PROGRAM VIR DIE EERSTE PLEGTIGHEID

DIE FAKULTEITE NATUURWETENSKAPPE, AGRIWETENSKAPPE, EKONOMIESE EN BESTUURSWETENSKAPPE, INGENIEURSWESE

'n Vriendelike beroep word op alle aanwesiges gedoen om selfone af te skakel en nie die saal tydens die plegtigheid te verlaat nie en sodoende te verseker dat die verrigtinge sonder ontwrigting verloop.

1. Akademiese prosessie kom die saal binne. U word versoek om te staan terwyl hulle die saal binnekom en te bly staan vir die sing van die Nasionale Lied.
2. Sing van die Nasionale Lied (kyk binneagterblad). Neem asseblief daarna u sitplekke in.
   Begeleiding: Universiteit Stellenbosch Koperblaasensemble.
   Orrelis: Brent Reynolds.
   Voorsanger: Lunathi Ncumani.
3. Konstituering deur die Viserektor (Leer en Onderrig).
4. Verwelkoming deur die Viserektor (Leer en Onderrig) en prof M Dlali.
5. Voorstelling van doktorandi deur die dekane van die betrokke fakulteite en toekenning van die grade deur die Viserektor (Leer en Onderrig).
6. Oorhandiging van die Kanselierstoekenning aan prof Helmut Prodinger deur die Viserektor (Leer en Onderrig).
7. Sluiting deur die Viserektor (Leer en Onderrig).
8. Akademiese prosessie verlaat die verhoog.

Die aanwesiges word versoek om te bly staan totdat die akademiese prosessie uitgestap het.

PROGRAMME FOR THE FIRST CEREMONY

THE FACULTIES OF SCIENCE, AGRISCIENCES, ECONOMIC AND MANAGEMENT SCIENCES, ENGINEERING

To help ensure that the proceedings run their course without disruption, will all those present kindly keep their cell phones switched off, and refrain from leaving the hall, while the ceremony is in progress.

1. Entrance of academic procession into the hall. You are requested to stand while it enters, and then to remain standing for the singing of the National Anthem.
2. Singing of the National Anthem (see inside back cover). Thereafter, please be seated.
   Accompaniment: University of Stellenbosch Brass Ensemble.
   Organist: Brent Reynolds.
   Precentor: Lunathi Ncumani.
3. Congregation formally constituted by the Vice-Rector (Learning and Teaching).
4. Welcome by the Vice-Rector (Learning and Teaching) and Prof M Dhali.
5. Presentation of doctoral candidates by the deans of the respective faculties and conferment of degrees by the Vice-Rector (Learning and Teaching).
6. Presentation of Chancellor's Award to Prof Helmut Prodinger by the Vice-Rector (Learning and Teaching).
7. Closing by the Vice-Rector (Learning and Teaching).
8. The academic procession leaves the stage.

Those present are requested to remain standing until the entire academic procession has left the hall.

isiXhosa →

ISICWANGCISO-NKQUBO SOMSITHO WOKUQALA

IIFAKHALTHI EYOBUNZULULWAZI KWEZOBUGQI, EYEZEEAGRISAYENSI, EYOBUNZULULWAZI KWEZOQOQOSHO NOLAWULO NEYOBUNJINELI

Ukuqinisekisa ukuba umsitho uqala ngaphandle kwesiphazamiso, bonke abakhoyo bayacelwa ukuba bacime iiselfowuni zabo, kwaye bangaphumi eholweni ngeli xesha umsitho uqhubekayo.

1. Kungena umkhosi wemithika eholweni. Niyacelwa ukuba nime ngeenyawo xa ungena, nihlale nime njalo ukuze kuculwe uMhobe weSizwe.
2. Kuculwa uMhobe weSizwe (Jonga kumphakathi weqweqwe lokugqibela). Emva koko, ningahlala phantsi.
   Umculo: yi-University of Stellenbosch Brass Ensemble.
   Umdlali wohadi: nguBrent Reynolds.
   Umhlabeli: nguLunathi Ncumani.
3. UMsitho uvulwa ngokusesikweni nguSekela-Nqununu (wezeMfundo nokuFundisa).
4. Ulwamkelo lwenziwa nguSekela-Nqununu (wezeMfundo nokuFundisa) noNjing M Dlali.
5. Ukwaziswa kwabafundi bezidanga zobugqirha ziintloko zeefakhalthi (iiDin) ezichaphazelekayo nokuthweswa kwezidanga nguSekela-Nqununu (wezeMfundo nokuFundisa).
6. Ukunikezwa kweBhaso likaTshansila kuNjing Helmut Prodinger nguSekela-Nqununu (wezeMfundo nokuFundisa).
7. Ukuvalwa koMsitho nguSekela-Nqununu (wezeMfundo nokuFundisa).
8. Umkhosi wemithika uyalishiya iqonga.

Bonke abakhoyo bayacelwa ukuba beme ngeenyawo de umkhosi wemithika ube uphume wonke eholweni.

KANDIDATE WAT KWALIFIKASIES ONTVANG

Hier volg 'n lys van graduandi met hul studierigtings, proefskriftitels en opsommings van die navorsing. Die grade van graduandi wat nie by die gradeplegtigheid teenwoordig kan wees nie, word in hulle afwesigheid toegeken.

CANDIDATES RECEIVING QUALIFICATIONS

Here is a list of graduands with their fields of study, dissertation titles and summaries of research. The degrees of graduands who are unable to attend the graduation ceremony are awarded in absentia.

ABAFUNDI ABAFUMANA IZINGQINI ZEZEMFUNDO

Apha kulandela uluhlu lwabathweswayo kwiinkalo zesifundo, izihloko zeedizetheyishini kunye nezishwankathelo zophando. Izidanga zabathweswayo abangakwazanga ukubakho ubuqu kumsitho wothweso-zidanga bathweswa bengekho benjalo.

Fakulteit Natuurwetenskappe

Faculty of Science

IFakhalthi yezobuNzululwazi kwezobuGqi

PhD

ABDALLA, Abdurahman Masoud (Mathematics)

Binary closure operators

The study introduces and studies so-called binary closure operators on ordered sets, and applies them in the theory of categorical closure operators, which is one of the main branches of modern categorical topology. The notion of a binary closure operator is a simultaneous self-dual generalisation of the notion of a closure operator and the notion of an interior operator on an ordered set. The study opens up a new research direction which lies at the overlap of order theory, topology and category theory.
Supervisor: Prof Z Janelidze

BABALOLA, Olusegun Oluwaseun (Zoology)

Ecotoxicological and potential endocrine disrupting effects of selected herbicides on life stages and development of the aquatic African clawed frog, Xenopus laevis

Manmade chemicals in the environment have been linked to a global decline in amphibians and endocrine disrupting effects in wildlife and humans. Although herbicides are designed to eradicate unwanted plants, these chemicals may have developmental and health effects in non-target animals. In South Africa, high volume use of herbicides in agriculture and alien plant eradication programmes is a real concern. Six herbicide formulations were tested, using different life stages of the African clawed frog, *Xenopus laevis*. The selected formulations showed differential health effects, including teratogenicity, thyroid and growth disruption, gonadotoxicity and skewed sex ratios following metamorphosis. Evaluating herbicides for weed control should include endocrine modulation studies before considered safe for wildlife and humans.
Supervisor: Prof JH van Wyk

BAKER, Andrea (Geology)

Bulk geochemical, biomarker and leaf wax isotope records of Mfabeni peatland, KwaZulu-Natal, South Africa since the late Pleistocene

A high-resolution geochemical proxy palaeoenvironmental reconstruction was undertaken on an 8 m Mfabeni peat core. The hydrologic reconstruction showed that substantial fluctuations occurred during both the glacial and interglacial periods and that plant assemblages responded to water levels as opposed to temperature variations. Terrestrial land plants were the major organic matter (OM) input, with the exception of elevated water levels when submerged macrophytes were dominant. A positive trend between temperature and precipitation, and definitive interchanges between C3 and C4 plants since peatland inception was observed. The dominant regional climate driver was the oscillations in Indian Ocean sea surface temperatures since the late Pleistocene.
Supervisor: Prof AN Roychoudhury
Co-supervisor: Dr J Routh

BARKHUYSEN, Shani (Chemistry)

High-resolution ^{119}Sn and ^{103}Rh NMR characterisation of stannous halide complexes of Rh(I/II) in aqueous and non-aqueous solutions

Since the discovery of Rhodium as a precious element by WH Wollaston in 1803, the origin of the signature intense deep-red colour that results when tin chloride is added to a solution of Rhodium in acidic solutions has remained obscure. Using modern ^{119}Sn and ^{103}Rh NMR spectroscopy, it was revealed that the characteristic colour is due to a complicated mixture of numerous Rhodium-tin-chloride complexes. Moreover the detailed chemical structure of more than ten of these complexes in solution was determined, which has not been possible before by any other spectroscopic technique to our knowledge.
Supervisor: Prof KR Koch

BEKELE, Bewketu Teshale (Mathematics)

Modelling the impact of early HIV treatment on the HIV and TB epidemic in South Africa

This study deals with HIV antiretroviral treatment (ART) in South Africa. The study starts by proposing a novel mathematical model,

which was analysed and fitted to HIV historical data in South Africa. The model was then used to project the impacts and costs of various levels of ART scale-up. To assess some of the challenges that ART scale-up faces, the proposed model was further extended to account for access to treatment, dropout from treatment and treatment failure. The model was used to assess the impact of these three factors on the effectiveness and cost-effectiveness of ART scale-up in South Africa.
Supervisor: Dr R Ouifki
Co-supervisors: Prof W Delva and Prof F Nyabadza

BENJAMIN, Ronalda Abigail Marsha (Wiskunde)

Fredholm theory in ordered Banach algebras

Fredholmteorie (relatief tot willekeurige homomorfismes) in abstrakte Banach-algebras, en in die besonder die Fredholm-, Weyl- en Browder-spektra, word reeds vir meer as dertig jaar bestudeer, en vorm 'n integrale deel van die spektraalteorie. Aan die ander kant word verskeie spektraalteoretiese aspekte van Banach-algebras met 'n parsiële ordening sedert die 1990s ondersoek. Hierdie twee teorieë word verenig deur die rol van positiwiteit in Fredholmteorie deeglik te verken. Die bo-Weyl- en bo-Browderspektra speel 'n sentrale rol in hierdie ondersoek. Die nuttigste teorie, wat ook by die klassieke Fredholmteorie aansluit, word verkry in die geval waar die betrokke homomorfisme die Riesz-eienskap het.
Promotor: Prof S Mouton

BOTHA, Roelf Cornelis (Physics)

Development of diode end-pumped Nd: YLF lasers at 1314 nm for high power operation

Several diode end-pumped 1,3 μm Nd: YLF lasers have been developed for lunar ranging applications with the final objective to measure sub-cm orbital positions of the moon. A novel laser diode end-pumping scheme, utilising YLF crystals with low average Nd doping and natural axial doping gradient, and pumping from the lower-doping crystal side has resulted in maximum cw laser output of 26,5 W and actively Q-switched pulse output of 5,6 mJ with pulse duration of 36 ns and average power of 18,6 W. These are the highest reported values for any actively Q-switched end-pumped Nd: YLF laser at 1314 nm.
Supervisor: Prof HM von Bergmann
Co-supervisors: Dr HJ Strauss and Prof WL Combrinck

BURGER, Liesl (Physics)

Novel implementation of the phase-only spatial light modulator in laser beam shaping

Novel laser beams were created using digital holograms written to a spatial light modulator – a miniature LCD display. A laser was demonstrated with such a device as the back mirror, creating a holographic mirror for laser beams on demand. Following this, laser beams were realised experimentally with the ability to self-heal after an obstruction. Firstly, a new means for the self-healing was discovered based on the angular momentum of light. Secondly, a new class of laser beam was produced that self-heals over distances extending to infinity. The outcome has advanced our understanding of laser beams and resonators.
Supervisor: Prof A Forbes
Co-supervisors: Prof EG Rohwer and Dr I Litvin

COETZEE, Anina (Botany)

Nectar distribution and nectarivorous bird foraging behaviour at different spatial scales

The broad research question was: How do nectar-feeding birds and nectar-producing plants influence each other's distribution and abundance? To answer this, research focussed on the iconic sugarbirds and sunbirds that visit proteas and ericas. Field experiments were conducted, pre-existing geographical distribution databases were analysed, and data gathered on the use of urban gardens by birds. It was found that birds influence the structure of plant communities by acting as a selective agent, and by mediating competition and facilitation among plants. Birds, in turn, are restricted to areas of high nectar availability such as protea stands or suburban gardens with artificial nectar feeders.
Supervisor: Prof A Pauw
Co-supervisor: Dr P Barnard

COLLING, Janine (Plant Biotechnology)

Functional characterisation of a putative signalling peptide TAXIMIN in the model plant Arabidopsis thaliana *and a medicinal plant* Sutherlandia frutescens *L.R. Br.*

Signalling peptides fine-tune plant growth and development, allowing interaction between plants and the environment. TAXIMIN, a novel family of signalling peptides with a putative role in regulation of plant secondary metabolism, was discovered in *Taxu baccata*. Functional characterisation of TAX1, a homolog in *Arabidopsis thaliana*, displayed a role in organ boundary formation. TAX1 over-expression reduced sinapoyl-malate abundance, but increased light-sensitivity. TAXIMIN homologs had little effect on sutherlandin and sutherlandioside production in *Sutherlandia frutescens,* suggesting different functional roles in different species. This study provided new insights into molecular function of signalling peptides in plants.
Supervisor: Prof NP Makunga
Co-supervisor: Prof A Goossens

GEBRU, Alem Kindeya (Physics)

Development of a kHz optical remote sensing system for in situ *insect monitoring*

A remote detection and ranging instrument was developed, using either sunlight or laser light, to monitor and identify flying insects over a range of up to several kilometres. Information such as size, species, sex, flight direction, prey-predator interactions, distribution and general insect activity can be obtained *in situ* and remotely. This information is essential for studying flying insect behaviour and distribution, and has been applied in real life environments measuring disease vectors and the spatial and temporal distribution of pollinators across agricultural fields. The information could lead to more efficient pesticide application and the conservation of ecologically important insects such as honeybees.
Supervisor: Prof EG Rohwer
Co-supervisors: Dr PH Neethling and Dr M Brydegaardt

GOOSEN, René (Biochemistry)

A comparative analysis of CoA biosynthesis in selected organisms: a metabolite study

The regulation of coenzyme A (CoA, an essential metabolic cofactor) production presents an important target for antimicrobial drug discovery. Previously, the first enzyme of the CoA biosynthetic pathway was thought to regulate the pathway and consequently to be the best drug target; this notion has been challenged by negative results in inhibitor development studies. New analytical procedures were developed to investigate the CoA pathway and used to construct a kinetic model for a systems analysis of regulation. Significantly, the results indicated that the last pathway enzyme in fact has the most control during biosynthesis, and should therefore be the focus of future inhibitor development studies.
Supervisor: Prof E Strauss
Co-supervisor: Prof JL Snoep

GREYLING, Guillaume Hermanus (Polymer Science)

Field-flow fractionation of amphiphillic block copolymers

The high demand for new materials with improved performance and tailored properties is one of the major driving forces behind the development of new and complex synthetic polymers. However, current analytical techniques are not well suited to analyse these new materials and to address this need. Thermal field-flow fractionation (ThFFF) has gained significant attention as an analytical tool to analyse complex materials. This study demonstrates that ThFFF exhibits greater sensitivity towards polymer chemical composition and microstructure than current techniques and that it is the only technique that can determine several important properties of polymer nanostructures from a single analysis.
Supervisor: Prof H Pasch

GROENEWALD, Ferdinand George (Chemistry)

Gold acting as Lewis base in the formation of hydrogen and halogen bonds

Hydrogen bonds are the most important and observed type of interaction between molecules. For the first time it was shown that gold(I) can act as a hydrogen bond acceptor, and thus as a Lewis base, counter to its normal behaviour as a Lewis acid. The hydrogen-bonding interaction between a variety of gold species and hydrogen bond donors was characterised with various theoretical tools, obtaining valuable insight into its nature and properties. Considering the many parallels between halogen and hydrogen bonding, it was also demonstrated that gold(I) can behave as a halogen bond acceptor, forming stronger interaction than with hydrogen bonds.
Supervisor: Prof C Esterhuysen
Co-supervisor: Prof JLM Dillen

HALL, Duncan James (Geology)

The processes of melt segregation, magma ascent and pluton emplacement in the continental crust of the Damara Belt, Namibia

Granite magmatism represents the most important process of heat and mass transport in the Earth's crust, but the physical characteristics of this process are only poorly understood. Based on natural examples from the Damara Belt in central Namibia, the project describes the fracture-controlled segregation and accumulation of melts through self-organised, interconnected fracture networks. The far-field, buoyancy-driven magma ascent through the crust is accomplished by the episodic separation and ascent of magma pockets as hydrofractures. The eventual arrest and emplacement of the magmas as large granite plutons is determined by crustal heterogeneities or switches of stress states in the upper crust.
Supervisor: Prof AFM Kisters

HEYNS, Andries Michiel (Operational Research)

A multi-objective approach towards geospatial facility location

Geospatial facility location science places a strong emphasis on geographical and spatial factors influencing site suitability for networks of facilities with complex location requirements, such as radars, telecommunication towers, watchtowers and wind turbines. Traditional placement procedures are designed to accommodate one type of facility only according to one placement objective, and are typically highly problem-specific. A generic geospatial facility location framework for identifying facility location trade-off alternatives was designed and was implemented as a computerised decision support system. The system also contains a novel, highly effective, multi-objective facility placement optimisation algorithm inspired by the aggressive manner in which viruses spread in mammals.
Supervisor: Prof JH van Vuuren

ISUNJU, John Bosco (Geography and Environmental Studies)

Spatiotemporal analysis of encroachment on wetlands: hazards, vulnerability and adaptations in Kampala City, Uganda

This study assessed the spatiotemporal extents of human encroachment on wetlands, and the hazards, vulnerability and adaptations among wetland communities in Kampala, Uganda, to inform risk reduction endeavours. The study applied a mix of methods including GIS and remote sensing techniques for analysis of very high resolution data, a survey of 551 households, four focus group discussions and five key informant interviews. Findings show a 62% loss of wetland vegetation between 2002 and 2014 in the Nakivubo wetland, bordering Lake Victoria. The principal hazard was flood waters which mostly affected tenant households and those who could not afford to adapt.
Supervisor: Dr JN Kemp
Co-supervisor: Dr C Orach

KOEGELENBERG, Corné (Geology)

Geology, structural evolution and controls of hydrothermal gold mineralisation in the eastern Karagwe-Ankole fold belt, northwestern Tanzania

The geology and tectonic setting of the Karagwe-Ankole fold-and-thrust belt in northwestern Tanzania has, to date, only been captured by regional reconnaissance studies. The structural evolution of the eastern termination of the belt overlying Archaean rocks of the Tanzania Craton was documented. Geochronological results constrain

the timing of regional tectonism and allow for a correlation with similarly old belts to the south. Hydrothermal fluid flow and associated gold mineralisation are structurally controlled by the regional-scale detachment between thrusted supracrustal sequences and underlying basement gneisses and localised to specific structural sites of long-lived fluid flow.
Supervisor: Prof AFM Kisters

KOEN, Wayne Sean (Physics)

Middle-infrared laser sources

A range of novel near diffraction-limited 2 µm lasers and amplifiers based on Tm: YLF and Ho: YLF were demonstrated. These systems varied from compact and efficient master oscillator power amplifiers delivering high average powers, to high-energy, single-frequency oscillators and amplifiers. This was made possible by exploiting various advantageous properties of holmium- and thulium-doped YLF crystals while mitigating its detrimental properties through the use of novel pump and laser design approaches. An optically pumped molecular HBr laser and amplifier system was demonstrated for the first time. The candidate also developed and demonstrated the first wavelength tuneable optically pumped molecular HBr laser.
Supervisor: Prof MJD Esser
Co-supervisors: Prof EG Rohwer, Dr HJ Strauss and Dr LR Botha

MAGADLELA, Anathi (Botany)

Variation of phosphorus (P) supply alter nitrogen (N) metabolism in the nodules and roots of Virgilia divaricata*, a Cape fynbos indigenous legume from the Cape Floristic Region (CFR)*

Phosphorus (P) deficiency affects the ability of legumes to acquire and metabolise available nitrogen (N). This research investigated the N metabolism of the legume *Virgilia divaricata*, in P-poor soils of the Cape fynbos. It was found that during P stress, this legume relies largely on symbiotic N_2-fixation and can alter the composition of organic N exported in xylem sap. In addition the P-stressed plants can also recycle their amino acids via glutamate dehydrogenase, to fuel the mitochondrial respiration with organic acids. This suggests that this legume species has evolved functional flexibility in N metabolism to overcome soil P stress.
Supervisor: Prof AJ Valentine
Co-supervisor: Prof E Steenkamp

MERT, Marlin John (Microbiology)

Saccharomyces cerevisiae *engineered for xylan utilisation*

Bioethanal from plant biomass (lignocellulose) is an attractive alternative to fossil fuels and does not compete with human food supplies. Xylan, made up of xylose units, represents a large component of lignocellulose. A Baker's yeast strain was constructed that expresses enzymes required for xylan utilisation. To better understand the utilisation of xylan, the underlying principles of recombinant xylose metabolism was investigated using a metabolomics approach. The central carbon metabolism revealed that transaldolase activity in the pentose phosphate pathway is rate-limiting. In addition, the flux through glucose 1-phosphate and pyruvate in glycolysis limit the rate of xylose metabolism.
Supervisor: Prof WH van Zyl
Co-supervisors: Dr SH Rose and Dr DC la Grange

MINOARIVELO, Henintsoa Onivola (Mathematics)

The eco-evolutionary dynamics of mutualistic networks: from pattern of emergence to stability

Mutualistic networks such as pollination networks are assembled in well-organised patterns. The study aims at understanding ecological and evolutionary mechanisms that contribute to the emergence of these patterns and the overall ecological and evolutionary stability of mutualistic communities. The candidate developed a mathematical and simulation model of the ecological dynamics of population densities and the evolutionary dynamics of functional traits of a mutualistic community. It was found that specific structures of mutualistic networks emerge when interactions are trait-dependent. Moreover, mutualism plays a determinant role in sustaining evolutionary stability and the productivity of the community. In the face of biological invasion, the stability of a mutualistic community primarily depends on invader characteristics relative to those of native species.
Supervisor: Prof C Hui

NDAYISHIMYE, Joram (Physics)

Multiple chiral bands in ^{193}Tl

Since the introduction of multi-chiral bands in nuclear physics, the investigation of chirality in the A ~ 190 mass region has attracted a significant amount of interest in nuclear structure physics. Data on ^{192}Tl, and ^{193}Tl have, until recently, been insufficient to make any clear conclusions on the existence of multi-chiral bands in the ^{192}Tl and ^{193}Tl isotopes. A new experimental study was performed at iThemba LABS, investigating the possible existence of multi-chiral bands in ^{192}Tl and ^{193}Tl, using the Afrodite gamma array. The results show agreement with the most popular theoretical studies on these two isotopes.
Supervisor: Prof SM Wyngaardt
Co-supervisor: Dr EA Lawrie

PHIRI, Justice Mohau (Polymer Science)

Multidimensional analytical approach for the characterisation of complex ethylene propylene copolymers

Impact polypropylene copolymers are complex multiphase materials having ethylene-propylene rubber (EPR) particles incorporated in a semi-crystalline isotactic polypropylene matrix. The EPR particles form the most critical part of the material being continuously dispersed in the matrix to prevent crack propagation under mechanical stress. Molecular properties of the EPR phase were investigated. A multi-dimensional analytical approach has been developed to investigate EPR in terms of molar mass and chemical composition distributions. A combination of selective fractionation techniques was used to obtain components with different chemical compositions that were subsequently analysed by advanced spectroscopic techniques.
Supervisor: Prof H Pasch

POSTMA, Ferdinand (Microbiology)

Rhizofiltration of urban effluent: microbial ecology and conceptual treatment mechanisms.

South African rivers are increasingly being polluted by urban runoff, one of the most common sources of diffuse pollution. Rhizofiltration is a novel type of phytoremediation mimicking riparian ecology. The rhizofilter was designed to rapidly filter large volumes of polluted urban runoff before it enters river systems. Analyses of chemical, physical and microbiological parameters, in combination with metagenomic analyses, revealed that the rhizofilter design and the composition of waste water selects for copiotrophic aerobic microorganisms capable of mineralising potentially recalcitrant organic carbon sources, while driving oxidative processes such as nitrification. Simultaneously, intestinal microbial commensialists and pathogens are removed by the system.
Supervisor: Prof A Botha
Co-supervisor: Dr M Mouton

RIGBY, Charles Ian (Physics)

Development and characterisation of an Nd: YAG pumped wavelength tunable VUV light source

Laser light in the vacuum ultraviolet spectral range was generated by focussing two visible laser beams into magnesium vapour. This source provided a vacuum ultraviolet intensity 440 times higher than previously available. Evidence was found for several nonlinear optical processes playing a role in the conversion process at high input power. The source was applied to measure rovibronic excitation spectra of carbon monoxide molecules, with individual rotational lines resolved. It facilitated the detection of forbidden spectral lines and calculation of molecular constants that are important to space science, as carbon monoxide is the second most abundant molecule in space.
Supervisor: Dr CM Steenkamp
Co-supervisor: Prof EG Rohwer

SHACKLETON, Ross Taylor (Botany)

A multi-scaled, transdisciplinary study on the impacts and management of Prosopis*, one of the world's worst woody invasive plant taxa*

A social-ecological approach was used to study a conflict-of-interest tree genus *Prosopis,* which is recognised as a major invader globally and in South Africa. Substantial insights into the negative impacts of this invader on biodiversity and local livelihoods, and evidence to support the integrated management of this tree was provided. A national strategy to guide the management of *Prosopis* in South Africa was also developed, which highlighted the urgent need for improved collaboration between stakeholders, the introduction of more biological control agents, and improved multi-level planning and prioritisation to improve use and efficiency of limited funding.
Supervisor: Prof DM Richardson
Co-supervisor: Dr DC le Maitre

VAN NIEKERK, Daniel Malan Emmanuel (Chemistry)

Experimental and computational approaches to investigate high oxidation state redox chemistry of osmium

Three simultaneous reactions that occur on different timescales during the reduction of OsVIII with methanol were investigated. The study combined detailed experimental and quantum mechanical computational work with regard to oxo/hydroxide, high oxidation state osmium (Os) chemistry. The kinetics and thermodynamics of the three reactions were shown to fit a well-defined set of chemical reactions. The comproportionation reaction of OsVIII and OsVI was found to occur via concerted electron-proton transfer whereas the rate-determining step of the reduction of OsVIII with methanol was found to occur via α-C-H (not O-H) hydrogen atom transfer.
Supervisor: Dr W Gerber
Co-supervisor: Prof KR Koch

VILJOEN, Monet (Physiological Sciences)

Correlations between stress-associated anxiety and physiological determinants of health in adolescents

Anxiety disorders are among the most prevalent of psychiatric disorders, with onset typically in childhood or early adolescence. Furthermore, risk for development of anxiety disorders increases with exposure to trauma/childhood maltreatment. Little is known about biomarkers of resilience/vulnerability in relation to subclinical anxiety, especially in trauma-exposed adolescents. Central and peripheral neuroendocrine and immunological profiles were elucidated in adolescents, in association with anxiety proneness and childhood trauma. Results indicated a relatively larger causative association of neurophysiological maladaptations, with anxiety proneness, compared to childhood trauma. Potential clinical outcome modulators, and thus therapeutic targets, were identified and included resilience and self-esteem.
Supervisor: Prof C Smith
Co-supervisor: Prof S Seedat

VOSLOO, Johan Arnold (Biochemistry)

Optimised bacterial production and characterisation of natural antimicrobial peptides with potential application in agriculture

A group of antimicrobial (antibiotic) peptides, the tyrocidines from soil bacteria, was identified as potential nature-friendly biocides. The optimised production of tyrocidines in bacterial cultures delivered appreciable amounts of these high value peptides. A novel mathematical model of the production was generated and applied to produce tailored peptide subsets. Tailored production eased purification of six peptides, which were then biophysically characterised in different solvent systems that were utilised in formulations. These peptides alone and in combination have potent antifungal and antibacterial activities, while they were not toxic towards beneficial insects such as bees. There is also a limited potential for resistance towards the tyrocidines due to their rapid membranolytic activity and alternate cellular targets.
Supervisor: Prof M Rautenbach
Co-supervisor: Prof J Snoep

DSc

PRODINGER, Helmut (Mathematics)

Contributions to the analysis of approximate counting

Approximate counting is a classical technique in computer science to handle large quantities of data with limited capacities. Over the course of several decades, Helmut Prodinger has contributed significantly to the analysis of this method. His work was instrumental in developing the mathematical toolkit required for the challenging asymptotic analysis of approximate counting and its performance parameters, and many ideas can also be applied to related topics such as digital search trees. A variety of different mathematical tools play a role in this context, and surprising connection to seemingly unrelated topics as q-analysis and partition theory can be found.
Supervisor: Prof S Wagner

Fakulteit Agriwetenskappe
Faculty of Agrisciences
IFakhalthi yezeeAgrisayensi

PhD

AYOOLA, Mathew Oluwaseyi (Animal Science)

*Application of dietary bentonite clay as feed additive on feed quality, water quality and production performance of African catfish (*Clarias gariepinus*)*

Poor feed quality, feed utilisation and water quality are hindering the growth of aquaculture. Effects of natural bentonite and its acid-activated form as additives in aquafeeds for African catfish (*Clarias gariepinus*) were investigated. Dietary clay improved aquafeeds' physical qualities, increased the rate of feed evacuation in the gut, enhanced production performance and maintained good water quality. An optimum level of performance was recorded at 1 500 mg/kg inclusion of natural bentonite and up to 50% combination blends (acid-activated: natural) at low inclusion levels of 500 mg/kg. The research provided important information on the application of clay mineral products at recommended inclusion levels as feed additives in aquaculture.
Supervisor: Dr K Salie
External Co-supervisor: Mr L de Wet

BALA, Shuaibu Mallam (Food Science)

Effect of forced convection roasting on physicochemical and antioxidant properties of whole grain maize (Zea mays L.) and optimisation of roasting conditions

Roasting of whole maize grain can be used as a value-adding pre-processing method during food manufacturing. Forced convection continuous tumble roasting was investigated and showed to improve pasting properties of hard and soft maize varieties. Roasting also did not negatively affect the nutritional quality and antioxidant properties of whole grain flour. Roasting conditions (roasting temperature, rotating speed) were optimised using response surface methodology, central composite design and desirability profiling. The candidate illustrated different optimisation conditions for different varieties. Higher optimum temperatures and rotating speeds were required for the harder compared to the soft white maize varieties.
Supervisor: Prof M Manley
Co-supervisor: Prof UL Opara

BEELDERS, Theresa (Food Science)

Xanthones and benzophenones from Cyclopia genistoides *(honeybush): chemical characterisation and assessment of thermal stability*

High-temperature processing of honeybush, important for development of the characteristic sensory properties of this herbal tea, leads to losses in bioactive phenolic compounds responsible for its health properties. The phenolic composition of unprocessed and processed *Cyclopia genistoides* was extensively characterised, including isolation and structure elucidation of a novel benzophenone diglucoside. Thermal degradation of the major xanthones and benzophenones was modelled in the plant material and aqueous solutions for the first time. These models provide insight into the effects of temperature, pH and structure on degradation kinetics. The models could be used to predict and subsequently minimise losses during thermal processing.
Supervisor: Prof E Joubert
Co-supervisors: Dr D de Beer (External) and Dr GO Sigge

BITALO, Daphne Nyachaki (Genetics)

Regional population dynamics of three elasmobranch species occurring in southern African waters: Galeorhinus galeus, Carcharhinus brachyurus *and* Rhinobatos annulatus

Elasmobranchs (sharks, skates and rays) are highly exploited worldwide and more vulnerable than most teleost fishes due to their life history traits. The tope shark *Galeorhinus galeus*, the copper shark *Carcharhinus brachyurus* and the endemic lesser sandshark *Rhinobatos annulatus* are targeted locally in commercial and recreational fisheries and considered either as "vulnerable" or "data deficient" within southern Africa. This study provided the first information on genetic diversity, population connectivity and evolutionary history of these species on a regional scale. Most significantly, the study confirmed the diverse gene flow patterns found across species, highlighting the urgent need for an integrated ecosystems approach to fisheries monitoring and biodiversity conservation.
Supervisor: Dr AE van der Merwe
Co-supervisor: Prof R Roodt-Wilding

CHIDI, Boredi Silas (Wine Biotechnology)

Organic acid metabolism in Saccaromyces cerevisiae*: genetic and metabolic regulation*

Acidity is a primary driver of wine sensory perception, and is a function of the concentration of organic acids. While total acidity is monitored in wine, little attention is given to individual acids, although each presents a different sensory profile. In this study, the production of fermentation-derived organic acids was investigated as a function of yeast strain and of environmental parameters including temperature and pH. Transcriptomic data were used to identify genes that are relevant for acid production. The data provide novel insights into the

metabolic and genetic regulation of acid metabolism and will be useful for winemakers.
Supervisor: Prof FF Bauer
Co-supervisor: Dr D Rossouw

CHUKWUMALUME, Rufina Chinelo (Food Science)

Assessment of persistent organic contaminants in selected marine fish species along the South African coastline

Seafood is an excellent source of essential and non-essential nutrients and has numerous health benefits when consumed regularly. However, consumption can also pose health risks as marine organisms can contain and accumulate harmful persistent organic contaminants. This dissertation outlined crucial baseline information (presence, concentration, source and safety) in this understudied topic, examining nine consumed marine species over seven locations within South Africa. DDT levels were considered low and of no immediate risk to consumers. The PAHs identified were from a common input source, petroleum, indicating marine pollution, where benzo(*a*)pyrene, a highly carcinogenic PAH was detected above safety limits in predatory species examined.
Supervisor: Prof LC Hoffman
Co-supervisors: Prof UL Opara, Dr M Stander and
Dr B O'Neil (External)

ENGELBRECHT, Adriaan (Conservation Ecology)

Phylogeography of the rodent mites Laelaps giganteus *and* Laelaps muricola *using mitichondrial and nuclear DNA markers: an evolutionary approach to host-parasite interactions*

Laelaps giganteus and *Laelaps muricola* (Mesostigmata: Laelapidae) are widespread and locally abundant mites on small mammals in southern Africa. A comparative phylogeographic approach was followed to study the evolution and taxonomy of the parasites and their host species. Strong support for evolutionarily distinct lineages within *L. giganteus* was found, and restricted dispersal ability has resulted in significant co-divergence with its rodent host. Novel insights into the host ranges of *L. giganteus* and *L. muricola* are also described and this study further provides the first evidence of putative cryptic lineages with both mite species.
Supervisor: Dr S Matthee
Co-supervisor: Prof CA Matthee

GAO, Yu (Wine Biotechnology)

Parameters involved in the enzymatic deconstruction of the wine grape cell wall during winemaking

In this study it was evaluated how wine enzymes worked on deconstructing the complex nature of grape berry cell walls during winemaking. New cell wall profiling tools were tested and used in-depth for the first time. The study revealed that two pectin-rich layers are found in grape berries. Commercial enzymes were shown to decrease intra-vineyard variation in harvested grapes for winemaking. Recombinant enzymes were used to develop a model of the grape berry cell wall. This new grape berry cell wall model will help in designing tailor-made enzymes for use in different winemaking scenarios.
Supervisor: Dr JP Moore
Co-supervisor: Prof MA Vivier

MARAIS, Jeannine (Food Science)

Factors influencing the flavour of the meat derived from South African game species

Game meat is derived from female and male animals from a variety of species, located throughout southern Africa. This study investigated the influence of farm location, species and gender on the flavour of the meat derived from various economically important South African game species. This was the first research quantifying the chemical flavour profile (volatile compounds) of South African game meat through SPME-GC-MS. The latter was correlated to the descriptive sensory analysis profile of game meat. The data indicates that game meat should be marketed according to the species from which it is derived, while the influence of farm location and gender was species-specific.
Supervisor: Prof LC Hoffman
Co-supervisor: Ms M Muller

MPHAHLELE, Rebogile Ramaesele (Horticultural Science)

Impacts of postharvest handling and processing on bioactive compounds and functional properties of pomegranate fruit fractions and by-products

Commercial production of pomegranates has grown rapidly in South Africa and other parts of the world due to increasing scientific evidence linking fruit consumption to better health outcomes. However, incidence of postharvest fruit losses remains high. This study investigated the effects of preharvest factors, postharvest handling and processing techniques on quality, nutritional value and medicinal properties of pomegranate fruit and its by-products. Results showed variation in fruit quality at different maturities and growing location. Fruit waste and by-products such as peel and seed contained substantial amounts of valuable bioactive compounds which are valuable ingredients in the health and pharmaceutical industries.
Supervisor: Prof UL Opara
Co-supervisors: Dr OA Fawole and Dr M Stander

MUZIRI, Tavagwisa (Horticultural Science)

The influence of cell wall bound calcium, cell number and size on the development of mealiness in 'Forelle' pear. Evaluation of X-ray CT and NIR as non-destructive techniques for mealiness detection

'Forelle', the second most exported South African pear, is prone to mealiness, a dry textural disorder leading to postharvest losses. This study established that mealy tissues were associated with elevated levels of free Ca^{2+}, larger cells and intercellular airspaces, a higher porosity (defects) in the neck of the fruit even before ripening, and higher total soluble solid levels. This study demonstrated that fruit have a predisposition to mealiness, which can be identified with X-ray computed tomography before ripening and mealiness occurs. Discriminant analysis using NIR spectra successfully classified mealy and non-mealy fruit and merits research on commercial scale.
Supervisor: Dr EM Crouch
Co-supervisor: Prof KI Theron

NEETHLING, Nikki Elrita (Food Science)

Factors influencing colour variations and oxidative stability of South African game meat species

Meat colour is the only quality factor that can be evaluated by consumers at the time of purchase. Thus, maintaining a desirable meat colour is wanted to maximise profits. This study investigated the colour stability of game meat from three different game species (springbok, blesbok and fallow deer) by measuring various surface colour attributes, surface myoglobin redox forms and biochemical factors which influence muscle colour stability. The study indicated that game meat colour varies between species and that its colour stability differs from that of beef. Furthermore, valuable baseline data was also provided for future studies.
Supervisor: Prof LC Hoffman
Co-supervisors: Dr GO Sigge and Prof SP Suman (External)

OMEJE, Victor Okonkwo (Aquaculture)

Effects of Carica papaya *seed powder on the reproductive, endocrine and immune systems of* Oreochromis mossambicus

The study investigated the potential of pawpaw (*Carica papaya*) seed powder (PSM), when included as part of Mozambique tilapia diets, to produce all-male populations for culture purposes, in an effort to overcome overcrowding and non-uniform growth in pond systems. The study indicated the safety of PSM to be included in Mozambique tilapia diets, as evident in the liver function and immune system functioning that was unaffected by the PSM. An inclusion level of 20 g PSM/kg basal tilapia diet resulted in 77,8% masculinisation, with female fish being more sensitive to the treatment.
Supervisor: Dr H Lambrechts
Co-supervisor: Prof D Brink

ROSE, Lindy Joy (Plant Pathology)

Investigating maize inbred line responses following infection by the mycotoxigenic fungus Fusarium verticillioides

The fungus *Fusarium verticillioides* causes Fusarium ear rot (FER) and deposits toxins harmful to humans and animals, called fumonisins, in maize grain. Host-plant resistance is considered the most feasible, economical and environmentally sound approach to manage *F. verticillioides* and its fumonisins. South African and Kenyan maize inbred lines resistant to *F. verticillioides* were identified in this study. Resistant plants were also generated by gamma irradiation. Candidate genes have been identified by using next-generation RNA sequencing that could enhance resistance in maize to *F. verticillioides* and fumonisins.
Supervisor: Prof A Viljoen
Co-supervisors: Dr C van der Vyver and Prof BC Flett (External)

SSALI, Reuben Tendo (Plant Pathology)

The identification and characterisation of resistance in banana to Fusarium oxysporum *f. sp.* cubense *race* 1

The soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* (Foc) can cause losses of up to 100% in banana fields. Host plant resistance is considered the only feasible method to control the disease. This study demonstrated that resistance to Foc race 1 is provided by a single recessive gene, named *pd1*. Candidate molecular markers and genes linked to resistance were identified by DArT analysis and RNA sequencing respectively. These markers and genes could be used for marker-assisted selection in conventional breeding and for genetic engineering of bananas for Fusarium wilt resistance.
Supervisor: Prof A Viljoen
External Co-supervisor: Dr A Kiggundu

STOKWE, Nomakholwa Faith (Entomology)

Potential control of the woolly apple aphid (Eriosoma lanigerum) *using entomopathogens*

The woolly apple aphid is an important insect pest of apples. Infestation can lead to severe damage to roots on the form of galls and the destruction of developing buds. Rising interest in environmentally sustainable farming has increased the demand for environmentally friendly pest control methods. The overall aim of the study was to determine the potential of insect parasitic nematodes and fungi to control the soil stages of the woolly apple aphid. The use of nematodes was found not to be ineffective, while promising results were obtained in laboratory and field trials with the application of entomopathogenic fungi.
Supervisor: Dr AP Malan
Co-supervisor: Dr P Addison

SWANEPOEL, Mon-Lee (Conservation Ecology)

*Distribution, management and utilisation of the extra-limital common warthog (*Phacochoerus africanus*) in parts of the Northern Cape and Free State provinces, South Africa*

The common warthog has been extra-limitally introduced to parts of South Africa and is simultaneously managed as an agricultural pest and valuable game animal by farmers. The study proposed the production of warthog meat as a strategy to sustainably manage introduced warthogs. Results indicated that warthog meat is high in protein and low in fat with a favourable fatty acid profile, and suitable for producing healthy processed meat products. In totality, the study provides baseline information on warthog meat quality characteristics, and concluded that warthogs can be safely utilised for sustainable meat production and utilisation.
Supervisor: Prof LC Hoffman
Co-supervisor: Dr A Leslie

UMEUGOCHUKWU, Obiageli Patience (Soil Science)

Mitigation of soil and ground water pollution caused by on-land disposal of olive mill waste water

The on-land disposal of the olive mill effluents has a significant negative effect on soil quality and may contaminate ground waters with phenols. Direct application to wheat trails resulted in up to 40% reduction in crop growth parameters. The effects on legumes was less detrimental. Pinewood biochar (pyrolised biomass) was shown to rapidly sorb phenols and reduce the effluent COD. The mechanism was shown as

mainly chemosorption following pseudo-second-order kinetics. The studied biochar was successfully used as a filtration material *ex situ* and as a soil amendment *in situ* to treat the olive mill waste waters and prevent water pollution.
Supervisor: Dr A Rozanov
Co-supervisor: Dr AG Hardie

WHITENER, Margaret Elizabeth Beckner (Wine Biotechnology)

*Metabolomic profiling on non-*Saccharomyces *yeasts in wine*

This study used metabolomics-based methodologies to study thoroughly non-*Saccharomyces* yeasts in the context of their contribution to wine aroma. A combination of targeted and untargeted gas chromatography-mass spectrometry analytical methods was developed. Results clearly demonstrated the differences in aroma compound production between the different non-*Saccharomyces* species in the initial stages of alcoholic fermentation and at the end of fermentation produced distinct profiles both sensorially and chemically. This study was the first to assess the impact of *Kazachstania* as a novel yeast associated with winemaking. This study expanded the scope of wine metabolomics and also our understanding on the contribution of non-*Saccharomyces* yeasts to wine aroma.
Supervisor: Prof M du Toit
Co-supervisors: Dr B Divol and Dr U Vrhovsek (External)

YEKWAYO, Inam (Conservation Ecology)

Biodiversity value of afromontane forest patches within KwaZulu-Natal timber production areas

Natural forests are important habitats for many species. This study determined the state of arthropod diversity in natural forest patches within a timber production landscape, and assessed the best way to conserve them in the future using ground-living arthropod diversity. Small patches had higher arthropod diversity than expected, although large and close patches are of greatest conservation priority. Pine plantations are not extensions of natural forests and it is best to conserve forests neighbouring natural grasslands. Critically, most populations of detritivores in this production system originate from forests, highlighting the importance of forests in the conservation of biodiversity and ecosystem processes.
Supervisor: Dr JS Pryke
Co-supervisors: Prof MJ Samways and Dr F Roets

PhD (Agric)

HOWELL, Carolyn Louise (Soil Science)

Using diluted winery effluent for irrigation of Vitis vinifera *L. cv. Cabernet Sauvignon and the impact thereof on soil properties with special reference to selected grapevine responses*

Wineries produce large volumes of poor quality waste water, particularly during harvest. The possible re-use of this waste water for vineyard irrigation was investigated in a field trial. Diluted winery waste water increased soil potassium and sodium after waste water application. Irrigation of grapevines using diluted winery waste water did not affect grapevine water status, vegetative growth, production, juice characteristics or wine sensorial characteristics. It must be noted that vineyard irrigation using diluted winery waste water was only investigated under one given set of conditions. Therefore, at this stage, it can only be recommended for vineyard irrigation in sandy soils in regions with high winter rainfall.
Supervisor: Dr JE Hoffman
External Co-supervisor: Dr PA Myburgh

STOFBERG, Algina Maria Johanna (Animal Science)

*A protocol for liquid storage and cryopreservation of ostrich (*Struthio camelus*) semen*

Storage of ostrich semen followed by artificial insemination could ease industry limitations like poor egg fertility and poor survival of embryos and chicks. This study developed a species-specific protocol for short- and long-term storage of ostrich semen. An ostrich-specific diluent maintained sperm function during short-term liquid storage for up to 48 hours at 5^0C while maintaining sperm quality. Ostrich semen stored indefinitely in liquid nitrogen with an added cryo-protectant maintained sufficient sperm function to fertilise eggs after thawing. Semen subjected to liquid storage and cryopreservation resulted in the production of fertile eggs in inseminated females.
Supervisor: Prof SWP Cloete
Co-supervisors: Prof K Dzama and Dr IA Malecki (External)

PhD (Food Sc)

HUNLUN, Cindy (Food Science)

Characterising the flavonoid profile of various citrus varieties and investigating the effect of processing on the flavonoid content

Citrus bioactive compounds are reported as being beneficial in cancer prevention, with citrus flavonoids being involved. Knowledge of the chemical composition of South African citrus cultivars, their products, and what effect seasonal and varietal differences have, was lacking in South Africa. This research can be used as a baseline, the first attempt at establishing a phenolic profile specific to South African citrus fruit varieties, also highlighting the importance of varietal and regional effects. It was also found that the phenolic composition of orange juice found in the South African market were much lower than those reported elsewhere in the world.
Supervisor: Dr GO Sigge
External Co-supervisors: Dr D de Beer and Prof J van Wyk

PhD (For)

MAGALHAES, Tarquinio Mateus (Forest Science)

Estimation of tree biomass, measurement uncertainties and morphological topology of Androstachys Johnsonnii *prain*

Biomass content and carbon sequestration of tree-based ecosystems are important information for assessing the climate-relevant impact as done by the IPCC. This information provides substantial arguments for protecting woodlands against exploitation and degradation. With this study the aboveground and belowground tree biomass in Mecrusse Woodlands in Mozambique was assessed for the first time. Mathe-

matical models for the quantification of biomass and carbon in forest inventories have been developed. In the course of the work several novel solutions for modelling biomass and descriptions of belowground biomass in particular were found, which will be useful for other studies in the future.
Supervisor: Prof T Seifert

Fakulteit Ekonomiese en Bestuurswetenskappe

Faculty of Economic and Management Sciences

IFakhalthi yezeeNzululwazi kwezoQoqosho noLawulo

PhD

AKINSOLA, Foluso Abioye (Development Finance)

Implication of financial crisis, financial regulation and business cycle for bank lending in South Africa

The candidate investigated using econometric techniques to determine the exact nature of the relationship between business cycles, financial crises, financial regulation and credit availability, especially for micro small and medium scale enterprises (MSMEs) in South Africa. The study found that financial regulation occasioned by a financial crisis tends to amplify a downturn in the business cycle. Thus, financial regulators must balance the benefits of financial stability against the need to ensure a free flow of credit to MSMEs during a crisis. Policy makers must consider intervention policies for the survival of MSMEs in a depression.
Supervisor: Prof S Ikhide

AMBOLE, Lorraine Amollo (Public and Development Management)

Understanding co-production through sanitation intervention case studies in South Africa

This dissertation presents three case studies of sanitation interventions in informal settlements in South Africa in order to advance an argument concerning the co-production of knowledge and the importance of an emerging field related to the way urban design and sustainability are understood and practiced. The central problem that the candidate strives to tackle is the question of, or possibility for, collaborative knowledge production on the provision of sanitation services in informal settlements.
Supervisor: Prof M Swilling

BURGER, Jacobus Wilhelm (Economics)

A structural approach to modelling South African labour market decisions

As statistics suggest, high employment mobility amongst black South African youths, their high unemployment and slow absorption into employment is surprising. After investigating whether the labour market is truly as mobile as reported, it is concluded that the high transition rates in labour market status rather reflect misclassification error or unobserved individual heterogeneity. The role of reservation wages in unemployment is examined by building a job search model to recover the reservation wages that are consistent with observed labour market behaviour, instead of using self-reported reservation wages. Finally the role of education in labour market outcomes is investigated through a dynamic programming model that mimics schooling decisions for forward-looking optimising agents, to determine whether ability bias is present and whether returns to education are inflated.
Supervisor: Prof S van der Berg

CILLIERS, Jeanne Alexandra (Economics)

A demographic history of Settler South Africa

The Western demographic transition of the late nineteenth century has had a profound effect on living conditions globally. Instead of having six or more children, most women today have only two. It is therefore surprising that so little is known about the demographic history of South Africa. In this dissertation, the candidate uses a novel and large genealogical dataset of settler families in South Africa to investigate the fertility transition, birth spacing and intergenerational mobility of South Africans before unification. Her pioneering results contribute to important debates within the fields of economic history, population studies and development economics.
Supervisor: Prof J Fourie

NABE, Tembela (Public and Development Management)

Impediments to meaningful and effective public participation in the formulation of local government budgeting in the Western Cape

The study endeavoured to identify the problems that impede meaningful and effective public participation in decision making with specific reference to local sphere of government in the Western Cape. The delimitation, scoping and scaling of the study are evident from the research aims and objectives and pertain to the examination of policy frameworks for public participation at the local sphere of government in South Africa, the identification of the challenges facing municipalities with regard to public participation in the budgeting process, learning from Brazil's experience regarding participatory budgeting and proposing an appropriate public participation model for the Western Cape.
Supervisor: Prof G Woods

NAUDÉ, Jan (Futures Study)

Constructive environmental scanning: a method in creating positive world paradigms for more sustainable alternative futures

Environmental scanners at the Litany Level of Knowing generally do not have good judgement and foresight about the contextual future and are, therefore, ill-equipped to influence thought leaders to adopt measures necessary to develop sustainable alternative global futures. Constructive Environmental Scanning (CES), as a more balanced and holistic approach, is posited to enhance people's future consciousness to pursue sustainable alternative futures. CES is a critical thinking approach based on a proposed new Matrix Integral Layered Environ-

mental Scanning (MILES) method. The purpose is to create depth in the environmental scanning inquiry to transcend superficial information and understanding encountered by scanning practitioners.
Supervisor: Prof A Roux

NELMAPIUS, Albert Hugo (Ondernemingsbestuur)

A motivational perspective on the user acceptance of social media

Die ontstaan van sosiale media het die manier hoe individue met mekaar kommunikeer verander deur hulle te bemagtig om inligting, idees en menings met mekaar te deel, te leer, handel te dryf en vermaak te word. Hierdie reeks gebruike het sosiale media eksponensieel laat groei, wat dit 'n belangrike bemarkingskommunikasiekanaal maak wat op 'n toepaslike manier benader moet word om maatpas-bemarkingsaanbiedinge te lewer. Hierdie studie ondersoek die motiverings, struikelblokke en belonings wat sowel gebruikers as nie-gebruikers van sosiale media najaag. Die studie het bevind dat spesifieke belonings, eerder as persoonlike eienskappe, die hoofdryfveer vir die gebruik van sosiale media is. Die bevindinge van die studie sal bemarkers in staat stel om hierdie nuwe kommunikasiekanaal optimaal te benut.
Promotor: Prof C Boshoff

SMITH, Anna Maria (Economics)

Health care reform priorities for South Africa: four essays on the financing, delivery and user acceptability of health care

South Africa has public health expenditure similar to that of upper-middle-income peer countries, but achieves health outcomes comparable to that of low-income countries. This dissertation examines the tension between high expenditure and poor health outcomes with four essays on the financing, user acceptability and delivery of health care. It considers how the user acceptability of health care services influences the ability of health care services to impact health outcomes in the context of the medical schemes market, TB care and antenatal care. Greater user acceptability is necessary to ensure that the health system can successfully prevent, detect and treat disease.
Supervisor: Prof R Burger

STEENKAMP, Pieter (Business Management and Administration)

Towards a client-based brand equity framework for selected business-to-business services

Brand equity is an important activity in which organisations should engage if they are to differentiate themselves in a competitive market. Traditionally, brand equity has been researched as it applies to products in a B2C setting, with less attention paid to the development in the B2B services context. The study investigates the short-term insurance industry as a provider of a service to a specific group, namely hotels in the Western Cape. The qualitative research that has been conducted results in the proposal of a CBBE model for brokers and for selected B2B services.
External Supervisor: Prof FJ Herbst
Internal Co-supervisor: Prof M Terblanche-Smit

VAN BROEKHUIZEN, Hendrik (Economics)

Graduate unemployment, higher education access and success, and teacher production in South Africa

This dissertation examines the nexus between schools, universities and the labour market. Using a probabilistic approach to link labour force and university data, graduate unemployment is found to be neither high nor rising rapidly, and interracial variation can be explained by types of institutions attended. University access, success and dropout of Western Cape matriculants are strongly correlated with matric performance, which also explains most racial differentials. Universities could begin to produce enough teacher graduates to satisfy teacher demand within the next decade, but only if current enrolment growth and throughput rates are maintained. Greater emphasis is needed to ensure that education students complete their programmes, specialise in high-demand subjects and phases, and quickly proceed into teaching.
Supervisor: Prof S van der Berg

WILLS, Gabrielle (Economics)

An economic perspective on school leadership and teachers' unions in South Africa

This dissertation considers two factors regarded as critical to disrupting an existing culture of inefficiency in the production of learning in South Africa, namely school leadership and teachers' unions. Using a unique administrative dataset of payroll and education data, the first part of the study constructs a quantitative profile of the labour market for school principals with implications for policy reforms in raising the calibre of school leadership. A key finding is that increasing numbers of principal replacements are taking place, given a rising age profile of principals, with implications for school performance. The final part explores teacher union membership and investigates a disruption hypothesis that student learning is lost as a consequence of teacher participation in strike action.
Supervisor: Prof S van der Berg

Fakulteit Ingenieurswese
Faculty of Engineering
IFakhalthi yezobuNjineli

PhD

AGUDELO AGUIRRE, Roberto Arturo (Chemical Engineering)

Integrated optimisation of pretreatment conditions for bioethanol production from steam-treated triticale straw

The impacts of cultivar/environmental variabilities on pretreatment-hydrolysis for triticale straw conversion-to-bioethanol were addressed for triticale grown in South Africa. Successive pretreatment optimisations of preferred cultivars with dilute-acid steam explosion improved the combined sugars yield up to 11%. Optimisation improved the lignocellulosic ethanol yield per hectare of triticale by nearly 28%.

A maximum experimental ethanol yield of approximately 200 L.ha-1 was obtained from simultaneous saccharification and fermentation of steam explosion pretreated straw at 13% solids loading. The selection of cultivars and further pretreatment optimisation improved the areal ethanol yield without compromising the grain yield.
Supervisor: Prof JF Görgens

BRINK, Isobel Christine (Civil Engineering)

Design of storm water ponds towards the reduction of metal toxins in surface waters that are utilised for South African primary food production

This research addressed metals pollution in storm water runoff. Metals removal efficiencies in storm water detention and retention ponds were investigated. The dissertation argued that a focus on relationships between pond efficiency and design could generate information towards augmenting prominent international design methodologies. Statistics and probability theory were the main analysis tools. Hydrodynamic modelling was used to theoretically test the validity of trends indicated from the statistical analysis. Prominent international design methods were found to be inadequate for efficient design. The results were used to improve design theory. Recommendations were made specifically for the South African context and focussed on pond hydraulics and sedimentation.
Supervisor: Prof GR Basson
Co-supervisor: Mr W Kamish

COMBRINCK, Riaan (Civil Engineering)

Cracking of plastic concrete in slab-like elements

Plastic settlement and plastic shrinkage cracking results in aesthetical and durability issues for mainly slab-like concrete elements within the first few hours after casting the concrete. This study uses various experiments to provide the fundamental understanding of both cracking types individually as well as combined. The tests revealed multiple plastic settlement cracks, followed by a singular plastic shrinkage crack, while both cracking types could be present internally without being visible at the surface. Finally, the experimental results of tensile material properties and volume change were used to develop a numerical model that can simulate the cracking behaviour of plastic concrete.
Supervisor: Prof WP Boshoff

CONRADIE, Pieter Johannes Theron (Industrial Engineering)

Cost modelling – a systematic approach for performance improvement of milling titanium alloys

South Africa is the second largest producer of titanium mineral concentrates, but has no market position to benefit further along the value chain. Concurrently, there is a lack of knowledge base for advanced and cost-effective manufacturing of titanium alloys. Cost modelling remains one of the key challenges faced by modern manufacturing industries. Due to technological advancements and complexities associated with theoretical models, implementation is limited. With a focus on titanium alloys, a practical approach to cost modelling is developed with a software user interface, allowing industry to establish benchmarks and improve machining performance for competitive manufacturing. At the same time it enables transfer of knowledge from academic institutions to industrial environments, underlining its relevance and thereby contributing to high-end skills development.
Supervisor: Prof D Dimitrov
Co-supervisor: Dr GA Oosthuizen

GERBER, Johan Andries Kritzinger (Civil Engineering)

Numerical modelling of performance and failure criteria for road seals

This study quantified single, double and cape seal deterioration according to three failure mechanisms which are: surface ravelling, surface cracking and surface texture loss. Each seal type was modelled with the finite element method to investigate the structural response and performance in accordance with a predefined list of seal design variables. The list was populated with a range of geometrical, material and traffic-related variables of typical seal layers. The outcome of this study demonstrated that finite element surfacing seal models can be used to reflect reality and serve as a powerful tool to investigate seal design adequacy prior to construction.
Supervisor: Prof KJ Jenkins

GILMORE, Jacki (Electronic Engineering)

Design of a dual-polarised dense dipole array for SKA mid-frequency aperture array

In the popular imagination, the Square Kilometer Array (SKA) telescope is a sea of dishes. However, the aperture array components – which will provide coverage of the scientifically crucial lower frequency bands – are equally important. SKA Phase 2 (scheduled for the 2020s) includes the Mid-Frequency Aperture Array (MFAA) and this dissertation proposes a new prototype design for this telescope component. A design methodology is proposed, implemented and verified by measurements of a prototype manufactured in collaboration with ASTRON, the Netherlands Institute for Radio Astronomy. The new prototype shows interesting potential as an MFAA candidate antenna.
Supervisor: Prof DB Davidson

GOUWS, Stephan (Electronic Engineering)

Training neural word embeddings for transfer learning and translation

Modern-day information processing systems like Google Translate and Siri are still notoriously bad at really understanding language. They require expensive human supervision and extensive tuning for each different task. This dissertation proposes neural word embeddings – automatically learned representations that use continuous values to represent language in a learned vector space of meaning – as an automated approach to learning representations of natural languages that are useful for predicting various aspects related to their meaning. We show experimental results which support this hypothesis, and present several contributions which make inducing these representations faster for translation and various other cross-lingual prediction tasks.
Supervisor: Prof G-J van Rooyen
Co-supervisors: Prof Y Bengio and Prof E Hovey

HEUNIS, Tosca-Marie (Mechatronic Engineering)

Early detection of risk of autism spectrum disorder based on recurrence quantification analysis of electroencephalographic signals

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that responds to early treatment, but most people are diagnosed late. We therefore need biomarkers for ASD that do not require highly trained professionals. Electroencephalography (EEG) might help the search for early biomarkers. In this interdisciplinary project recurrence quantification analysis of 5-second segments of resting state EEG data was used to identify a potential biomarker for ASD. In three studies, the biomarker was able to differentiate between ASD and typically developing children, ASD and non-ASD within a genetic syndrome, and between non-syndromal ASD and syndromal ASD, all with greater than 90% accuracy.
Supervisor: Prof MJ Nieuwoudt
Co-supervisors: Prof C Aldrich and Prof PJ de Vries

JORDAAN, Hendrik Willem (Electronic Engineering)

Spinning solar sail: the deployment and control of a spinning solar sail satellite

Solar sailing has become a viable and practical option for current satellite missions. A novel tri-spin solar sail and tri-spin gyro-controlled satellite configuration are proposed that combines the advantages of spinning and three-axis stabilised sail designs. The tri-spin solar sail satellite is able to perform faster attitude manoeuvres than a standard spinning solar sail. This will enable the satellite to produce the required solar thrust to change its orbit. Attitude changes results in oscillations of non-rigid elements of the sail, which influences the attitude dynamics of the satellite. This dissertation focuses on the deployment control of the sail and attitude control of this satellite.
Supervisor: Prof WH Steyn

KRIEL, Steven Cornelius (Electronic Engineering)

Automated aerial refuelling of a large receiver aircraft

Performing aerial refuelling with a large receiver aircraft is an extremely strenuous task for a pilot. While significant research has been performed on autonomous aerial refuelling of unmanned and fighter-sized aircraft, the challenges of autonomously refuelling a large receiver are largely unknown. This dissertation sheds light on these challenges. Primarily it determines that the long distance between the centre of gravity and refuelling receptacle creates challenging problems. A novel controller is designed, using a new architecture that takes the relative dynamics of the centre of gravity and refuelling receptacle into account in order to overcome these challenges.
Supervisor: Prof T Jones
Co-supervisor: Mr JAA Engelbrecht

KRISHNANNAIR, Syamala (Chemical Engineering)

Nonlinear singular spectrum analysis and its application in multivariate statistical process monitoring

Multivariate statistical process monitoring methods based on nonlinear singular spectrum analysis and using nonlinear principal component analysis, multidimensional scaling and kernel multidimensional scaling are proposed. A multimodal representation is obtained that can be used together with existing statistical process control methods to develop novel process monitoring schemes. The method was compared with classical principal component analysis and multimodal singular spectrum analysis on base metal flotation plant data and the Tennessee Eastman process benchmark data. The nonlinear singular spectrum analysis method better captured nonlinearities and yielded improved detection rates for various faults in nonlinear data compared with alternative competing multivariate methods.
Supervisor: Prof C Aldrich
Co-supervisor: Prof SM Bradshaw

KWISANGA, Christian (Electronic Engineering)

SQUIDs (superconducting quantum interference devices), geomagnetic signal analysis and modelling of Schumann resonances in the earth-ionosphere cavity

Superconducting quantum interference devices (SQUIDs) are very sensitive magnetometers. Schumann resonance in the Earth-ionosphere cavity, which is pumped by lightning, shows up in these geomagnetic measurements. A model was developed to allow numerical simulation of the entire Earth-ionosphere cavity, and variations in amplitude, frequency and quality factor of the Schumann resonance harmonics are found to agree with theory. From the results, Schumann resonances can be predicted and identified in the French data, while Hermanus data is shown to be too noisy.
Supervisor: Prof CJ Fourie

MALAN, Antonie du Toit (Civil Engineering)

Delay and disruption claims and damages in relation to construction projects

The delay and disruption matters in relation to the Joint Building Contracts Committee (JBCC) standard Principal Building Agreement of 2014 was researched. This was done through an analysis of the application of the concepts of extension of time, penalties, critical path, ownership of float, concurrent delays, delay analysis methods and time at large. This analysis revealed certain shortcomings in dealing with the above concepts which may impact on material terms such as penalties, termination, risk of damage to the works, insurance, security and time barring. It is also argued that the current legal position and status of the programme is unsatisfactory and creates uncertainty, which may lead to disputes. Appropriate amendments to the standard document are accordingly recommended.
Supervisor: Dr JAvB Strasheim
Co-supervisor: Prof G Lubbe

MSADALA, Vincent (Civil Engineering)

Sediment transport dynamics in dam-break modelling

Overtopping of dams during floods is the cause of more than 50% of South African dam incidents. Earth dams are characterised by steep embankment slopes. The application of sediment transport equations that were derived from data on mild or moderately steep slopes is one of the sources of uncertainty in dam-break modelling. This research developed new empirical sediment transport equations based on steep

slopes and are suitable for application in homogeneous earth embankment dam-break modelling. An analysis of the dam-break modelling results showed that the newly developed sediment transport equations performed better on steep embankment slopes in predicting the dam breaching and outflow flood hydrograph.
Supervisor: Prof GR Basson

MWANDAWANDE, Ikukumbuta (Chemical Engineering)

Investigation of the gas dispersion and mixing characteristics in column flotation using computational fluid dynamics

In this study, computational fluid dynamics (CFD) was employed to investigate gas dispersion and mixing in column flotation. Gas dispersion and mixing parameters affect flotation column performance. However, these two themes have not been adequately studied by previous CFD models in the literature. In the gas dispersion component, two-phase (air-water) systems were simulated in order to predict the average and local gas holdup and flow regime transition in bubble columns. Mixing in industrial columns was investigated, using three-phase (gas-liquid-solid) simulations. The predicted (simulated) results were in good agreement with experimental data in the literature.
Supervisor: Prof G Akdogan
Co-supervisor: Prof SM Bradshaw

NASSAR, Shamim Omar (Electronic Engineering)

Miniaturised multilayer RF and microwave circuits

The use of ceramic and laminate multi-layered technologies are investigated in this work for the implementation of passive microwave circuits. New pedestal resonators and folded waveguide resonators in Surface-Integrated-Waveguide are proposed, and evaluated through the design of a number of filters and diplexers. The implementation of polyphase filters and a PIN diode limiter switch in low-temperature co-fired ceramic is evaluated. The new structures find use in communication and RADAR receivers, offer reductions in size, weight and cost, and allow for high-volume manufacturing.
Supervisor: Prof P Meyer
Co-supervisor: Prof PW van der Walt

NIEUWOUDT, Pieter Daniel (Civil Engineering)

Time-dependent behaviour of cracked steel fibre reinforced concrete: from single fibre level to macroscopic level

The candidate investigated and quantified the time-dependent crack width opening behaviour of cracked steel fibre reinforced concrete (SFRC) under sustained uni-axial tensile loading and developed a model to simulate this behaviour. Experimental investigations on a single fibre level showed that matrix creep and micro cracking are the dominant mechanisms causing the crack widening over time due to sustained loading. The developed model is based on the mechanisms and factors that affect the time-dependent single fibre pull-out behaviour. This work is the first step for creating a design model which includes the time-dependant behaviour of cracked SFRC.
Supervisor: Prof WP Boshoff

OLAWUYI, Babatunde James (Civil Engineering)

Understanding the mechanical behaviour of high-performance concrete with superabsorbent polymers (SAP)

Superabsorbent polymers (SAP) as internal curing agent (IC-agent) in high-performance concrete (HPC) is reported to be promising. This study quantified and modelled the mechanical behaviour of HPC containing SAP. Concentration of cement pore solution on SAP absorption, SAP's influence on concrete rheology, cement hydration and strength development were examined. Concrete microstructure was also investigated, using X-ray CT and SEM. A slight decrease in compressive strength of the HPC was reported as SAP contents increased, but no such effect was observed on the elastic and fracture properties. The study further postulates 12,5 g/g as the optimum additional water for SAP's effective internal curing.
Supervisor: Prof WP Boshoff

PIENAAR, Hardie (Electronic Engineering)

Karoo array telescope site shielding: laboratory, computational and multi-copter studies

The Northern Cape has been chosen to host the Square Kilometer Array (SKA) due to the area's overall radio quietness. Necessary infrastructure required on site, especially the Karoo Array Processing Building (KAPB), potentially threatens this pristine area with undesired radio frequency interference (RFI). This dissertation focussed on understanding the shielding and propagation characteristics of both the KAPB, as well as a man-made soil berm. Scale models, computational models and on-site measurements, using a multi-copter vehicle developed by the candidate, were used to investigate the local electromagnetic environment. The work has resulted in a detailed appreciation of RFI shielding levels on the SKA-SA site.
Supervisor: Prof DB Davidson
Co-supervisor: Prof H Reader

RIDOUT, Angelo Mark Christopher Juan Johan (Chemical Engineering)

Valorisation of paper waste sludge using pyrolysis processing

Pyrolysis of low and high ash paper waste sludge (PWS), and its fermentation residues (FR), was assessed using various reactor configurations and operating conditions. Performance of fast, slow and vacuum pyrolysis was statistically compared based on the yield and quality of the liquid and solid products. Differences were rationalised in terms of transfer phenomena and chemical degradation mechanisms respectively linked to the operating conditions and nature of PWS/FR. Characteristics of the products (biomaterials, chemicals and fuels) revealed the potential of raw and treated PWS to be considered as a commodity feedstock for a stand-alone or integrated bio-refinery.
Supervisor: Prof JF Görgens
Co-supervisor: Dr M Carrier

ROODT, Louis de Villiers (Civil Engineering)

Maintenance engineering standards to fulfil the legal duty of road authorities towards safe roads

Roads are essential for mobility of people and goods. South Africa has one of the worst accident rates in the world. Legislation, policy and common law place a legal duty on road authorities to provide reasonably safe roads. Lack of maintenance results in hazardous conditions, accidents and claims that could have been avoided. The study proposes standards for maintenance for roadway characteristics such as potholes, texture, traffic control such as signs and markings, drainage and roadside elements such as vegetation and barriers. It gives standards for maintenance inspection and response procedures to ensure asset and risk management for safety.
Supervisor: Prof CJ Bester

STRUWIG, Claudia Bernadine (Civil Engineering)

Management by measurement

The candidate developed an all-encompassing performance measurement framework and tool for managing transport technology projects. Current approaches are often modular and inconsistent, and therefore not able to provide a holistic view and true reflection of the projects' health. Extensive verification and validation processes were performed within the context of the project life cycle, with specific attention to sustainable deployment in the developing country environment. She managed to combine and apply various seemingly unrelated and diverse research fields, coupled with multi-criteria decision-making principles, to establish a comprehensive performance measurement structure to enable the continuous management and assessment of transport technology projects.
Supervisor: Prof CJ Bester

THERON, André Karl (Civil Engineering)

Methods for determination of coastal setback lines in South Africa

This dissertation describes the author's research on methods for determination of coastal development setback lines in South Africa, focussing strongly on the abiotic (geophysical) components. In view of South Africa's generally very exposed coastline, the escalating South African coastal development, and problems with some previous methods, the need for appropriate and implementable methodologies is clear. Suitable setback line methods were developed for use in "data poor" environments that are efficient to apply in extensive study areas, and that are robust and defendable. Recommendations and guidelines are provided for practical methodologies to determine coastal development setback lines in South Africa.
Supervisor: Mr G Toms
Co-supervisor: Prof GR Basson

TOMLINSON, Daniel Males (Electrical Engineering)

A fixed switching frequency technique for finite-control-set model predictive control for the control of single-phase converters

Predictive control is similar to a chess game where the player predicts all the possible moves up to the point of victory. The same principle was applied to the control of power electronic converters. The scheme provided a simplified solution to allow longer predictions to be made in less time. Micro-controllers require some time to do calculations. By reducing the time needed to do the calculations, more predictions can be done further into the future, which leads to a better control result. Experimental results showed that the scheme was effective in providing a fast and accurate control response.
Supervisor: Prof HdT Mouton

DIng

GOLIGER, Adam Mikolaj Witald (Civil Engineering)

Wind engineering science and its role in optimising the design of the built environment

In this dissertation the candidate presents an overview of wind engineering research activities and outputs over his extensive career in the field. Significant contributions to wind engineering practice both internationally and under South African conditions are presented. The research involved wind-tunnel modelling of structural loading and environmental conditions, analyses of wind damage and disasters, full-scale measurements, development of predictive models, design guides and standards, as well as consulting inputs to the construction industry. The knowledge and experience he gained in this specialised field aided him in providing unequalled advice and direction to the Civil Engineering industry in South Africa and further afield.
Supervisor: Prof JV Retief

KANSELIERSTOEKENNING / CHANCELLOR'S AWARD / IBHASO LIKATSHANSILA

Fakulteit Natuurwetenskappe

Faculty of Science

IFakhalthi yezobuNzululwazi kwezobuGqi

PROFESSOR HELMUT PRODINGER

Prof Prodinger word as een van die vaders van moderne analise van algoritmes en analitiese kombinatorika beskou. Van sy vele wetenskaplike prestasies is sy werk oor digitale stelsels veral invloedryk, en het dit ons begrip van die asimptotiese eienskappe van digitale stelsels verruim deur nuwe tegnieke soos die Mellin-transformasie bekend te stel. Sy baanbrekersartikel oor die toepassing van die Mellin-transformasie op syfersomme is reeds meer as 100 keer aangehaal en dien as kernbron op sy vakgebied. Prodinger het meer as 300 gekeurde vaktydskrifartikels saam met meer as 60 medeouteurs gepubliseer. Hierdie ontvanger van 'n goue medalje en navorsingstoekenning van die Suid-Afrikaanse Wiskunde-vereniging dien ook in verskeie konferensieprogramkomitees en in die redaksiekommissies van sommige van die voorste vaktydskrifte op sy gebied, soos *Theoretical Computer Science*.

Prof Prodinger is regarded as one of the fathers of modern analysis of algorithms and analytic combinatorics. Among his many scientific achievements, his work on digital systems has been particularly influential and has greatly enhanced our understanding of the asymptotic properties of digital systems by introducing novel techniques such as the Mellin transform. His groundbreaking article on applying the Mellin transform to digital sums has been cited more than 100 times and serves as an integral resource in his field. Collaborating with more than 60 co-authors, Prodinger has published over 300 reviewed journal articles. This recipient of a gold medal and research award from the South African Mathematical Society also serves on various conference programme committees as well as the editorial boards of some of the leading journals in his field, such as *Theoretical Computer Science*.