinction). Gerhard de Jager (with distinction) and Luthando Bopheka obtained their MSc degrees in Zoology.

The following students received their PhD degrees in 2018:

Otto, Mia.
Thesis: *Diatom community composition and ecological gradients on selected rivers in the Eastern and Western Cape, South Africa.*
Promoter: Prof JG van As.

Welch, Rebecca Jane.
Thesis: *Quantifying perceived risk in a small mesocarnivore, the bat-eared fox.*
Promoter: Prof A le Roux.

POSTDOCTORAL RESEARCH FELLOWS

The Department of Zoology and Entomology hosted five Postdoctoral Research Fellows in 2018. These were:

Dr Dolapo Akinnuoye-Adelabu (Nigeria).
Dr Ogbeide Ozekeke (Nigeria).
Dr Anton Pérez-Rodríguez (Spain).
Dr Mpho Ramoejane (South Africa).
Dr Joaquin Verdu-Ricoy (Spain).

STAFF MATTERS

Dr Charles Haddad was promoted to Associate Professor.

Sadly, two of our senior colleagues passed away at the beginning of 2018. Prof Jo van As and Prof Schalk Louw, although both retired, were still actively involved with teaching and postgraduate training in the department.

Dr Mdu Ndlovu resigned as senior lecturer and Dr Daryl Codron has been appointed as senior lecturer (to start in 2019).

RESEARCH OUTPUTS

RESEARCH ARTICLES

Baron, S, Barrero, RA, Black, A, Bellgard, MI, Van Dalen, EMS and Maritz-Olivier, C. 2018. Differentially expressed genes in response to amitraz treatment suggests a proposed model of resistance to amitraz in *R. decoloratus* ticks. *International Journal for Parasitology: Drugs and Drug Resistance* 8(3): 361-371.

Bayartogtokh, B, Ermilov, SG, Hugo-Coetzee, EA and Khaustov, AA. 2018. Contribution to the knowledge of the oribatid mite genus *Licnodamaeus* Grandjean, 1931 and synonymy of *Licnodamaeolus* Covarrubias, 1998 (Acari, Oribatida, Licnodamaeidae). *Systematic and Applied Acarology* 23(1): 42-60.

Blick, T and Marusik, YM. 2018. Three junior synonyms of jumping spider genera (Araneae: Salticidae). *Arthropoda Selecta* 27(3): 237–238.

Comley, J, Bissett, C, Tambling, CJ, Welch, RJ and Parker, DM. 2018. Diet of recently established brown hyenas in the Eastern Cape, South Africa. *African Journal of Wildlife Research* 48(2):1-7.

Cook, CA, Netherlands, EC, Van As, J and Smit, NJ. 2018. Two new species of *Hepatozoon* (Apicomplexa: Hepatozoidae) parasitising species of *Philothamnus* (Ophidia: Colubridae) from South Africa. *Folia Parasitologica*, 65: 1-11.

Dang, M, Basson, L, Bach, L, Sonne, C, Nørregaard, R and Nowak, B. 2018. Trichodinid infections in internal organs from shorthorn sculpins *(Myoxocephalus Scorpius)* collected around an industrial harbour in Nuuk, Greenland. *Parasitology* 146(4):1-5.

De Bruin, R, Ganswindt, A, Bennett, NC and Medger, K. 2018. The influence of food restriction and photoperiod on reproduction in male spiny mice *(Acomys spinosissimus)*: Evidence for terminal investment? *Mammalian Biology* 90: 38-41.

De Bruin, R, Ganswindt, A, Laver, A and Le Roux, A. 2018. Friendly foxes: the relationship between steroid hormones and social behaviour in a monogamous African canid. *Frontiers in Zoology* 306(2): 110-118.

De la Hera, I, Fandos, G, Fernández-López, J, Onrubia, A, Pérez-Rodríguez, A, Pérez-Tris, J and Tellería, JL. 2018. Habitat segregation by breeding origin in the declining populations of European Robins wintering in southern Iberia. *Ibis* 160(2): 355-364.

Dippenaar-Schoeman, AS, Haddad, CR, Lyle, R, Lotz, LN, Foord, SH, Jocqué, R and Webb, P. 2018. South African national survey of Arachnida: A checklist of the spiders (Arachnida, Araneae) of the Tswalu Kalahari Reserve in the Northern Cape Province, South Africa. *Koedoe* 60(1): 1–11 (a1486).

Ermilov, SG, Hugo-Coetzee, EA and Theron, PD. 2018. To the knowledge of oribatid mites of the subgenus *Galumna (Galumna)* Heyden 1826 (Acari, Oribatida, Galumnidae) in South Africa, with a key to species known from the Ethiopian region. *Zoologichesky Zhurnal* 97(5): 515-527.

Fernández-González, S, Pérez-Rodríguez, A, Proctor, HC, De la Hera, I and Pérez-Tris, J. 2018. High diversity and low genetic structure of feather mites associated with a phenotypically variable bird host. *Parasitology* 145(9): 1243-1250.

Fomichev, AA and Marusik, YM. 2018. Five new species of the *Acantholycosa*-complex (Araneae: Lycosidae) from Mongolia. *Zootaxa* 4497(2): 271–284.

Fomichev, AA, Marusik, YM and Koponen, S. 2018. New data on spiders (Arachnida: Aranei) of Iraq. *Zoology in the Middle East* 64(4): 329–339.

Fomichev, AA, Marusik, YM and Sidorov, VV. 2018. A survey of East Palaearctic Gnaphosidae (Aranei). 9. New data on the *Parasyrisca potanini*-group from Central Asia. *Arthropoda Selecta* 27(2): 155-168.

Haddad, CR and Butler, VP. 2018. Ground-dwelling spider assemblages in contrasting habitats in the central South African Grassland Biome. *Koedoe* 60(1): 1–12 (a1482).

Hugo-Coetzee, EA and Le Roux, PC. 2018. Distribution of microarthropods across altitude and aspect in the sub-Antarctic: climate change implications for an isolated oceanic island. *Acarologia* 58 (suppl): 43-60.

Joseph, GS, Seymour, CL, Coetzee, BWT, Ndlovu, M, Deng, L, Fowler, K, Hagan, J, Brooks, BJ, Seminara, JA and Foord, SH. 2018. Elephants, termites and mound thermoregulation in a progressively warmer world. *Landscape Ecology* 33(5): 731-742.

Kamdem, MM, Otomo, PV, Ngakou, A and Yanou, NN. 2018. Distribution and diversity of earthworm (Annelida, Clitellata) populations across four land use types in northern Cameroon. *Turkish Journal of Zoology* 42(1): 79-89.

Khaustov, AA, Hugo-Coetzee, EA and Ermilov, SG. 2018. A new species of *Scutacarus* (Acari: Heterostigmata: Scutacaridae) associated with *Trinervitermes trinervoides* (Isoptera: Termitidae) from South Africa. *International Journal of Acarology* 44 (2-3): 59-67.

Khaustov, AA, Hugo-Coetzee, EA and Ermilov, SG. 2018. New taxa of the family Microdispidae (Acari: Heterostigmata) associated with *Trinervitermes trinervoides* (Sjostedt) (Isoptera: Termitidae) from South Africa. *International Journal of Acarology* 44(6): 218-226.

Kushata, JNT, Périquet, S, Tarakini, T, Muzamba, M, Mafuwa, B, Loveridge, AJ, Macdonald, DW, Fritz, H and Valeix, M. 2018. Drivers of diurnal rest site selection by spotted hyenas. *Journal of Zoology* 304(2): 1 32-140.

Le Roux, A. 2018. Trends in behavioural ecology: Putting South African research in a global perspective. *South African Journal of Science* 114(5-6): 21-26.

Le Roux, A, Mukwada, G and Lombard C. 2018. The Afromontane Research Unit – growing as a hub of transdisciplinary research. *Mountain Research and Development* 38(1): 85-87. (Platform statement).

Lobe, PDD, Filser, J and Otomo, PV. 2018. Avoidance behaviour of *Enchytraeus albidus* (Oligochaeta) after exposure to AgNPs and AgNO 3 at constant and fluctuating temperature. *European Journal of Soil Biology* 87: 40-45.

Lyle, R and Haddad, CR. 2018. *Jocquestus* gen. nov., a new genus of trachelid sac spiders from the Afrotropical Region (Arachnida: Araneae). *Zootaxa* 4471(2): 309–333.

Marusik, YM. 2018. Case 3774 – *Diphyini* Simon, 1894 (Arachnida, Araneae, Tetragnathidae): proposed emendation of the current spelling to *Diphyaini* to remove homonymy with Diphyidae Quoy & Gaimard, 1827 (Hydrozoa, Siphonophorae). *Bulletin of the Zoological Nomenclature* 75(1): 169 171.

Marusik, YM. 2018. Redescription of *Alopecosa albostriata* (Araneae: Lycosidae) based on specimens from Siberia. *Zootaxa* 4482(2): 383 391.

Marusik, YM. 2018. Redescription of the Siberian species *Pardosa jeniseica* (Araneae: Lycosidae). *Zootaxa* 4497(1): 141–144.

Marusik, YM. 2018. Supraspecific names in spider systematics and their nomenclatural problems. *Arachnology Letters* 55(1): 42 45.

Marusik, YM, Fomichev, AA and Vahtera, V. 2018. A new species of *Chalcoscirtus* (Araneae: Salticidae) from Altai, South Siberia, Russia. *Entomologica Fennica* 29(1): 39-48.

Marusik, YM and Larsen, N. 2018. A synopsis of African *Metellina* (Araneae, Tetragnathidae, Metinae) with a description of new species from South Africa. *Vestnik Zoologii* 52(3): 205–216.

Marusik, YM and Nadolny, AA. 2018. Redescription of enigmatic spider genus *Stoliczka* O. Pickard-Cambridge, 1885 (Aranei: Lycosoidea) based on the type species. *Zootaxa* 4497(2): 295–300.

Marusik, YM and Omelko, MM. 2018. First description of *Eupoa pulchella* (Araneae: Salticidae) female. *Far Eastern Entomologist* 354: 19-22.

Marusik, YM and Omelko MM. 2018. New data on *Synaphosus* (Araneae: Gnaphosidae) from Southeast Asia. *Zootaxa* 4374(2): 235–248.

Marusik, YM, Omelko, MM and Koponen, S. 2018. Redescription of Himalayan *Trachelas costatus* (Araneae: Trachelidae). *Zootaxa* 4433(2): 390–392.

Marusik, YM, Perkovsky, EE and Eskov, KY. 2018. First records of spiders (Arachnida: Aranei) from Sakhalinian amber with description of a new species of the genus *Orchestina* Simon, 1890. *Far Eastern Entomologist* 367: 1 9.

Marusik, YM and Zonstein, S. 2018. Notes on the spider genus *Steriphopus*, with redescription of the type species (Araneae, Palpimanidae). *Arachnology* 17(9): 497–502.

Mbande, A, Tedder, M and Chidawanyika, F. 2018. Offspring diet supersedes the transgenerational effects of parental diet in a specialist herbivore *Neolema abbreviata* under manipulated foliar nitrogen variability. *Insect Science* 0: 1-14.

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RESEARCH REPORTS

Butler, HJB. 2018. *Reptile survey for Kolomela Mine*. Report delivered to Anglo America, Kolomela Mine.

Fourie, DV and Coertzen, J. 2018. *The dissemination of fungal pathogens on avocado trees in South Africa with reference to vector potential of insect pests.* Final Research Report delivered to the South African Avocado Growers Association, Nelspruit.

CONFERENCE CONTRIBUTIONS

Chidawanyika, F. 2018. *Transgenerational effects of host plant quality in biocontrol agents; does offspring environmental matching matter?* Paper delivered and poster presented at the XV International Symposium on the Biological Control of Weeds, Engelberg Switzerland. 26-31 August.

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Fourie, DeV and Coertzen, J. 2018. *The dissemination of fungal pathogens on avocado trees in South Africa with reference to vector potential of insect pests.* Paper delivered at the South African Avocado Growers Association Research Symposium, Tzaneen, South Africa. 15 September.

Le Roux, A. 2018. *Mountain Solutions World Café.* Paper delivered at the Adaptation Futures Conference, Cape Town, South Africa. 18-21 June.

Le Roux, A. 2018. *Where the wild things are? Wildlife and humans coexisting in an African montane town.* Paper delivered at the Mountains 2018 Conference, Nova Friburgo, Brazil. 10-14 December.

Mogorosi, KL, Van As, LL and Christison, KW. 2018. *Parasitic crustaceans Lernaea cyprinacea and Argulus japonicus and the possible role they play in the development of aquaculture in the Free State Province.* Paper delivered at the Southern African Society of Aquatic Sciences Conference, Cape St Francis, South Africa. 24-26 June.

Otto, M, Van As, JG, Van As, LL and Jonathan, T. 2018. *Diatom community composition across ecological gradients in the Eastern Cape, South Africa.* Paper delivered at the 25th International Diatom Symposium, Berlin, Germany. 25-30 June.

Swanepoel, PJ, Van As, JG, Van As, LL and Christison, KW. 2018. *Myxozoan detection and identification by means of silver-nitrate impregnation.* Poster presented at the Southern African Society of Aquatic Sciences Conference, Cape St Francis, South Africa. 24-26 June.

Swart, VR and Copeland, RS. 2018. *A new species of the wormlion genus Alhajarmyia Stuckenberg (Diptera: Vermileonidae), the second wormlion fly described from Kenya.* Paper delivered at the 9th International Congress of Dipterology, Windhoek, Namibia. 25-30 November.

Van As, M, Netherlands, EC and Smit, NJ. 2018. *Two new Hepatozoon species (Apicomplexa: Adeleorina: Hepatozoidae) co-infecting wild and captive leopards Panthera pardus pardus (Linnaeus, 1758) in South Africa.* Paper delivered at the 14th International Congress of Parasitology, Daegu, South Korea. 19-24 August.

Whitehead, L, Swart, VR, Gryzenhout, M and Koekemoer LL. 2018. *Phylogenetic analysis of South African Aedes Meigen, Anopheles Meigen and Culex L. (Culicidae) based on COI, ITS2 and ND4 sequences.* Paper delivered at the 9th International Congress of Dipterology, Windhoek, Namibia. 25-30 November.

DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY

STAFF (2018)

Head of Department: Prof L Basson

BLOEMFONTEIN CAMPUS
Distinguished Professor: Prof LJ Fourie

Professors: Prof L Basson and Prof NJL Heideman

Associate Professors: Prof LL van As and Prof CH Haddad

Senior Lecturers: Dr F Chidawanyika and Dr M Ndlovu (resigned)

Lecturers: Dr C Jansen van Rensburg, Dr VR Swart, Ms L Heyns, Ms EMP van Dalen, and Mr HJB Butler

Junior Lecturer: Mr DV Fourie

Research Associates: Dr LM Barkhuizen, Dr J Botha-Brink, Dr KW Christison, Dr L Coetzee, Dr EA Hugo-Coetzee, Prof SvdM Louw, Dr Y Marusik, Dr RJ Pretorius, and Dr C Scheepers

Officers – Professional Services: Ms NW Mokhethi and Mr JM Mabena

Senior Assistant Officers: Mr B Maasdorp and Ms SAM Teele

QWAQWA CAMPUS
Associate Professor: Prof A le Roux (Subject Head)

Senior Lecturer: Dr P Voua Otomo

Lecturers: Dr E Bredenhand, Dr PM Leeto, Dr J van As, and Ms M van As

Officer – Professional Services: Ms MP Sithole

ACADEMIC
CENTRES/INSTITUTES

CENTRE FOR ENVIRONMENTAL MANAGEMENT

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OVERVIEW OF 2018

The year 2018 came with some significant achievements in the Centre for Environmental Management (CEM) in terms of research outputs and the delivery of postgraduate students in Environmental Management. Our research outputs included 10 book chapters, 48 articles, and 21 conference contributions, while 17 Master of Environmental Management students received their degrees in 2018. This is in line with the centre's strategy to develop its research profile alongside the postgraduate degree programmes. We furthermore welcomed Dr Jackie Codron and Prof Bram Vanschoenwinkel as Research Associates in the centre.

ACHIEVEMENTS

Staff Achievements

Mrs Marinda Avenant and Prof Maitland Seaman hosted a workshop in collaboration with Drs Dirk Jungman and Niels Shütze from the Technical University of Dresden, to develop a transdisciplinary research proposal under the CLIENT II programme.

Lecturer in the CEM, Dr Falko Buschke, was awarded a Global Minds Fellowship from the Flemish Interuniversity Council for University Development Cooperation (VLIR-UOS) to visit the University of Leuven, Belgium, for a collaborative project on the effect of environmental fluctuations on biodiversity. In addition, Dr Buschke achieved second place in the Faculty of Natural and Agricultural Sciences Flash Fact competition, held on 6 June 2018.

Dr Buschke and Prof Bram Vanschoenwinkel (CEM Research Associate) led a workshop on 'Material happiness – Uncoupling a meaningful life from the destruction of nature', at the Vrije Universiteit Brussel, Belgium, on 4 December 2018. This workshop was funded by a Small-Great Grant from the VLIR-UOS.

Mrs Surina Esterhuyse contributed to the development of a science action plan for shale-gas extraction in South Africa. This initiative, held in Cape Town on 27 February 2018, was driven by the Academy of Science of South Africa (ASSAf). Mrs Esterhuyse also served as a member of the editorial board of the journal *Water International.*

Dr Shola Ololade participated as a panellist for the ASSAf seminar on 'The Water-Energy Nexus and the application of green technologies', held in Pretoria on 14 June 2018. Dr Ololade was also invited as a specialist panel member of the Department of Science and Technology (DST)-National Research Foundation (NRF) Freestanding Innovation Scarce Skills Postdoctoral Fellowships. In addition, together with Dr Sabelo Mavimbela and Ms Fulufelo Mudau, she participated in the Mangaung Metro Planning Department's Climate Change Day discussion on 'Climate change resilience into city plans and budget', held in Bloemfontein on 19 September 2018.

Prof Anthony Turton, CEM Affiliate Professor, was a finalist in the African Utility Week Industry Awards in the category Outstanding Contribution Award: Water.

Many of the CEM Research Associates were involved in notable achievements during 2018, including the following.

Dr Nico Avenant served on the Executive Committee of the 6th International Conference on Rodent Biology and Management, held in Postdam, Germany, from 3 to 7 September 2018.

Dr Shola Ololade participating in the discussion on the Water-Energy Nexus and the application of green technologies organised by ASSAf

Dr James Brink, a CEM Research Associate, was presented with the contents of a special issue of *Quaternary International* (Vol. 495, pp. 1-184), published in his honour. The publication consists of 13 articles and contributions by 45 authors (25 from abroad). The papers represent the broad range of topics covered by Dr Brink's research interests. Dr Daryl Codron served as one of the editors of the publication.

Dr Nacelle Collins was appointed as a member of the Inland Aquatic Reference Group for the National Biodiversity Assessment, and as a member of the National Wetlands Ecosystem Classification Committee.

In the book *Soil Classification: A natural and anthropogenic system for South Africa,* published by the ARC Institute for Soil, Climate and Water, Dr Piet-Louis Gründling and Ms Lulu Pretorius (formerly associated with the CEM) were acknowledged for drawing attention to the significance of peat and organic soil in the natural environment, and for their significant contribution to the text, profile descriptions, and analyses for this group of soils.

Dr Gründling also participated as a panellist at the National Wetland Indaba 2018 on 'Red-listing South African wetland ecosystems: What standard criteria should we use?' held in Kimberley from 8 to 11 October 2018.

Dr Joe Henschel served as one of the editors for the Karoo Special Issue of the *African Journal of Range and Forage Science*.

Dr Danie Toerien participated as a panellist at the Central Karoo Small Business Institute (SBI) Small to Medium Enterprise (SME) Indaba on 'Small town economies and local economic development' in Prince Albert on 14 September 2018, and also served as member of the editorial board for the journal *Cogent Social Sciences.*

Student Achievements

Ms Nancy Job participated as a panellist at the National Wetland Indaba 2018 on 'Red-listing South African wetland ecosystems: What standard criteria should we use?' held in Kimberley from 8 to 11 October.

Ms Tshiamo Legoale won the Maitland Seaman Prize for Best Magister Student in Environmental Management 2017. The title of her mini-dissertation was 'An investigation on the gold hyperaccumulatory ability of *Triticum aestivum* (bread wheat) and its possible application in the environmentally sound exploitation of gold-bearing substrates'. She was supervised by two people from the industry.

Mr Sandile Dlamini won the prize for the Best Mini-dissertation in Environmental Management in 2017. His research was on 'The loading capacity of the Elands River: A case study of the Waterval Boven Wastewater Treatment Works, Mpumalanga Province'. He was supervised by Dr Andrew Slaughter from Rhodes University and co-supervised by Dr Thomas Gyedu-Ababio from the Inkomati-Usuthu Catchment Management Agency.

Mr Sakeus Ihemba from Namibia was awarded the Dr Limpho Letsela Prize for the Best Foreign African Student in Environmental Management for 2017. He was supervised by Mrs Surina Esterhuyse. The title of his mini-dissertation was 'Assessing the sustainability of permitted irrigation water use in the Grootfontein-Tsumeb-Otavi Subterranean Water Control Area in Namibia'.

Centre for Environmental Management prize-winners: From the left, Sakeus Ihemba (Dr Limpho Letsela Prize for the Best foreign student from Africa), Tshiamo Legoale (Maitland Seaman Prize for the Best student in Environmental Management), and Sandile Dlamini (Centre for Environmental Management Prize for the Best mini-dissertation)

RESEARCH

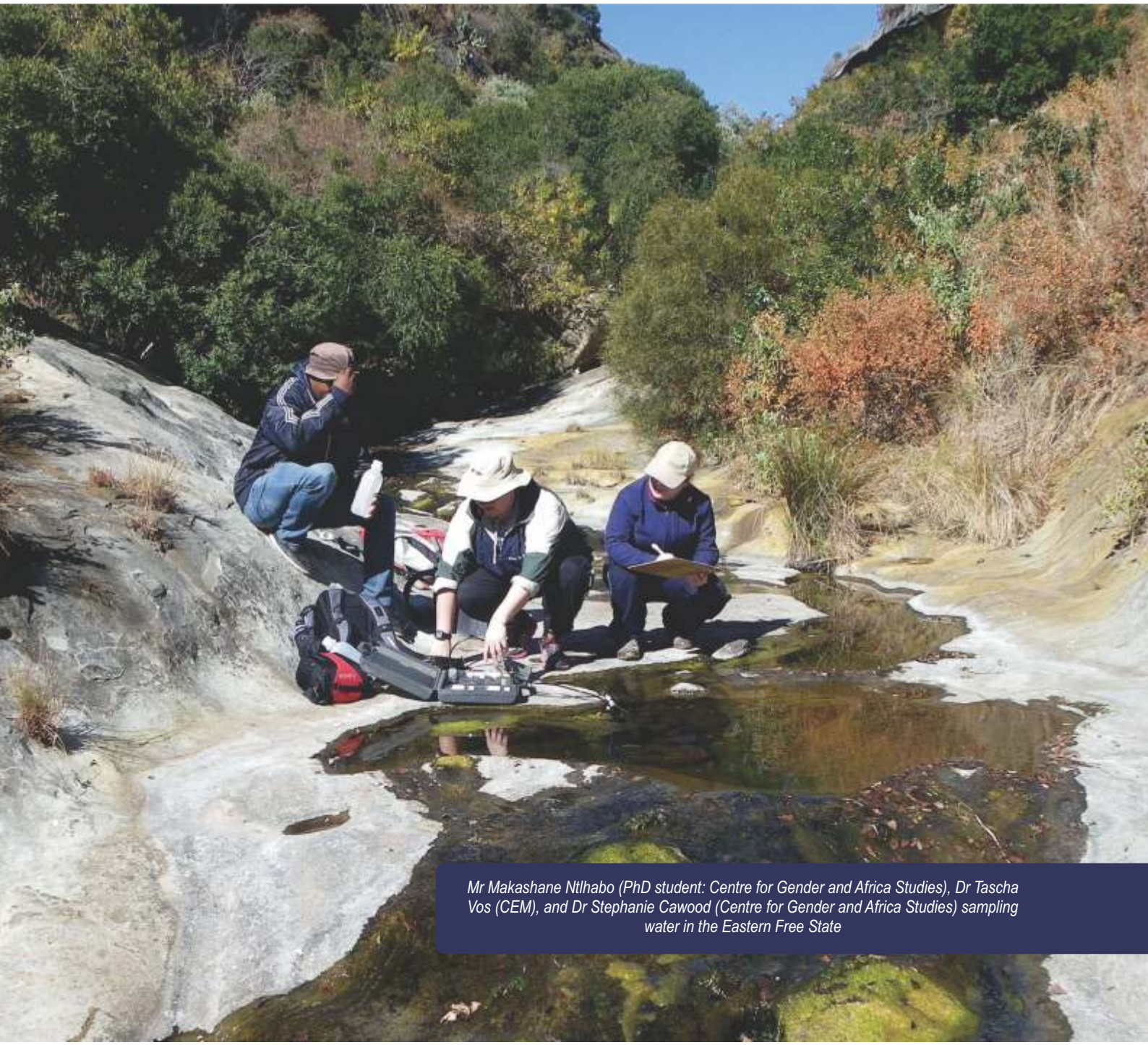
Dr Falko Buschke has undertaken a research project using butterfly assemblages to identify important habitats for the sustainability of biodiversity under climate change. This project focused on the sandstone inselbergs of the Eastern Free State and was funded by the South African National Biodiversity Institute (SANBI) Foundational Biodiversity Information Programme (FBIP).

Together with Emily Botts (private consultant) and Sam Sinclair (University of Oxford), Dr Buschke also collaborated on a project examining South African biodiversity planning through the philosophical lens of post-normal science.

Dr Shola Ololade was the principal investigator of a research project to assess the viability of biogas as an alternative energy source, using livestock waste amid water constraints in South Africa. The project was funded by the Faculty of Natural and Agricultural Sciences Central Research Fund (CRF). One Postdoctoral Research Fellow and three master's students were involved in the project. One student graduated with a Master of Environmental Management at the December 2018 graduation, while the other two are expected to graduate in 2019. The project will be completed in 2019.

Dr Ololade was also the principal investigator of an interdisciplinary project, titled 'Evaluating environmental impacts of solid waste landfills in the Mangaung Municipality, Free State Province, South Africa', funded by the University of the Free State (UFS) Interdisciplinary Research Fund. Collaborators on the project included Dr JJ van Tol and Dr MP Aghoghovwia (Soil Science), Dr R Hansen (Geology), Prof A Pelser (Sociology), Dr S Mavimbela (Postdoctoral Research Fellow at the CEM), and five master's students.

Drs Tascha Vos and Stephanie Cawood (Centre for Gender and Africa Studies) were involved in a research project in the Eastern Free State, testing water in various rivers and streams.



Mr Makashane Ntlhabo (PhD student: Centre for Gender and Africa Studies), Dr Tascha Vos (CEM), and Dr Stephanie Cawood (Centre for Gender and Africa Studies) sampling water in the Eastern Free State

COMMUNITY SERVICE

Aquatic monitoring of Loch Logan

Dr Tascha Vos and the postgraduate students based at CEM 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 gathered was shared with the Mangaung Local Municipality and the owners of the Waterfront development, for use in the management of the lake.

Tree-planting project in collaboration with the Student Representative Council (SRC)

CEM participated with Mr Lefa Makara (SRC member: Student Development and Environmental Affairs) on a tree-planting project. The centre sponsored 19 trees *(Combretum erythrophyllum, Olea africana,* and *Searsia pendulina)*. Mrs Marthie Kemp and Mrs Marinda Avenant represented CEM at two local schools during the tree planting, namely Legae Intermediate School and Sehunelo Secondary School.

Tree planting project at a local school

NATIONAL AND INTERNATIONAL COLLABORATION

Dr Falko Buschke collaborated on various projects with, *inter alia*, 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 University of Oxford), and Jeff Manuel (SANBI).

Marinda Avenant collaborated with Dr Dirk Jungman (Institute of Hydrobiology), Dr Niels Schütze (Chair of Hydrology, Institute of Hydrology and Meteorology), and Dr Mareike Braekenveldt (Institute for Settlement and Industrial Water Management) from the Technische Universität Dresden, Germany.

Surina Esterhuyse collaborated with Prof Andrzej Kijko (University of Pretoria), Prof Jan Glazewski (University of Cape Town), Prof Barbara Sherwood Lollar (University of Toronto), and Greg Schreiner (Council for Scientific and Industrial Research).

Workshop presented by the CEM and the Technical University of Dresden, Germany

The CEM, in collaboration with the Technical University of Dresden, hosted a workshop from 3 to 5 December 2018 to develop a research proposal for a transdisciplinary study investigating the development of a decision-support system to manage future threats associated with extreme climate events. Thirty-six representatives from eight universities (UFS, Technical University of Dresden, United Nations University Flores, Central University of Technology, University of KwaZulu-Natal, University of Pretoria, Cape Peninsula University of Technology, and the Namibia University of Science and Technology), government agencies, industry, and non-governmental organisations participated in the two-day workshop and excursion to the intended study sites.

Participants at the workshop presented by CEM in collaboration with the Technical University of Dresden

Modder-Riet Catchment Management Forum

Dr Tascha Vos and Mrs Marinda Avenant represented the CEM on the Modder-Riet Catchment Management Forum in 2018. 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.

Geographic information systems (GIS) facility at the CEM

Mr Frank Sokolic, a recognised expert and consultant on GIS, continued his close collaboration with the CEM by spending a week of each month at the centre. This collaboration has been exceptionally fruitful. The CEM students and staff greatly benefited from the opportunity to discuss their GIS challenges first-hand with him and from the solutions he provided. He also presented valuable environmentally oriented GIS courses for students and outsiders, as well as supervision to master's students.

Short courses

The CEM presented two short courses in 2018. The 'GIS Intermediate: Hydrological modelling and terrain analysis using digital elevation models and geographical information systems' was presented by Mr Frank Sokolic from 12 to 14 June 2018, and the 'Introduction to geographical information and global positioning systems wetland management: Introduction and delineation' was presented by Dr Piet-Louis Gründling and a team of wetland specialist staff members from Digby Wells Environmental, from 12 to 16 November 2018.

Visitors to the CEM

Dr Falko Buschke hosted Prof Bram Vanschoenwinkel and his students from the Vrije Universiteit Brussel as part of the long-term collaborative research regarding the effects of climate change on the biodiversity of temporary aquatic ecosystems. This included visits by master's student, Adwine Vanslembrouck (January-February 2018) and two PhD candidates, Joren Snoeks (July 2018) and Lana Ramaekers (October 2018).

Mr Joren Snoeks and Ms Adwine Vanslembrouck from the Vrije Universiteit Brussel

Dr Dirk Jungman and Dr Niels Schütze, from the Technische Universität Dresden in Germany, visited the centre during the last week of October 2018 for discussions and planning of collaborative research projects, as well as the proposed summer school in 2019.

POSTGRADUATE STUDENTS

Thirteen Master of Environmental Management degrees were conferred at the June 2018 graduation ceremony, and an additional four students graduated with the same degree in December 2018. They were:

Sandile Dlamini.
Nondumiso Dumakude.
Chantelle Howlett-Downing.
Ansuné Human.
Sakeus Ihemba.
Mwema Kapenya.
Josua Kazeurua.
Tshiamo Legoale.
Lawrence Machebe.
Victor Manavhela.
Nthai Ngwepe.
Madisemelo Palo.
Richard Williamson.
Matala Makhetha.
Azwifaneli Mulovhedzi.
Sheehamandje Niipale.
Bridget Tshikalange.

Graduates from the CEM on graduation day, June 2018

The first intake of students for the postgraduate diploma in Integrated Water Resource Management completed their studies in November 2018. Their degrees will be conferred in June 2019.

The first students enrolled for the new Postgraduate Diploma in Integrated Water Management

POSTDOCTORAL RESEARCH FELLOWS

Dr Sabelo Mavimbela from Lesotho continued as a Postdoctoral Research Fellow in the CEM during 2018.

STAFF MATTERS

Prof Nnenesi Kgabi was appointed as an Affiliated Professor in the CEM.

Miss Fulufelo Mudau was appointed as a Research Assistant and Mr Sinalo Malindie was re-appointed as a Student Assistant.

Mrs Veena Padayachee started as Course Coordinator at the beginning of 2018.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Arena, G, Van der Merwe, H, Todd, SW, Pauw, MJ, Milton, SJ, Dean, WRJ and Henschel, JR. 2018. Reflections, applications and future directions of Long-Term Ecological Research at Tierberg. *African Journal of Range & Forage Science* 35(3-4): 257-265.

Backwell, L, Steininger, C, Neveling, J, Abdalam F, Pereira, L, Mayer, E, Rossouw, L, De la Peña, P and Brink, J. 2018. Holocene large mammal mass death assemblage from South Africa. *Quaternary International* 495: 49-63.

Belle, JA, Collins, N and Jordaan, A. 2018. Managing wetlands for disaster risk reduction: A case study of the eastern Free State, South Africa. *Jàmbá: Journal of Disaster Risk Studies* 10(1): 1-10.

Bessah, E, Raji, AO, Taiwo, OJ, Agodzo, SK and Ololade, OO. 2018. Variable resolution modeling of near future mean temperature changes in the dry sub-humid region of Ghana. *Modeling Earth Systems and Environment* 4(3): 919-933.

Brown, LR and Bezuidenhout, H. 2018. Ecosystem description and diversity of the Jurisdam–Seekoegat sections of the Mountain Zebra National Park, South Africa. *South African Journal of Botany* 118: 166-178.

Bousman, CB and Brink, JS. 2018. The emergence, spread, and termination of the Early Later Stone Age event in South Africa and southern Namibia. *Quaternary International* 495:116-135

Buschke, FT, Brendonck, L and Vanschoenwinkel, B. 2018. The conservation status of African vertebrates is unrelated to environmental and spatial patterns in their geographic ranges. *Biodiversity and Conservation* 27(3): 567-582.

Codron, D, Clauss, M, Codron, J and Tütken, T. 2018. Within trophic level shifts in collagen–carbonate stable carbon isotope spacing are propagated by diet and digestive physiology in large mammal herbivores. *Ecology and Evolution* 8(8): 3983-3995.

Codron, D, Radloff, FG, Codron, J, Kerley, GI and Tambling, CJ. 2018. Meso-Carnivore Niche Expansion in Response to an Apex Predator's Reintroduction-a Stable Isotope Approach. *African Journal of Wildlife Research 48*(1): 1-12.

Codron, J, Avenant, NL, Wigley‐Coetsee, C and Codron, D. 2018. Carnivore stable carbon isotope niches reflect predator‐prey size relationships in African savannas. *Integrative Zoology* 13(2): 166-179.

Deboelpaep, E, Keleman, PJ, Vanschoenwinkel, B and Koedam, N. 2018. Gallant geese, fearful flocks? Flock size and heterospecifics alter the escape behaviour of an invasive goose. *Belgian Journal of Zoology* 148(2): 135-147.

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Malindie, S, Buschke, F and Codron, D. 2018. *Stable isotope niche structure of herbivore communities provides insights about inter- and intra-specific resource partitioning.* Paper delivered at the annual South African Wildlife Management Association (SWAMA) Symposium, Bela-Bela, South Africa. 9-13 September.

Malindie, S, Buschke, F and Codron, D. 2018. *Understanding intra- and inter-specific niche interactions in assemblages of large herbivores.* Paper delivered at the 16th Annual Savanna Science Networking Meeting, Skukuza, South Africa. 4-9 March.

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Paine, OCC, Koppa, A, Henry, AG, Leichliter, JN, Codron, D, Codron, J and Sponheimer, M. 2018. *The effects of season and habitat on the mechanical and nutritional properties of potential hominin plant foods.* Paper delivered at the Annual meeting of the American Association of Physical Anthropologists (AAPA), Austin, USA. 11-14 April.

Seaman, M. 2018. *Temporary waters as ecosystems worth studying*. Plenary paper delivered at the National Wetlands Indaba 2018, Kimberley, South Africa. 8-11 October.

Toerien, D. 2018. *Local Economic Development in Oudtshoorn: Consideration of a Maverick Researcher*. Paper delivered at the Greater Oudtshoorn Area Regeneration Symposium, Oudtshoorn, South Africa. 16 February.

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CENTRE FOR ENVIRONMENTAL MANAGEMENT

STAFF (2018)

Acting Director: Dr OO Ololade

Affiliated Professors: Prof NA Kgabi and Prof A Turton

Senior Lecturers: Dr FT Buschke and Dr OO Ololade

Lecturers: Mrs MF Avenant, Ms S Esterhuyse, and Mr F Sokolic (units)

Research Associates: Prof MT Seaman, Prof B Vanschoenwinkel, Dr NL Avenant, Dr H Bezuidenhout, Dr JS Brink, Dr D Codron, Dr J Codron, Dr NB Collins, Dr PL Gründlingh, Dr JR Henschel, Dr SA Mitchell, Dr T Pinceel, Dr DF Toerien, Dr C van Ginkeland, and Dr PC Zietsman

Course Coordinator: Mrs Veena Padayachee

Senior Professional Officer: Ms ME Kemp

Professional Officer: Dr AT Vos

Senior Assistant Professional Officer: Ms DM Kolesky

Research Assistant: Miss Fulufhelo Mudau

Student Assistant: Mr SN Malindie

Messenger: Mr PS Thibiri

CENTRE FOR MICROSCOPY

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OVERVIEW OF 2018

The Centre for Microscopy is a faculty-based research facility that primarily supports researchers and students from the University of the Free State (UFS) to obtain data using advanced techniques in scanning and transmission electron microscopes. The centre also has a confocal laser microscope which is used by researchers in biochemistry and biomedical research for fluorescence imaging. During 2018, several researchers from local and international institutions collaborated on microscopic research with various UFS departments. Researchers from the Central University of Technology (CUT) customarily utilise the facilities at the centre. Our staff supported 51 researchers and students at the centre, covering a range of areas in microscopic and nanotechnology research. Staff from the centre prepare samples according to each applicant's specific requirements. This forms an integral part of the support services offered by the centre.

The table below indicates the number of users over the past four years.

2015	2016	2017	2018
85	90	59	51

The variation each year is due to students who either start or finish new projects or graduate. In 2018, the total time spent on laboratory preparation of samples for researchers amounted to 448 hours - prior to any microscopic analysis. The total combined usage time, on all the microscopes, was 750 hours.

ACTIVITIES

The microscope usage by different users and departments is set out in the table below.

DEPARTMENT	USAGE HOURS		
	CLSM/LM	SEM	TEM
Cardiothoracic Surgery	-	29	-
Centre (data processing, services, training)	10	58	1
Chemistry	-	35	23
Consumer Science	-	16	-
Microbial, Biochemical and Food Biotechnology	13	42	10
Pharmacology	27	3	-
Physics	-	362	11
Plant Sciences	4	5	-
Zoology and Entomology	40	17	-
External researchers/projects:			
Central University of Technology (CUT)	-	44	-
Total Usage	**94**	**611**	**45**

Each year our staff 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. By means of a small project, each student examined one sample that they had personally fully prepared. Microscopy research was also demonstrated to undergraduate students from Engineering Sciences. Applicable engineering samples were used to illustrate the mechanical and electronic engineering principles of electron microscopes and preparation equipment.

Ms Buzui Shezi (left) explaining the centre's activities to students from the Department of Microbial, Biochemical and Food Biotechnology

The Electron Microscopes

The average annual operating hours over four years (2015 to 2018) of the scanning electron microscope (SEM) was 625 hours, while for the transmission electron microscope (TEM) it was 145 hours. The TEM had a down-time of four months due to a serious electronic failure. It was repaired at a cost of R120 000. The calculated four-year average use for light microscopy (LM), including confocal laser scanning microscopy (CLSM), is 31 hours. The centre does not fully support all options for light microscopy, as most departments have their own equipment. The centre mainly assists researchers who need light microscope observations, but do not have one in her/his own department. The SEM, which delivers impressive dimensional images, was more popular and attracted more researchers than the TEM. The latter also involves ultra-thin samples that require specialised handling of a microtome, which can be very time-consuming.

The TEM has been in use for 23 years, and although still fully functional, the manufacturer no longer makes any service parts. The replacement of the TEM remains an urgent issue. The purchase of a new TEM will be coordinated by the equipment enhancement initiative of the faculty and the university. The first tenders were received in 2018.

User support

The centre accommodated 51 users in 2018, with three researchers preferring to work independently. Support-service staff prepared the majority of samples according to the specific requirements for analysis by each type of microscope, as discussed and prearranged with the relevant researcher.

The service offered by the centre is saving researchers money and time, due to the cost involved in purchasing chemicals for microscopy preparations and the limited shelf life thereof. In some cases, routine examinations were also done by the centre's staff. Results are delivered to users through internet cloud-based storage. This overall support approach, which has been in operation since 2012, has proven to be very successful and provides researchers with an economically viable route to integrate microscopic research. Time constraints and unnecessary expenses are thus not a drawback for researchers planning small (and large) projects in microscopy.

STAFF MATTERS

A new full-time academic staff member, Mr Edward Lee, was appointed, replacing the previous temporary contract appointment. The full-time laboratory assistant, Ms Buzui Shezi, resigned in 2018.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Balakrishna, A, Duvenhage, MM and Swart, HC. 2018. Surface and chemical characterization of ZnO:Eu3+/Yb3+spin coated thin films using SEM-CL and TOF-SIMS. *Vacuum* 157: 376-383.

Foka, KE, Dejene, BF, Koao, LF and Swart, HC. 2018. Structural and luminescence properties of self-yellow emitting undoped and (Ca, Ba, Sr)-doped $Zn_2V_2O_7$ phosphors synthesized by combustion method. *Physica B: Condensed Matter* 535: 245-250.

Koao, LF, Dejene, BF, Hone, FG, Swart, HC, Motloung, SV, Motaung, TE and Pawade, VB. 2018. Effects of octadecylammine molar concentration on the structure, morphology and optical properties of ZnO nanostructure prepared by homogeneous precipitation method. *Journal of Luminescence* 200: 206-215.

Lee, E, Kroon, RE, Terblans, JJ and Swart, HC. 2018. Luminescence properties of Y_2O_3:Bi^{3+}, Yb^{3+} co-doped phosphor for application in solar cells. *Physica B: Condensed Matter* 535: 102-105.

Lee, E, Terblans, JJ and Swart, HC. 2018. The effect of pH on the luminescence properties of Y_2O_3:Bi phosphor powders synthesised using co-precipitation. *Vacuum* 157: 237-242.

Mokoena, PP, Swart, HC and Ntwaeaborwa, OM. 2018. Upconversion luminescence of Er^{3+}/Yb^{3+} doped $Sr_5(PO_4)_3OH$ phosphor powders. *Physica B: Condensed Matter* 535: 57-62.

Ogugua, SN, Swart, HC and Ntwaeaborwa, OM. 2018. The influence of post-deposition annealing on the structure, morphology and luminescence properties of pulsed laser deposited $La0.5Gd1.5SiO_5$ doped Dy^{3+} thin films. *Physica B: Condensed Matter* 535: 143-148.

Potter, G, Swart, CW, Van Wyk, PWJ, Duvenhage, M-M, Coetsee, E, Swart, HC, Budge, SM and Alex Speers, R. 2018. Compositional, ultrastructural and nanotechnological characterization of the SMA strain of Saccharomyces pastorianus: Towards a more complete fermentation yeast cell analysis. *PLoS ONE* 13(7).

Shingange, K, Swart, HC and Mhlongo, GH. 2018. Au functionalized ZnO rose-like hierarchical structures and their enhanced NO_2 sensing performance. *Physica B: Condensed Matter* 535: 216-220.

Yousif, A, Abbas, BH, Kumar, V, Pandey, A and Swart, HC. 2018. Luminescence properties of Eu3+ activated Y_2O_3 red phosphor with incorporation of Ga3+ and Bi3+ trace hertero-cations in the Y_2O_3 lattice. *Vacuum* 155: 73-75.

CENTRE FOR MICROSCOPY

STAFF (2018)

Director: Prof PWJ van Wyk

Professor: Prof PWJ van Wyk

Junior Lecturer: Mr E Lee

Senior Assistant Officer: Ms H Grobler

Assistant Officer: SB Shezi (resigned)

CENTRE FOR

SUSTAINABLE AGRICULTURE, RURAL DEVELOPMENT AND EXTENSION

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OVERVIEW OF 2018

The main focal point for the 2018 academic year in the Centre for Sustainable Agriculture, Rural Development and Extension was the implementation of our new postgraduate qualifications. The curriculum design for the newly implemented academic qualifications speak to the global need for research, and provide solutions for sustainability in the field of agriculture. Our degrees in Sustainable Agriculture seek to sustain farms, resources, and communities by promoting farming practices and methods that are profitable, environmentally sound, and benefit the communities.

The postgraduate and master's qualifications in Sustainable Agriculture were successfully implemented in 2018, with the first intake of 49 students enrolled for the PGDip, and 28 students enrolled for the master's degree.

ACHIEVEMENTS

Staff Achievements

Dr JW Swanepoel was appointed as Assistant Editor of the *South African Journal of Agricultural Extension*, the journal of the South African Society for Agricultural Extension (SASAE).

Dr J van Niekerk chaired the contents committee for the SASAE conference, which was held in East London from 5 to 8 June.

During December 2018, Ms Hlamalani Ngwenya was appointed to lead a global initiative on the New Extensionist, aimed at equipping extension personnel with 21st century skills in the context of the Agricultural Innovation System. Dr Van Niekerk was appointed and trained as one of the 10 master trainers who will lead this project.

Ms Ngwenya was appointed as Deputy Chair for the Citrus Industry Trust (CIT). She was also appointed as an ambassador for the Nuffield International Scholarship Programme.

Ms Ngwenya represented the centre at the launch of the Global Forum for Rural Advisory Services (GFRAS) New Extensionist Learning Kit in Lausanne, Switzerland, in March 2018; she subsequently acted as guest speaker, on the topic 'The New Extensionist' at a conference on Best Practices in Agricultural Advisory Services (AAS) in Asia and the Pacific Islands – a regional learning and experience-sharing event held in Bangkok, Thailand from 30 to 31 July. She also served as a panellist at the International Association for Media and Communication Research (IAMCR) Conference, in Oregon, USA, in June.

Hlamalani Ngwenya (second row, fourth from left), newly appointed Deputy Chair of the Citrus Trust, with the Minister of Agriculture, Dr Senzeni Zokwana (second row, fifth from left), and other members of the Citrus Trust

NATIONAL AND INTERNATIONAL COLLABORATION

A team from the University of the Free State (UFS), including Drs Johan van Niekerk and Jan Swanepoel, visited Europe in March 2018 to facilitate further collaboration with staff and project leaders from the Centre for Development Innovation (CDI) at Wageningen University in the Netherlands, and to investigate and compare curriculum development at the UFS.

Visit to Wageningen University by (from the left) Prof Frikkie Neser, Prof Danie Vermeulen, Dr Johan van Niekerk, Dr Jan Swanepoel, and Ms Elzmarie Oosthuizen

POSTGRADUATE STUDENTS

Forty-eight students graduated in 2018 with the Master of Sustainable Agriculture (MSA), six with distinction, namely René Bastian, Anthony Esabu, Mthintwa Hove, Nicholus Mbabazi, Jacobus van Zyl, and Noél van Zyl.

Awonke Sonandi completed his PhD degree during the 2018 academic year. His study was titled 'Determining the nutritional status of children from agri-business families in the Eastern Cape, South Africa'. His promoter was Dr JA van Niekerk. He is currently Director of Agricultural Extension and Advisory Services in the Department of Rural Development and Agrarian Reform in the Eastern Cape.

STAFF MATTERS

To ensure that language, writing, and research capabilities and skills of students are continuously developed, the centre contracted Mrs Kirsty Green and Ms Anathi Silwana to focus on language and skills development, contributing to the holistic development of our students. Mrs Green assisted students with data analysis of their research projects. In 2018, the centre introduced a presentation of Agricultural Extension on undergraduate level. Ms Silwana led these teachings.

The centre appointed industry experts and recognised academia to ensure that the students receive the best teaching, introduction to new developments, and combined experience. These included Prof J van Rooyen, Prof E Zwane, Prof E Nesamvuni, Dr D Nkosi, Dr H Smit, Dr M Blum, Dr N Fouché, and Mr J van den Berg.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Muchesa, E, Nkosi, D, Zwane, EM and Van Niekerk, JA. 2018. Agricultural product types and household income contribution in Mhondoro-Mubaira (Zimbabwe). *International Journal of Agricultural Economics* 3(4): 83-88.

Muchesa, E, Nkosi, D, Zwane, EM and Van Niekerk, JA. 2018. Perceptions and experiences regarding the current market system by communal farmers in Mhondoro-Mubaira (Zimbabwe). *International Journal of Sustainable Development Research* 4(2): 31-35.

Sonandi, A, Zwane, EM and Van Niekerk, JA. 2018. Study on the indicators of nutritional status of children of historically disadvantaged agri-business families in South Africa. *Advances in Nutrition and Food Science* ANAFS-110.

Sonandi, A, Zwane, EM and Van Niekerk, JA. 2018. Nutritional status, nutrient intake and anthropometric indices of children from agri-business families, South Africa. *Nutrition and Food Science International Journal* 6: 2.

Ngaka, MJ and Zwane, EM. 2018. The role of partnerships in agricultural extension service delivery: A study conducted in provincial departments of agriculture in South Africa. *South African Journal for Agricultural Extension* 46(1): 14-25.

Swanepoel, JW and Van Niekerk, JA. 2018. The level of household food security of urban farming and non-farming households. *South African Journal for Agricultural Extension* 46(2): 89-106.

Van Niekerk, JA and Moloi, Z. 2018. Introduction of extensive cage culture systems for breeding of catfish (*Clarius gariepinus*) and common carp (*Cyprin carpionus)* at the Aquaculture Technology Demonstration Centre, Xhariep district: An agricultural extension perspective. *South African Journal for Agricultural Extension* 46(1): 106-112.

Swanepoel, JW, Van Niekerk, JA and Van Rooyen, CJ. 2018. An analysis of the indicators affecting urban household food insecurity in the informal settlement area of the Cape Town metropole. *South African Journal for Agricultural Extension* 46(1): 113-129.

CENTRE FOR SUSTAINABLE AGRICULTURE, RURAL DEVELOPMENT AND EXTENSION

STAFF (2018)

Director: Dr JA van Niekerk

Lecturers/Researchers (permanent): Dr JW Swanepoel and Ms HJ Ngwenya

Lecturers/Researchers (part-time): Prof FWC Neser, Dr P Malan, Dr E Kotze, Dr JH Barnard, Mr L Kruger, Ms K Green, and Ms A Silwana

Senior Officers: Ms G Green and Ms A Calitz

Officer: Ms R Coetzee

DISASTER MANAGEMENT
TRAINING AND EDUCATION CENTRE FOR AFRICA

CONTACT DETAILS

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OVERVIEW OF 2018

The mission of the Disaster Management Training and Education Centre for Africa (DiMTEC) is to be the leading organisation in disaster management education and training in Africa. The strategy employed to achieve this goal, was to establish the centre as the leader in teaching and learning in Africa with a strong African footprint, and once achieved, to also establish itself as a leading research centre in disaster management. The second phase of the strategy was implemented with the registration of the PhD qualification in 2013. At that time, the centre reached maturity in terms of education and training and as a centre of excellence with international recognition. The first PhD students graduated in 2016; since then, eight PhD candidates qualified with a PhD in Disaster Management. Four students graduated with the degree in 2018.

Since 2016, four of the six DiMTEC staff members have been working on PhD studies, two of whom qualified during 2017 (Dr Belle and Dr Ncube), and Ms Kunguma and Ms Van Straaten will complete their studies during 2019. To have such a large percentage of staff working on PhD studies while all other activities in the centre continued as usual, is indeed an achievement.

DiMTEC has established a strong national and international profile and network. Disaster management provides much opportunity for DiMTEC to expand and to be a flagship programme. The multi-disciplinary nature of disaster management also provides much opportunity for collaboration.

DiMTEC was awarded a new project of national interest on the development of agricultural water scenarios for South Africa, worth R3 million.

In September 2018, DiMTEC successfully completed the EvIDENz (Earth observation-based information products for drought-risk reduction at national level) research project, which was undertaken in collaboration with the University of Bonn, United Nations University, and the Ukraine Satellite Agency, and was funded by the European Satellite Agency.

DiMTEC continued to play a significant role in disaster management issues in South Africa and abroad, participating in numerous national and international forums and conferences.

The centre is currently playing a leading role in the development of a national incident-management system for South Africa, and the International Federation of Red Cross and Red Crescent Societies (IFRC) recently requested us to develop a master's module in Mass Fatality Management.

DiMTEC is also proud of the successful implementation of the ERASMUS (European Community Action Scheme for the Mobility of University Students) Programme with the National University of Public Service (NUPS) in Hungary. Prof Jordaan and Dr Belle each spent two weeks in Budapest as guest lecturers, while Prof Agoston Restas visited the University of the Free State (UFS) on a two-week exchange programme. Three of the DiMTEC lecturers – Dr Belle, Dr Ncube, and Ms Kunguma – participated in an international lecture seminar from 26 November to 6 January 2018. Ms Van Coppenhagen should be acknowledged for her efforts to make our participation in the ERASMUS Programme a success.

ACHIEVEMENTS

Staff Achievements

Prof Jordaan was a member of the International Scientific Committee for the 12th International Conference for Environmental Legislation, Safety Engineering and Disaster Management, (ELSEDIMA 2018), held in Cluj Napoca, Romania.

RESEARCH

To date DiMTEC's research has focused mainly on agriculture-related topics and was primarily led by Prof Andries Jordaan. Dr Ncube focused on social sciences and gender issues and Dr Belle on environmental and climate-related issues, while Ms Kunguma focused on communication and information management. Two major research projects formed part of our research activities in 2018.

The 'EvIDENz: Earth observation for drought monitoring' research project is led by the Centre for Remote Sensing of Land Surfaces (ZFL) at the University of Bonn. The collaborating partner institutions are the United Nations University, United Nations Office for Outer Space Affairs (UNOOSA), the Ukraine Satellite Agency, and DiMTEC. This project was funded by the European Space Agency and was completed in 2018.

The Water Research Commission (WRC) project, 'Development of agricultural water management scenarios for South Africa', 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. GAME theory is applied to develop different scenarios. The project commenced in 2017 and is scheduled for completion in 2021, and will include at least two national water symposia. Prof Andries Jordaan is the project leader and principal researcher; the research team includes Dr Abiodun Ogundeji, Prof Anthony Turton, Prof Sue Walker, Ms Chantelle Illbury, Ms Aniebo Hagan (master's student), and Mr Sebastian Yong (PhD student). Ms Gerdamarie van Coppenhagen is the project administrator.

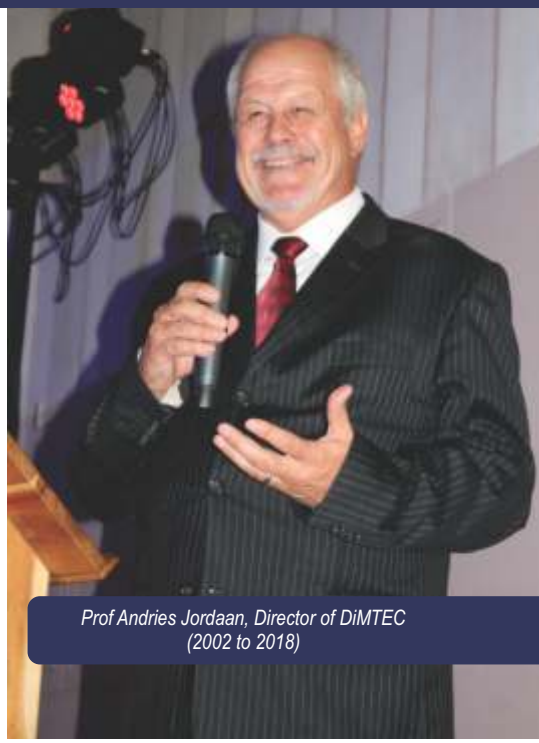
NATIONAL AND INTERNATIONAL COLLABORATION

All DiMTEC staff participated in international study tours to Europe. This included a visit to NUPS in Budapest, Hungary, where staff attended a training conference on the ERASMUS Programme and international liaison. Other universities visited were the Technical University of Dresden, University of Ljubljana, and the Babes-Bolyai University in Romania. Universities visited during another tour included the Vrije Universiteit Amsterdam, Freie Universität Berlin, University of Hanover, University of Bonn, and the United Nations University.

Prof Jordaan participated in a number of events as part of our international collaboration. These included, *inter alia*:

- Participated in the International Conference on Mass Fatality Management at invitation of the IFRC, which requested DiMTEC to develop SLPs (short learning programmes) and a master's module for African specialists.
- Led the South African delegation to Berlin for meetings with the Freie Universität Berlin and the IFRC.
- Facilitated a workshop at the 7th International Water Network Symposium in Hamburg, Germany, which focused on South Africa.
- Participated in the EvIDENz workshop in Berlin, Germany, with the University of Bonn, United Nations University, United Nations Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), and other United Nations (UN) organisations.
- Led the South African delegation to the National Drought Monitor Centre in Lincoln, Nebraska (USA) and to the US Forestry Service in Montana, visiting active wildfire fighting and incident command in action.
- Invited by the United States Forest Service to the International Disaster Management Seminar.
- Participated in a three-week training exercise in the USA on the Federal Emergency Management Agency (FEMA) National Incident Management System and Incident Command.
- Participated in the United Nations Disaster Assessment and Coordination (UNDAC) mission in Namibia to advise the Office of the Prime Minister on disaster management issues. The Office of the Prime Minister invited the UN to undertake a skills audit on disaster management systems in Namibia, and Prof Jordaan was part of the team of international experts.

Mrs van Coppenhagen visited Budapest in June 2018 as part of the ERASMUS+ training staff-mobility programme between NUPS in Budapest, Hungary, and DiMTEC. Subsequently, DiMTEC hosted Prof Agnes Jenei and Ms Olena Chyzh from NUPS during April 2018.



Prof Andries Jordaan, Director of DiMTEC (2002 to 2018)

From the left: Olena Chyzh (Erasmus Coordinator at NUPS), Prof Agnes Jenei (NUPS), and Ms Germie van Coppenhagen (DiMTEC)

COMMUNITY SERVICE

DiMTEC was involved in the training of extension officers and farmers in the Eastern Cape. The training workshops, involving more than 200 people, were held in Mthatha, Sterkspruit, Aliwal North, and Port Elizabeth. The focus was on drought management.

POSTGRADUATE STUDENTS

At the 2018 graduations, 33 students graduated with the Postgraduate Diploma in Disaster Management, while 16 students graduated with the Master of Disaster Management (MDM): The MDM graduates were:

Vuyiswa S Khumalo.
Bongeka N Kubheka.
Ntebaleng A Leteno.
Izak J Louw (with distinction).
Lawrence M Magagula.
Thulani G Mahlangu.
Moatlhodiemang P Mainaakae.
Judith M Malambo.
Lucia Maloka.
Nokuzola P Mlilo.
Tsungai Mukwashi.
Mmagadima J Ratlabala.
Brenna-Leigh Robertson.
Kgadiko L Serage.
Nonhlanhla N Yalala.
Lwando Zandile.

The following candidates graduated with the PhD in Disaster Management in 2018:

Maipise, Albert.
Thesis: *Strengthening disaster risk reduction (DRR) in Zimbabwe.*
Promoter: Prof AJ Jordaan.

Ndlovu, Thabo.
Thesis: *Communal livestock drought risk reduction strategies: A case of Umzingwane District in southern Zimbabwe.*
Promoter: Prof AJ Jordaan.

Hlalele, Bernard Moeketsi.
Thesis: *Spatio-temporal analysis of dry spells variability in Lesotho.*
Promoter: Prof DM Sakulski.

Shwababa, Siviwe Zukile.
Thesis: *Sustainable land reform model assessing the extent and severity of shocks and stressors among land reform beneficiaries: A case of rainfed land reform beneficiaries in the Eastern Cape Province of South Africa.*
Promoter: Prof AJ Jordaan.

Currently, seven candidates are registered for their doctoral qualification.

STAFF MATTERS

Prof Alexandru Ozuno from the Babes-Bolyai University in Romania was appointed as Affiliated Professor in DiMTEC.

At the end of 2018, we bade farewell to Prof Andries Jordaan. He served as the Director of DiMTEC from 2002 to 2018, and under his leadership DiMTEC achieved the status it enjoys today as the leading centre of its kind in Africa.

RESEARCH OUTPUTS

RESEARCH ARTICLES

Belle, JA, Collins, N and Jordaan, A. 2018. Managing wetlands for disaster risk reduction: A case study of the Eastern Free State, South Africa. *Jàmbá: Journal of Disaster Risk Studies* 10(1): 1-10.

Belle, JA. 2018. Managing wetlands for climate change adaptation: A case study of the eastern Free State, South Africa. *International Journal of Science and Research Methodology* Vol 9(1).

Graw, V, Ghazaryan, G, Dall, K, Gomez, AD, Abdel-Hamid, A, Jordaan, A, Piroska, R, Post, J, Szarzynski, J, Walz, Y and Dubovyk, O. 2018. Drought dynamics and vegetation productivity in different land management systems of Eastern Cape, South Africa – A remote sensing perspective. *Sustainability* 9: 1-19.

Jordaan, A, Bahta, Y and Phatudi-Mphahlele, B. 2018. Ecological vulnerability indicators to drought: Case of communal farmers in Eastern Cape, South Africa. *Jàmbá: Journal for Disaster Risk Studies* 11(1).

Kunguma, O, Pelser, A, Tanyi, P and Muhame, C. 2018. Social and structural vulnerability as a barrier in HIV and/or AIDS communication campaigns: Perceptions of undergraduate students at a South African tertiary institution. *Jàmbá: Journal of Disaster Risk Studies* 10(1), a407.

Mekuyie, M, Jordaan, A and Melka, Y. 2018. Land-use and land-cover changes and their drivers in rangeland-dependent pastoral communities in the Southern Afar Region of Ethiopia. *African Journal of Range and Forage Science* 35(1):33-43.

Mekuyie, M, Jordaan, A and Melka, Y. 2018. Understanding resilience of pastoralists to climate change and variability in the Southern Afar Region, Ethiopia. *Climate Risk Management* 20: 64-77.

Ncube, A and Jordaan, A. 2018. Analysis of African migrant women coping and adaptation in South Africa: The human and social livelihoods approach. *Disaster Management Southern Africa* 2(4).

Ncube, A, Jordaan, A, Restas, A and Bahta, YT. 2018. Human and social capital livelihood to increase resilience among migration women - A case study of managing human disaster. *Fire protection* 2: 135-151.

Ncube, A, Mangwaya, PT and Ogundegi, AA. 2018. Assessing vulnerability and coping capacities of rural women to drought: A case study of Zvishavane district, Zimbabwe. *International Journal of Disaster Risk Reduction* 28(1): 69-79.

CHAPTERS IN BOOKS

Jordaan, AJ, Sakulski, D, Maybuye, C and Mayumbe, F. 2018. Measuring drought resilience through community capitals. In: *Resilience: The Science of Adaptation to Climate Change* edited by Z Zommers and K Alverson. Elsevier. pp. 105-115.

RESEARCH REPORTS

Walz, Y, Dall, K, Graw, V, Villegrán de Léon, JC, Kussel, N and Jordaan, AJ. 2018. *Understanding and reducing agricultural drought risk: Examples from South Africa and Ukraine, Policy Report No. 3.* Bonn: United Nations University – Institute for Environment and Human Security (UNU-EHS).

CONFERENCE CONTRIBUTIONS

Graw, V, Ghazaryan, G, Schreier, J, Gonzales, J, Abdel-Hamed, A, Walz, Y, Dall, K, Post, J, Jordaan, A and Dubovyk, O. 2018. *Timing is everything – Drought classification for risk assessment*. Paper presented at 2018 IEEE International Geoscience and Remote Sensing Symposium, Valencia, Spain. 22-27 July.

Jordaan, AJ. 2018. *Disaster risk reduction through climate change adaptation.* Paper presented at the 12th International Environmental Legislation, Safety Engineering and Disaster Management (ELSEDIMA) Conference: Disaster Risk Reduction for Sustainable Societies, Cluj Napoca, Romania. 17-18 May.

Jordaan, AJ. 2018. *Disaster management in South Africa: Status Report.* Paper presented at the 33rd Annual Conference, of the Disaster Management Institute of South Africa (DMISA), Kempton Park, South Africa. 18-20 September.

Jordaan, AJ. 2018. *Early warnings in disaster risk reduction*. Paper presented at the BRICS Scientific Symposium, Nelspruit, South Africa. 19 June.

DISASTER MANAGEMENT
TRAINING AND EDUCATION CENTRE FOR AFRICA

STAFF (2018)

Director: Prof AJ Jordaan

Professors: Prof AJ Jordaan, Prof B Grové (affiliated), and Prof R Bragg (affiliated)

Lecturers: Dr A Ncube, Dr JA Belle, Dr H Booysen, Ms O Kunguma, Ms M Joubert, Dr E Louw (affiliated), Dr C Barker (affiliated), Dr N Matthews (affiliated), Dr A Ogundeji (affiliated), Dr D Chikobvu (affiliated), Dr M Schutte-Smith (affiliated), Ms L Nogabe (affiliated), Mrs L de Wet (affiliated), Mr W Ellis (affiliated), and Dr E du Plessis (affiliated)

Affiliated Associate Professors: Prof J Szarzynski, Prof F Renaud, and Prof Alexandru Ozuno

Senior Assistant Officers: Ms G van Coppenhagen and Ms A van Straten

INSTITUTE FOR GROUNDWATER STUDIES

CONTACT DETAILS

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OVERVIEW OF 2018

The Institute for Groundwater Studies (IGS) specialises in groundwater research, software development, laboratory services, development of groundwater monitoring programmes, geochemical assessments, acid-mine drainage prediction and management, geohydrological impact assessments, groundwater in a mining environment, and the assessment of groundwater pollution.

ACHIEVEMENTS

Staff Achievements

The Faculty of Natural and Agricultural Sciences hosted a two-day Flash Facts Competition, which was a huge success. The aim of this competition is to promote research debate by allowing postgraduate students and staff in the different departments to present and share their research. The competition started in the different departments in the faculty, and departmental winners faced each other in the final round at faculty level. Each participant was allowed three minutes to present their research and thereafter answer questions from a panel of adjudicators as well as from the audience. Dr Francois Fourie, Senior Lecturer, was the winner in IGS.

Student Achievements

At the June 2018 graduations, Mashudu Clifford Mathobo was awarded the Dean's Medal for the student who achieved the best results in respect of a master's degree in the faculty.

Dr Francois Fourie (second from left in the second row) with other participants in the Flash Facts Competition

RESEARCH

Research in the IGS is aimed at various aspects of geohydrology. Staff members and students actively contributed towards generating research outputs and actively provided services to industry and community. Different projects are funded by different funding institutions and little or no resources are required from the University of the Free State (UFS).

Prof Abdon Atangana continued his research, and new trends of non-local operators based on power law, exponential decay, and the generalised Mittag-Leffler were introduced and have been applied in many fields of science, technology, and engineering.

Dr Francois Fourie continued working on a research project to investigate the emplacement and properties of granophyre dykes within the Vredefort Impact Structure.

Mr Fanie de Lange's research was focused on a project for Bloemwater in the Thaba 'Nchu area, including hydrocensus reports, geophysical investigations, and drilling and aquifer testing to ascertain the viability of groundwater as a sustainable augmentation resource over the medium- to long-term. During the research, methodologies had to be adapted to achieve a higher success rate, which led to a comparison between the two strategies and why the latter delivered higher yielding boreholes. A final study was undertaken on how geohydrological investigations can assist in facilitating rural development in drought-prone areas in the Free State. All aquifer test data from the Thaba 'Nchu project is currently being re-evaluated to assist in research on slug tests in fractured aquifers, how a more accurate 'safe' yield can be estimated, and how accurate transmissivity values from numerical modelling of slug test data are.

Dr Modreck Gomo investigated the use of large diameter hand-dug wells in South Africa in terms of their utilisation, research and development, and the legislative and policy framework guiding their development and use. In two additional projects, he investigated the evolution of fluid electrical conductivity

profiles associated with a saline contaminant plume in a horizontal single-lane fractured-rock aquifer system. He also evaluated the application of the Cooper and Jacob (1946) time-drawdown method to interpret multi-well aquifer pumping tests in confined porous aquifers, using numerical modelling.

Through the research undertaken by Dr Amy Allwright, numerical groundwater transport models were developed for industry to assess potential environmental impacts, ranging from a leaking petrol station in a national park to mining-related processes and alternative mine waste-disposal options using advanced coupled models. Research on numerical methods and alternative formulations for the groundwater transport equation provided fundamentals for models of the future.

Collaboration with other departments and external consultants on these projects promoted interdisciplinary research.

NATIONAL AND INTERNATIONAL COLLABORATION

The IGS has been collaborating with the International Groundwater Resources Assessment Centre (IGRAC – Netherlands) on a Southern African Development Community (SADC)-Groundwater Management Institute (GMI) project on 'Capacity building for data collection and management in SADC member states (2017-2019)'. One of the major highlights of 2018 was the successful workshop held at IGS from 28 to 30 May. The workshop was aimed at capacitating young groundwater professionals with some hands-on technical skills for collecting basic groundwater data, handling processing, and basic analysis. Dr Modreck Gomo was responsible for preparing material and facilitating the training on professional drilling supervision.

IGS collaboration with IGRAC on the SADC-GMI project

The Water Research Commission (WRC), in collaboration with the IGS, held the WRC101 Workshop on 10 May 2018. The purpose of this workshop is to familiarise new project leaders with the process of research-proposal submission and related funding and project-management issues.


WRC Workshop held in collaboration with IGS
Front row (from the left): Ms Thobile Gebashe (WRC), Mr Vhafunani Tshishonga (WRC), Dr Mandla Msibi (WRC), Dr Mamohloding Tlhagale (WRC), and Mr Fanie de Lange (IGS)
Back row (from the left): Dr Shafick Adams (WRC), Mr Thabo Mthombeni (WRC), and Mr Eelco Lukas (Director: IGS)

POSTGRADUATE STUDENTS

Each year we receive an overwhelming number of applications for honours, master's, and PhD studies. Due to the intensity of the modules, limited staff capacity, and space, we can only select the most promising students. In 2018, a total of 21 students were enrolled for the BScHons in Geohydrology, 67 for the MSc, and 20 for the PhD.

The commitment and enthusiasm of IGS personnel and students were clearly demonstrated by the graduation numbers. At the 2018 graduations, 20 students graduated with the BScHons majoring in Geohydrology, and 17 students graduated with the MSc (with specialisation in Geohydrology). They were:

Philip J Hughes – with distinction.
Rendani V Makahane.
Manthofeela C Makoae.
Matshitane E Masemola.
Mashudu C Mathobo – with distinction.
Setjhaba S Mofokeng.
Lerato M Mokitlane.
George G Molaolwa.
Thato B Molokwe.
Nancy Ntseze Njonguo.
Schalk J Oberholzer.
Neville J Paxton.
Mmanthupi A Ramotsho – with distinction.
Reinhardt Raubenheimer.
Luke C Towers.
Albert van Heerden.
Morné van Wyk – with distinction.

One PhD with specialisation in Geohydrology was conferred:

Sakala, Emmanuel.
Thesis: *Development of rapid assessment tools for groundwater vulnerability mapping using integrated geoscientific datasets and artificial intelligent algorithms: Case study from Witbank and Ermelo coalfields, South Africa.*
Promoter: Dr FD Fourie.

The annual Winter School for honours students is always a highlight, providing them with exposure to the practical aspects of groundwater. In July 2018, the students visited Rustfontein Dam, Finsch Mine, and the Barkley East area. The field trip was organised by Mr Fanie de Lange and Mr Paul Lourens.

Attendees of the ICARD and IMWA Conference (from the left): Mr Paul Lourens, Ms Lizel Kennedy, Ms Josepha Zielke-Olivier, Ms Alba Gomez-Arias, and Prof Danie Vermeulen

POSTDOCTORAL RESEARCH FELLOWS

The IGS hosted three Postdoctoral Research Fellows during 2018 – Dr Yolande Kotzé (from South Africa), Dr Pacome Ahokpossi (from Benin), and Dr Kolade Owalabi (from Nigeria).

STAFF MATTERS

Two of our staff members were promoted in 2018. Ms Amy Allwright was promoted to Lecturer and Dr Modreck Gomo to Senior Lecturer.


Dr Modreck Gomo (left) and AbdulHamid Al-Gheth from Dubai, United Arab Emirates, at the International Conference on Environmental Geochemistry and Geochemical Mapping (ICEGGM)

RESEARCH OUTPUTS

RESEARCH ARTICLES

Ahokpossi, DP, Atangana, A and Vermeulen, PD. 2018. Hydro-geochemical characterizations of a platinum group element groundwater system in Africa. *Journal of African Earth Sciences* 138: 348-366.

Ahokpossi, DP, Atangana, A and Vermeulen, PD. 2018. Modelling of fractal flow in dual media with fractional differentiation with power and generalized Mittag-Leffler laws kernels. *European Physical Journal: Special Topics* 226: 3705-3727.

Ali, MN, Husnine, SM, Ak, T and Atangana, A. 2018. Solitary wave solution and conservation laws of higher dimensional Zakharov-Kuznetsov equation with nonlinear self-adjointness. *Mathematical Methods in the Applied Sciences* 41: 6611–6624.

Allwright, A and Atangana, A. 2018. Augmented upwind numerical schemes for the groundwater transport advection–dispersion equation with local operators. *International Journal for Numerical Methods in Fluids* 87: 437-462.

Allwright, A and Atangana, A. 2018. Fractal advection-dispersion equation for groundwater transport in fractured aquifers with self-similarities. *The European Physical Journal Plus* 133(2): 48.

Atangana, A. 2018. Blind in a commutative world: Simple illustrations with functions and chaotic attractors. *Chaos Solitons & Fractals* 114: 347-363.

Atangana, A. 2018. Non validity of index law in fractional calculus: A fractional differential operator with Markovian and non-Markovian properties. *Physica A-Statistical Mechanics and Its Applications* 505: 688-706.

Atangana, A and Alkahtani, B. 2018. New model for process of phase separation in iron alloys. *Iranian Journal of Science and Technology Transaction A-Science* 42: 1351-1356.

Atangana, A and Alqahtani, R. 2018. New numerical method and application to Keller-Segel model with fractional order derivative. *Chaos Solitons & Fractals* 116: 14-21.

Atangana, A and Alqahtani, R.T. 2018. Tumour model with intrusive morphology, progressive phenotypical heterogeneity and memory. *The European Physical Journal Plus* 133: 85.

Atangana, A and Gómez-Aguilar, JF. 2018. Decolonisation of fractional calculus rules: Breaking commutativity and associativity to capture more natural phenomena. *The European Physical Journal Plus* 133: 166.

Atangana, A and Gómez-Aguilar, J. 2018. Fractional derivatives with no-index law property: Application to chaos and statistics. *Chaos Solitons & Fractals* 14: 516-535.

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INSTITUTE FOR GROUNDWATER STUDIES

STAFF (2018)

Director: Mr E Lukas

Professor: Prof A Atangana

Senior Lecturer: Dr F Fourie

Senior Researcher: Dr M Gomo

Lecturers: Mr SS de Lange and Mr PJH Lourens

Lecturer: Mrs A Allwright

Affiliated Associate Professor: Prof KT Witthüser

Affiliated Researcher: Prof JF Botha

Chief Officer – Financial Manager: Mrs L Rust

Officer – Professional Services: Mrs A Rossouw

Messenger/Cleaner: Mrs P Mosala

IGS Laboratory:
Deputy Director (IGS Laboratory): Dr L-M Deysel

Assistant Director (IGS Laboratory): Mrs E de Necker

Quality Manager: Mrs G Ntwaeaborwa

Officers: Ms WC Geyer and Ms T Letebele

Senior Officer: Mrs NV Ntswabule

Intern: Ms A Hadebe

Cleaner: Ms K NciNci

PARADYS
EXPERIMENTAL FARM

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OVERVIEW OF 2018

During 2018, we saw the revitalising of the dairy on the farm, with a herd of 40 Jersey cows being purchased. The average production of these cows was 23 litres per day. Both the cattle and sheep enterprises performed exceptionally well, in spite of the ongoing gripping drought. The beef herd and the sheep flock obtained conception rates of 80% and 90% respectively. The newly established pig production unit also performed well, with an average litter size of 15 piglets and a weaning percentage of 90%. The farm established a pecan orchard of 2 ha that will, *inter alia*, focus on researching diseases that may affect current cultivars in the Free State.

The farm served as a practical hub for students and the general public. During these practical days, the University of the Free State (UFS) and the learners were exposed to the practical activities of relevance to the agricultural industry, livestock, and fodder production. The farm also hosted some social functions for the public and students in the farm's lapa.

RESEARCH

During the course of 2018, a number of trials were conducted on the farm, including:

Data collection for the Afrikaner beef herd

Data was collected and trials conducted in terms of:

- Production norms for beef cattle kept under extensive conditions.
- Deoxyribonucleic Acid (DNA) sampling: Collecting DNA samples of all the animals born on the farm, as part of the national Afrikaner Cattle Breeders' Society, 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 acts as a genetic baseline for the Afrikaner breed, as they are genetically diverse and well-adapted to the environment. Paradys animals that were sold, have adapted extremely well to other areas of the country, which in itself is very rare.
- Crossbreeding: Over the past four years, the Afrikaner maternal line has been crossbred with Simmentaler and Simbra to establish a terminal breed called the Afrisim, which increases the weaning weight and provides an alternative market for selling weaners to feedlots.
- Selective breeding: The main herd has been selectively bred, using excellent bull stock to improve the genetic composition of the herd, especially increasing the birth and weaning weight of calves, thereby ensuring optimal producing animals.

The beef herd

Data collection for the sheep herd

Data for sheep on the farm is still being collected. Data was collected on:

- Reproductive performance: The herd continued to be subjected to excelled mating frequency (three births in two years) to increase the reproductive rate in the herd. The conception and lambing rates were recorded to ensure that reproductive performance increases.
- Early weaning practices: Lambs are weaned a month earlier than usual and are given various feeds to determine the best feeding and practice for early weaning.
- Mineral supplementation: The effect of mineral supplementation has also been tested, particularly in terms of its effect on the reproductive performance. The results show that mineral supplementation is needed for increased reproductive performance.

Data collection for the dairy herd

For the dairy herd, data was collected on fertility (the mating of heifers and cows using artificial insemination, ensuring a respectable inter-calving period and outstanding genetics) and feed-to-milk conversion to ensure cost-effective milk production, as well as the feeding of calves for early weaning and rapid growth.

The dairy herd

Feeding trials for cattle and sheep

These trials included:

- Feeding of weaned lambs, whereby different types of feed were tested to determine their effect on the growth of the lambs, feed conversion, and carcass composition.
- Feeding of bulls for slaughter, in order to research the economic viability of feeding Afrikaner bulls for slaughter and determining their feed conversion.
- Lick supplementation, by giving animals various types of production lick to research its effect on animal growth and body condition, as well as to determine the economic viability of different supplementation regimes.

Crop production trials

Planted pastures in both irrigation and dry-land conditions were investigated by planting various types of perennial grasses to research their production potential under irrigation, on the one hand, and normal rainfall areas on the other hand, as a method of improving the fodder flow of natural veld.

Dry-land production of teff for effective fodder production under various plant-population densities was also researched.

COMMUNITY SERVICE

A number of farmers' days were held on the farm for the general public, farmers, and students to create awareness and provide information. These included topics on lucerne (crop for cultivated pastures), pig production, stock theft (in conjunction with the South African Police Service), branding of animals, agricultural engineering (e.g. irrigation systems), feed catalogue (i.e. various feeds and supplying companies), and an animal-health week.

The commitment to providing training to the community continued in 2018, involving training in:

- The correct handling of animals to avoid stress or injury.
- Breeding goals – determining the type of production system that is needed and advising on the best possible breed and breeding plan to follow.
- Vaccination of animals – training on the correct way to vaccinate and the type of vaccinations to be administered.
- Branding and marking of animals – training with regard to the correct way and age of marking and branding animals.
- Stockmanship – training people to farm better and produce livestock.

School visits to the farm were also organised to familiarise the students with the practical aspects of farming and the farming industry.

Establishing the pecan orchard

PARADYS
EXPERIMENTAL FARM

STAFF (2018)

Farm Manager: Mr J Barnard

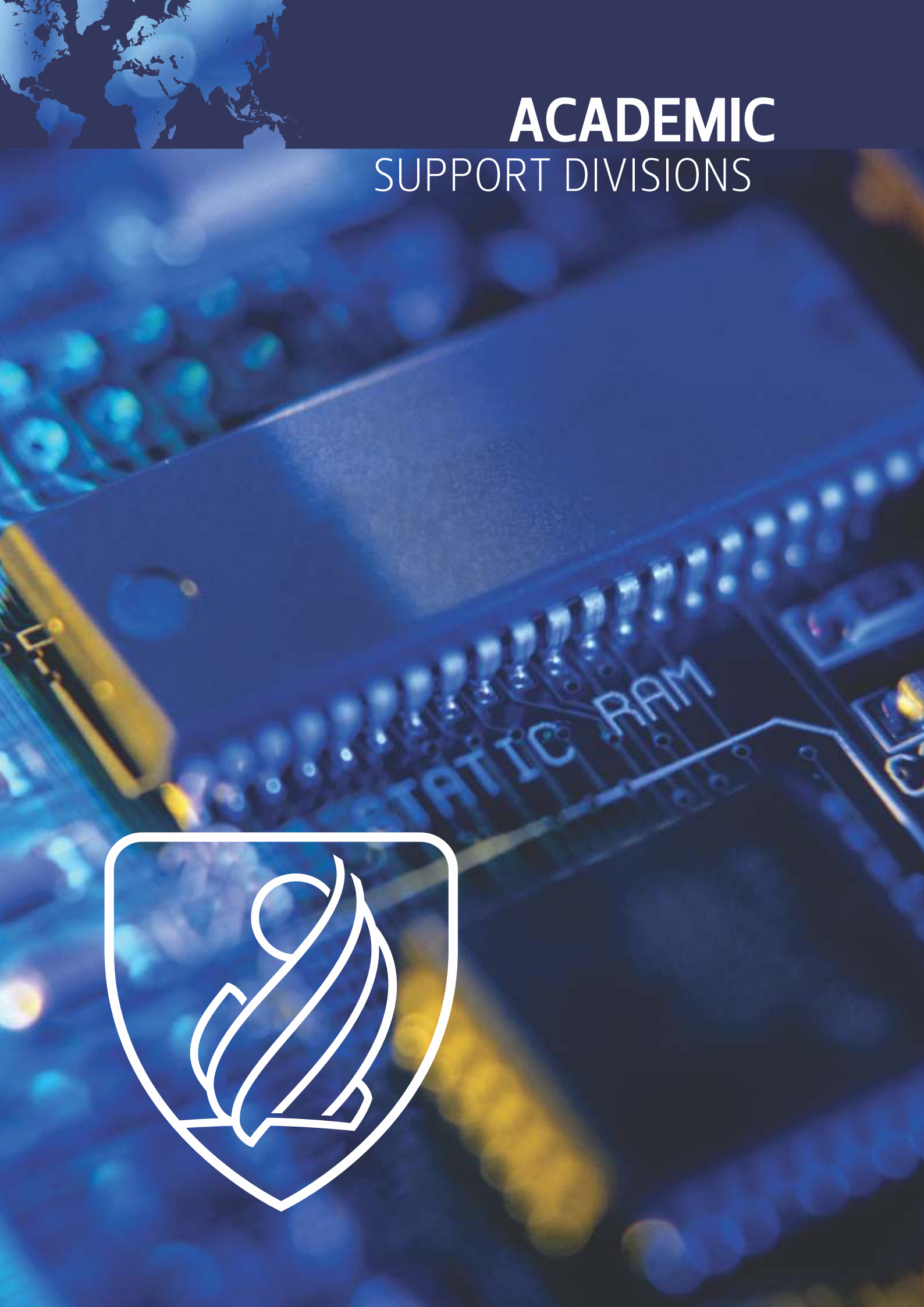
Lecturer: Mr L Kruger

Assistant Officer: Ms AM Smith

Research Assistants: Mr JF McDonald and Mr B Madyibi

Farm Workers: Mr MA Khoele, Mr TF Kubheka, Ms MA Kubheka, Mr LE Maqala, Mr PM Morirhela, Mr YS Motswari, Mr KP Ramatekoane, Ms EM Sebonyane, and Mr PM Somi

ACADEMIC
SUPPORT DIVISIONS



ELECTRONICS DIVISION

CONTACT DETAILS

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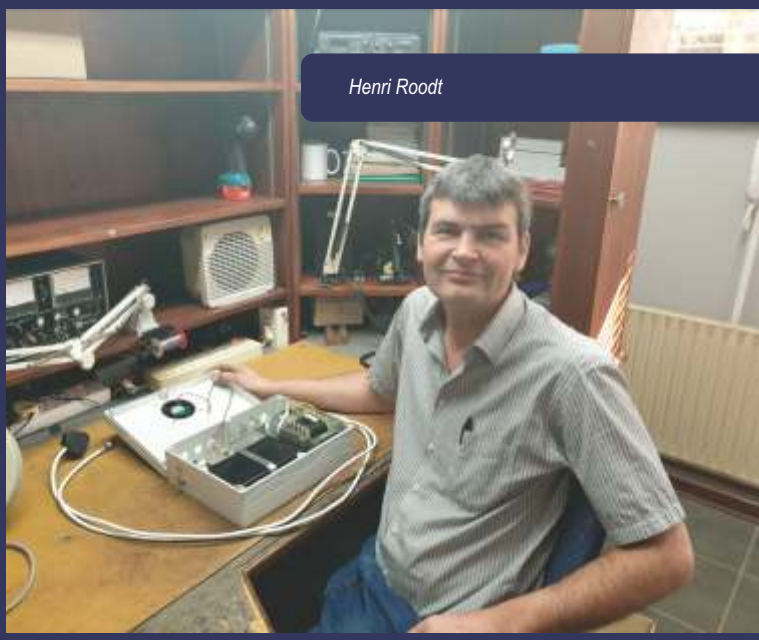
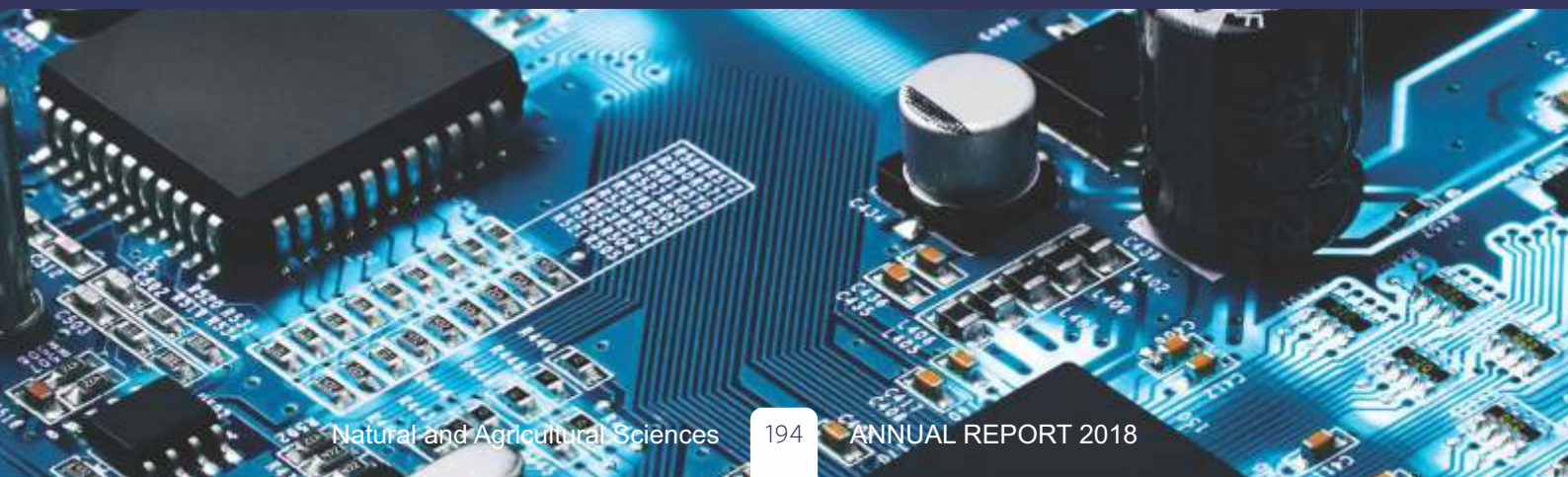
OVERVIEW OF 2018

Since 2018, the Electronics and Instrumentation Divisions have resorted under one Divisional Head. It took some time for the personnel to accept the change and the new style of management. The two divisions started to work together very well, which is evident from the number of work orders received by both divisions. The Electronics Division has taken on the most work in its history. There is still room for improvement, but we are making good progress. Because of the duplication of the two divisions' vehicles, we sold Instrumentation's Nissan MP200 pickup and replaced it with a Nissan MP300 for carrying larger 1-ton loads. We also bought a new high-power power supply and a 3D printer. The following expensive apparatus has been repaired: Versaprobe, XPS, ICP, MS ICP, SAM700, AA and numerous other instruments. Savings through these repairs and other cost-saving initiatives resulted in an estimated total saving of approximately R8 931 700.

Adriaan Hugo, Mark Jackson, Innes Basson, and Denver de Koker



Henri Roodt



WORK ACTIVITIES

A total of 538 work requisitions were received in 2018, representing 880 items of apparatus. Twenty-one of these requisitions 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 6 390 working hours (based on 7,5 hours per day per person present), 6 331 were actively used (i.e. 99%).

Table 1 below illustrates the time spent on work for the 38 departments and divisions using the services of the Electronics Division in 2018.

Table 1: Utilisation of the Electronics Division by departments and divisions (2018)

DEPARTMENT/DIVISION	TOTAL TIME SPENT (HOURS)	% TIME SPENT
Physics	1 845	29,14%
Chemistry	1 241	19,60%
Internal Administration	553	8,73%
Plant Sciences	548	8,66%
Biotechnology	467	7,37%
Soil, Crop and Climate Sciences	263	4,15%
External Work	208	3,29%
Animal, Wildlife and Grassland Sciences	195	3,08%
Computer Science and Informatics	170	2,69%
Institute for Groundwater Studies	129	2,04%
Engineering Sciences	124	1,96%
Electronics Division	104	1,64%
Instrumentation Division	84	1,33%
Zoology and Entomology	74	1,17%
Physical Resources	51	0,81%
South African Doping Control Laboratory (SADoCoL)	28	0,44%
Environmental Management	27	0,43%
National Control Laboratory	27	0,43%
Virology	23	0,36%
Agricultural Economics	22	0,35%
Architecture	18	0,28%
South Campus	18	0,28%
Anatomical Biomedics	17	0,27%
Geology	15	0,24%
Genetics	14	0,22%
Centre for Microscopy	9	0,14%
Office of the Dean	8	0,13%
Mathematics	8	0,13%
Urban and Regional Planning	8	0,13%
Odeon School of Music	6	0,09%
Geography	6	0,09%
Health and Wellness	6	0,09%
Wynand Mouton	6	0,08%
Farmovs	4	0,06%
Haematology and Cell Biology	2	0,03%
Basic Medical Sciences	2	0,03%
Drama and Theatre	2	0,03%
TOTAL	**6 331**	**100,00%**

A total of 1 836 hours was spent on development (26%), 3 942 hours on maintenance (62,27%), and 553 hours on administration (8,73%).

Work for the Faculty of Natural and Agricultural Sciences amounted to 5 932 hours (93,7%), while 399 hours were spent on work for departments/divisions outside the faculty.

The table below provides information on the projects completed per department/division in 2018.

Table 2: Completed projects (2018)

DEPARTMENT/DIVISION	APPARATUS
Chemistry	3 x access-control expansions 2 x UV lamp enclosures 1 x carbon dioxide apparatus 1 x freezer SMS alarm system 1 x thermocouple display for chemical reaction
Physics	16 x practicum apparatus 1 x security system with movement and camera surveillance 1 x 4-station physics bowl 1 x air-track experiment
Biotechnology	6 x access-control expansions 1 x dryer system
Soil, Crop and Climate Sciences	4 x freezer SMS alarm systems 3 x access-control expansions
Engineering Sciences	21 x camera systems
Institute for Groundwater Studies	4 x maglocks
Computer Sciences and Informatics	2 x tracking devices
Anatomical Biomedics	2 x timers
South African Doping Control Laboratory (SADoCoL)	1 x temperature satellite station

At the end of 2018, there were two unfinished projects.

Table 3: Unfinished projects (2018)

DEPARTMENT/DIVISION	APPARATUS
Animal, Wildlife and Grassland Sciences	1 x feed mixer
Physics	1 x filter-control system

ELECTRONICS DIVISION

STAFF (2018)

Head of Division: Mr AB Hugo

Control Technicians: Mr I Basson, Mr HJ Roodt, and Mr MH Jackson

Technical Assistant: Mr D de Koker

Secretary: Mrs A Kasper (shared with the Instrumentation Division)

INSTRUMENTATION DIVISION

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OVERVIEW OF 2018

At the end of 2017, Mr Adriaan Hugo was appointed as Head of both the Instrumentation and Electronics Divisions. As a result, a new structure was implemented in 2018. Mr Barry Crous and Mr Innes Basson will be appointed as Assistant Line Heads for the Instrumentation and Electronics Divisions respectively, to assist Mr Hugo with day-to-day activities.

The Instrumentation Division was fortunate to acquire the services of three new staff members – Mr Lucky Mokoena (Cleaner/Technical Aide), Mr Lucas Odendaal (Control Technician), and Mrs Alicia Kasper (Secretary), who assists both divisions with general administration.

Although 2018 presented adaptation challenges, it has been a successful year in which we have achieved most of our goals; with the new management and the willingness of the personnel, we will be able to reach new heights. The income for the year amounted to R1 494 309, with a repayment amount of R486 000 to the university for the loan agreement made by the previous management. We worked hard to get stock levels back to normal and also spent resources (time and funds) to repair faulty equipment and to build new equipment for handling heavy material of up to three tons.

After a profitable reassessment by the new management, we unfortunately lost some of our outside clients to a company that has a laser cutter with lower running costs than our waterjet cutter. We are thankful for the huge swing back to the university as our primary client, and we are grateful to the departments for their support. We have a new policy of doing all the work that is within our capability and will do everything possible to serve our faculty and the university.

Sylvester Jones, Alicia Kasper, and Lucas Odendaal

Adriaan Hugo, Lucky Mokoena, Wicus Storm, Barry Crous, Joggie Rautenbach, and Kobus Kruger

WORK ACTIVITIES

In 2018 a total of 406 work orders were received, of which 39 were for development projects. Some were new and others were extensions of existing instruments, as well as the upgrading of older instruments – as reflected in Table 2.

Table 1 below illustrates the time spent on work for the 24 departments and divisions using the services of the Instrumentation Division in 2018.

Table 1: Utilisation of the Instrumentation Division by departments and divisions (2018)

DEPARTMENT/DIVISION	TOTAL TIME SPENT (HOURS)	% TIME SPENT
Physics	1 742	28,31%
Internal Administration	694	11,28%
Chemistry	632	10,27%
Biotechnology	508	8,25%
External Work	497	8,08%
Animal, Wildlife and Grassland Sciences	449	7,30%
Soil, Crop and Climate Sciences	406	6,60%
Institute for Groundwater Studies	287	4,66%
Electronics Division	203	3,30%
Zoology and Entomology	142	2,30%
Instrumentation Division	135	2,19%
Geology	100	1,62%
National Control Laboratory	82	1,33%
Engineering Sciences	65	1,06%
Computer Sciences and Informatics	46	0,75%
Plant Sciences	42	0,68%
Office of the Dean	31	0,50%
Finance	24	0,39%
Genetics	16	0,26%
Farmovs	16	0,26%
Environmental Management	14	0,23%
Medical Physics	11	0,18%
BMW Anatomic	9	0,15%
South African Doping Control Laboratory (SADoCoL)	3	0,05%
Total	**6 154**	**100,00%**

Work for the Faculty of Natural and Agricultural Sciences amounted to 5 536 hours (90%), while 618 hours were spent on work for departments/divisions outside the faculty.

The table below provides a list of the completed projects per department/division in 2018.

Table 2: Completed projects (2018)

DEPARTMENT/DIVISION	APPARATUS
Physics	40 x first-year practicum apparatus 15 x waits for measurement 9 x perspex cabinets 3 x light boxes 2 x trollies 2 x reservoir tubes for sound experiment 1 x reservoir for water experiment 1 x luminesce apparatus 1 x parts for planetarium telescope 1 x brachistochrome curve demonstration apparatus 2 x trollies
Chemistry	1 x table and granite top 1 x fume cabinet 1 x stainless-steel holder with formica top 1 x pill press
National Control Laboratory	2 x stainless-steel trollies 2 x aluminium heating blocks 1 x stainless-steel table 1 x vail holder for biological indicator for autoclave
Soil, Crop and Climate Sciences	120 x sedimentation cylinders 30 x PVC chambers 1 x poison spray unit 1 x tube holder
Biotechnology	15 x sample trays 2 x pipette stands 1 x dryer cabinet 1 x sterilisation cabinet
Institute for Groundwater Studies	6 x bailers 1 x evaporation pan 1 x perspex borehole demonstration apparatus 1 x re-built trailer
Animal, Wildlife and Grassland Sciences	3 x trollies 2 x disc ploughs 1 x cabinet for glass tubes 1 x suction ducting
Computer Science and Informatics	1 x eye tracker 1 x Raspberry Pi rack
Geology	1 x water cooler

At the end of 2018, there was only one unfinished project - the installation of the Planetarium Telescope for the Department of Physics.

Poison spray unit built for Department of Soil, Crop and Climate Sciences

Rebuilt disc plough for Paradys Experimental Farm

INSTRUMENTATION DIVISION

STAFF (2018)

Head of Division: Mr AB Hugo

Control Technicians: Mr BJ Crouse, Mr JPW Rautenbach, Mr MJ Kruger, and Mr L Odendaal

Technical Assistant: Mr LS Jones

Technical Aides: Mr WJR Storm and Mr L Mokoena

Secretary: Mrs A Kasper (shared with the Electronics Division)

STATISTICAL DATA

2018 REGISTRATIONS BY QUALIFICATION LEVEL AND NATIONALITY

QUALIFICATION	INTERNATIONAL	SOUTH AFRICAN	TOTALS
Undergraduate	137	5 031	5 168
Postgraduate	300	1 645	1 945
Occasional	21	210	231
TOTAL	**458**	**6 886**	**7 344**

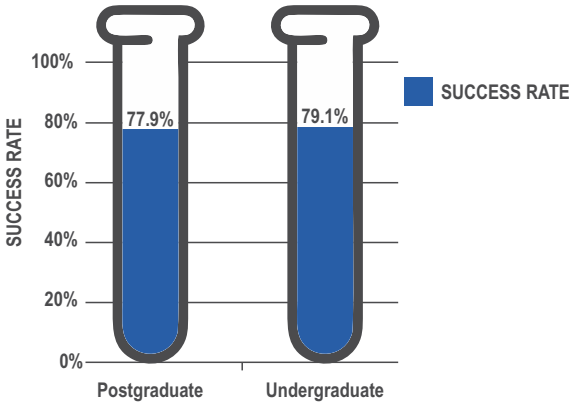
2018 STUDENT NUMBERS BY GENDER

QUALIFICATION	FEMALE	MALE	TOTALS
Undergraduate	2 481	2 687	5 168
Postgraduate	949	996	1 945
Occasional	132	99	231
TOTAL	**3 562**	**3 782**	**7 344**

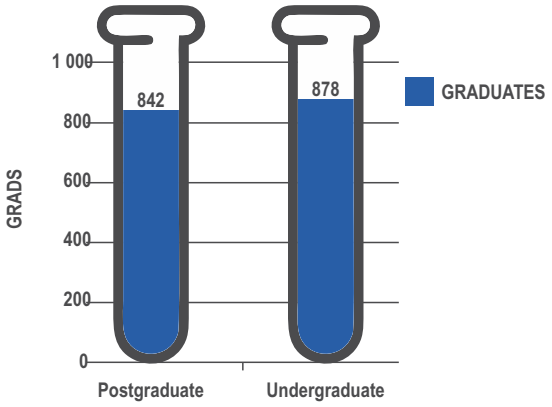
FACULTY REGISTRATIONS BY CAMPUS (2017 - 2018)

CAMPUS	2017	2018
Bloemfontein	5 785	6 031
Qwaqwa	671	808
South	517	505
TOTAL	**6 973**	**7 344**

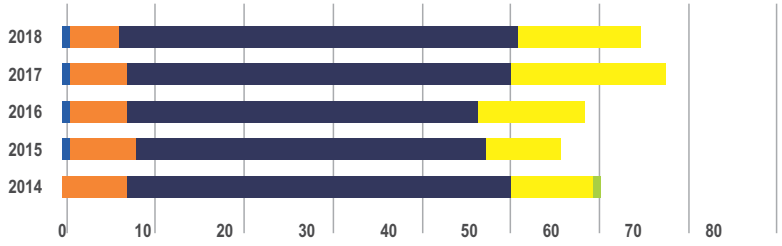
2018 SUCCESS LEVELS



2018 GRADUATES BY QUALIFICATION LEVEL



NRF RATED RESEARCHERS (2014 - 2018)



ACRONYMS

LIST OF ACRONYMS

A

AAS	Agricultural Advisory Services
ACPB	Annual Congress on Plant Science & Biosecurity
ADF	Amsterdam Density Functional
ADHD	Attention-deficit / hyperactivity disorder
AEE	Association of Energy Engineers
AERC	African Economic Research Consortium
AFASA	African Farmers' Association of South Africa
AFMA	Animal Feed Manufacturers Association
AfRota	Antigens and Reassortant strains for rotaviruses circulating in Africa
AgriFoSe	Agriculture for Food Security
AI	Artificial insemination
ALFA	African Livestock Fair
AMI	Advanced Metals Initiative
ANC	African National Congress
AP	Admission Point
APS	American Phytopathological Society
ARC	Agricultural Research Council
ARC-GC	ARC-Grain Crops
ARC-SG	Agricultural Research Council-Small Grain
ARC-VOP	ARC-Vegetable and Ornamental Plants
ARNTD	African Research Network for Neglected Tropical Diseases
ARS-USDA	Agricultural Research Service - United States Department of Agriculture
ARU	Afromontane Research Unit
ASAQS	Association of South African Quantity Surveying
ASCA	Agulhas System Climate Array
ASOCSA	Association of Schools of Construction of Southern Africa
ASSAf	Academy of Science of South Africa
AU	African Union
AU-NEPAD	African Union-New Partnership for Africa's Development
AVCASA	Association of Veterinary and Crop Associations of South Africa

B

BCI	Brain-Computer Interface
BCIS	Bachelor of Computer Information Systems
BfR	Bundesinstitut für Risikobewertung/Federal Institute for Risk Assessment
BGRI	Borlaug Global Rust Initiative
BLUP	Best Linear Unbiased Prediction
BotSoc	South African Botanical Society
BRICS	Brazil, Russia, India, China and South Africa

C

CBC	Centre for Biological Control
CCDC	Cambridge Crystallographic Data Centre
CCP4	Collaborative Computational Project Number 4
CCSHWC	Combined Crops, Soils, Horticulture and Weeds Congress
CDI	Centre for Development Innovation
CEM	Centre for Environmental Management
CHPC	Centre for High Performance Computing
CIB	Centre for Invasion Biology
CIDB	Construction Industry Development Board
CIMERA	Centre of Excellence for Integrated Mineral and Energy Resource Analysis
CIMMYT	International Centre for the Improvement of Wheat and Maize
CIT	Citrus Industry Trust
CLiPS	Computational Linguistics and Psycholinguistics Research Center
CLSM	Confocal laser scanning microscopy

CNS	Central nervous system
CPD	Continuing professional development
CPT	Chemical Process Technology
CPUT	Cape Peninsula University of Technology
CRF	Central Research Fund
CSD	Cambridge Structural Database
CSE	Computer Science Education
CSIL	Computer Science and Informatics Literacy
CSIR	Council for Scientific and Industrial Research
CSL	Community Service Learning
CUT	Central University of Technology

D

DAAD	Deutscher Adademischer Austauschdiens/German Academic Exchange Service
DBI	Dragonfly Biotic Index
DEA	Department of Environmental Affairs
DESTEA	Department of Economic, Small Business Development, Tourism and Environmental Affairs
DFG	Deutsche Forschungsgemeinschaft/German Research Foundation
DII	Development and Investment in Infrastructure
DiMTEC	Disaster Management Training and Education Centre for Africa
DNA	Deoxyribonucleic Acid
DSC	Differential Scanning Calorimetry
DSSC	Dye-sensitized solar cells
DST	Department of Science and Technology
DUT	Durban University of Technology

E

ECLA	Economic Computer Literacy Assessment
EDP	Edamame Development Programme
EEG	Electroencephalogram
ELSEDIMA	Environmental Legislation, Safety Engineering and Disaster Management
EPPM	Engineering, Project, and Production Management
ERASMUS	European Community Action Scheme for the Mobility of University Students
ESI	Evolution Studies Institute
ESM	Ecology of Soil Microorganism
ESRC	Economic and Social Research Council
EU	European Union
EvIDENz	Earth Observation based information products for drought risk reduction on the national level

F

FABI	Forestry and Agricultural Biotechnology Institute
FBIP	Foundational Biodiversity Information Programme
FD	Functional Diversity
FEMA	Federal Emergency Management Agency
FET	Further Education and Training
FHB	Fusarium head-blight
FSA	Free State Agriculture

G

GBI	Green Building Index
GCRF	Global Challenges Research Fund
GFAAS	Graphite Furnace Atomic Absorption Spectroscopy
GFRAS	Global Forum for Rural Advisory Services
GFZ	Deutsches GeoForschungsZentrum/German Research Centre for Geosciences
GIS	Geographic information systems
GLYAT	Glycine-N-acyltransferase
GMI	Groundwater Management Institute
GSSA	Grassland Society of Southern Africa

H

HACCP	Hazard Analysis and Critical Control Points
HCI	Human-computer interaction
HPC	High Performance Computing

I

IAMCR	International Association for Media and Communication Research
ICARD	International Conference for Acid Rock Drainage
ICDP	International Continental Scientific Drilling Program
ICE	International Congress of Endocrinology
ICEGG	International Conference on Environmental Geochemistry and Geochemical Mapping
ICP-MS	Inductively Coupled Plasma Mass Spectroscopy
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
ICPAM	International Conference on Physics of Advanced Materials
ICPP	International Conference on Porphyrins and Phthalocyanines
ICPP	International Congress of Plant Pathology
ICRA	International Center for Development Oriented Research In Agriculture
ICRPMC	International Cereal Rusts & Powdery Mildews Conference
ICSD	Inorganic Crystal Structure Database
ICT	Information and Communications Technology
IDC	Industrial Development Corporation
IFHE	International Federation for Home Economics
IFRC	International Federation of Red Cross and Red Crescent Societies
IGRAC	International Groundwater Resources Assessment Centre
IGS	Institute for Groundwater Studies
IITA	International Institute for Tropical Agriculture
IMSS	Instituto Mexicano del Seguro Social
IMWA	International Mine Water Association
INCEDI	International Conference on Education, Development and Innovation
INTI	National Institute of Industrial Technology
IoT	Internet of Things
IPC	Industrial Process Chemistry
IR	Infrared
IR4	Fourth Industrial Revolution
ISC	International Supercomputing Conference
ISFM	International Symposium on Functional Materials
ISI	International Scientific Indexing
IT	Information Technology
ITSA	Information Technology Students' Association
IUSS	International Union of Soil Sciences

K

KASMS	Kinetically Activated Subsurface Microbial Sampler
KAUST	King Abdullah University of Science and Technology

L

LM	Light microscopy

M

MCR	Mangaung Concerned Residents
MDM	Master of Disaster Management
MOF	Metal Organics Framework
MSA	Master of Sustainable Agriculture

N

NAU	Nanjing Agricultural University
NDV	Newcastle disease virus
NDVI	Normalised Difference Vegetation Index
NECSA	Nuclear Energy Corporation of South Africa
NEPAD	New Partnership for Africa's Development
nGAP	Next Generation of Academics Programme
NICD	National Institute for Communicable Diseases
NIHSS	National Institute for the Humanities and Social Sciences
NMR	Nuclear Magnetic Resonance
NMU	Nelson Mandela University
NRF	National Research Foundation
NRMP	National Resource Management Programme
NSFAS	National Student Financial Aid Scheme
NUPS	National University of Public Service
NWU	North-West University

O

OAU	Obafemi Awolowo University
OLED	Organic light emission device

P

PCT	Patent Cooperation Treaty
PGE	Platinum-group elements
PI	Primary investigator
PoPI	Protection of Personal Information

R

RAETP	Recent Advances in Experimental and Theoretical Physics
ReMec1	1st Microsymposium on Reaction Mechanisms
RICS	Royal Institute of Charted Surveyors
RISE	Research Internship in Science and Engineering
RMRD SA	Red Meat Research and Development South Africa
RPO	Red Meat Producers' Organisation
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture

S

SAAB	South African Association of Botanists
SAAO	South African Astronomical Observatory
SACAP	South African Council for the Architectural Profession
SACPCMP	South African Council for the Project and Construction Management Professions
SACPLAN	South African Council for Planners
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SADC-GMI	Southern African Development Community-Groundwater Management Institute
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
SAGS	South African Genetics Society
SAIA	South African Institute of Architects
SAICSIT	South African Institute of Computer Scientists and Information Technologists
SAIP	South African Institute of Physics
SALT	South African Large Telescope
SANAP	South African National Antarctic Programme
SANBI	South African National Biodiversity Institute
SANORD	Southern African Nordic Centre
SANParks	South African National Parks
SANSA	South African National Survey of Arachnida
SANSOR	South African National Seed Organization
SAPBA	South African Plant Breeders' Association
SAPER	South African Planning Education Research
SAPPA	South African Pecan Nut Producers Association
SAPS	South African Police Service
SARChI	South African Research Chairs Initiative
SASAE	South African Society for Agricultural Extension
SASBi	South African Society for Bioinformatics
SASCP	South African Society of Crop Science
SASM	South African Society for Microbiology
SASRI	South African Sugarcane Research Institute
SASRN	South African Sclerotinia Research Network
SASTA	South African Sugar Technologists' Association
SASUF	South Africa-Sweden University Forum
SAWMA	Southern African Wildlife Management Association
SAWSS	Southern African Weed Science Society
SBI	Small Business Institute
SBITC	Standard Bank Information Technology Competition
SEM	Scanning electron microscope
SLCi	Sub-Antarctic Landscape-Climate Interactions
SLP	Short learning programme
SLU	Swedish University of Agricultural Sciences
SME	Small to Medium Enterprise
SMEG	Soil and Microbial Ecology Group
SMEOS	Sensors, MEMS and Electro-Optical Systems

SRC	Student Representative Council
SSAG	Society of South African Geographers
SSAJRP	Swiss-South Africa Joint Research Programme
ST6	Sequence Type 6
START	Synchrotron Techniques for African Research and Technology
STFC	Science and Technology Facilities Council
SUERC	Scottish Universities Environmental Research Centre
SWAMP	Soil Water Management Programme
SWAT	Soil and Water Assessment Tool

T

TEM	Transmission electron microscope
TGA	Thermal Gravimetric Analysis
TIA	Technology Innovation Agency
TIBA	Tackling Infections to Benefit Africa
TUT	Tshwane University of Technology

U

UAP	University Access Programme
UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UK	United Kingdom
UKZN	University of KwaZulu-Natal
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDAC	United Nations Disaster Assessment and Coordination
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNILORIN	University of Ilorin
UNOOSA	United Nations Office for Outer Space Affairs
USA	United States of America
USDP	University Staff Doctorate Programme
UV/Vis	Ultraviolet-visible
UWC	University of the Western Cape

V

VKB	Vrystaat Koöperasie Beperk
VLIR-UOS	Vlaamse Interuniversitaire Raad – Universiteit Ontwikkelingssamenwerking
VR	Virtual reality

W

WCSU	Western Connecticut State University
WEEC	World Energy Engineering Congress
WRB	World Reference Base
WRC	Water Research Commission

X

XRF/XNES	X-ray Fluorescence/X-ray Near Edge Structure

Z

ZFL	Centre for Remote Sensing of Land Surfaces