

**FACULTY OF SCIENCE**

DEAN: PROFESSOR N CHETTY BSc Hons (Natal) MS PhD (Urbana-Champaign) MSAIP MASSAf

**Doctor of Philosophy**

**ADELEYE**, Oluwafunbi Christianah

*Animal, Plant and Environmental Sciences*

*THESIS:* The effects of concurrent extreme temperature and water deficit on the phytochemical profile and phytopharmacological activities in *Portulacaria afra* Jacq

This thesis examines how extreme temperatures and water deficit impact phytochemical accumulation and pharmacological activities in *Portulacaria afra*. It explores the species' phytochemical profiles and biological activities using various solvents, revealing diverse responses in different plant parts, including changes in secondary metabolites, antioxidant, antimicrobial, and antidiabetic activities. It is evident that abiotic factors in combination influence the production of secondary metabolites, which could increase the output of phytomedicine and enhance the production of phytochemicals.

Supervisor: Dr I Risenga

**AHMED**, Mogahid Mamoon Abkar

*Mathematics*

*THESIS:* The role of invariants in obtaining exact solutions of differential equations

Variational and gauge symmetries have additional applications to the integrability of differential equations. A study of invariance properties and conservation laws were used to `twice' reduce differential equations to solutions. In some cases, variational and gauge symmetries have additional applications following a known Lagrangian in which case the first integral is obtained by Noether's theorem. Generally, it is more convenient to adopt the `multiplier' approach to find the first integrals.

Supervisor: Professor A Kara

**BERNERT**, Martin

*Molecular and Cell Biology*

*THESIS:* Investigating telomere dynamics using standard and AuNP-based assays and developing an LRP-based nanoparticle drug

A telomerase-enzyme activity assay was developed using DNA-modified gold nanoparticles, where telomerase activity is determined by a colour change in the nanoparticle solution. Additionally, a drug delivery system for the therapeutic protein, LRP, was developed using bio-compatible polymer nano-capsules, for treatment of age-related diseases. Therapeutic efficacy was confirmed in mammalian cells where treatment showed elevated telomerase activity and cell viability.

Supervisors: Professor S Weiss and Dr E Van der Merwe

**COOK**, Robin Michael

*Animal, Plant and Environmental Sciences*

*THESIS:* The value of large trees and their protection where elephants and trees co-exist

The candidate's thesis adds to our understanding of how elephant impact, when combined with environmental factors, negatively affects tree survival. Crucially, it focuses on how human stakeholders perceive elephant impact on trees, evaluates the efficacy of tree protection methods, and assesses elephant impact on trees containing white-backed vulture nests.

Supervisors: Professor E Witkowski and Dr M Henley

**DALZIEL**, Alexandra-Belle Mendes

*Geography, Archaeology and Environmental Studies*

*THESIS:* Moving towards landscape initiatives: An analysis of environmental frameworks, protected areas, and community perspectives in the Vhembe District, Limpopo Province, South Africa

This research delves into the potential of emerging landscape-centric conservation approaches in South Africa, particularly in the Vhembe District, Limpopo. The study presents a thorough literature and environmental legislation review, maps the region's sites of ecological significance, and reveals community perceptions. The findings reveal significant shortcomings and highlight potential opportunities in conservation corridors and ecological networks. The study underscores the importance of supportive legislation and prioritising community engagement.

Supervisor: Associate Professor M Evans

**DUMISA**, Senamile Siyaya

*Geosciences*

*THESIS:* Constraints on the genesis of orbicular granites and sulphide mineralisation in the Koperberg Suite, South Africa and the Diana's Pool area, Zimbabwe

This research tackles the enduring problem in petrology: comprehending the formation of orbicular granitoids, found as distinct rocks or enriched zones within plutons. Despite a generally accepted magmatic origin, the specific conditions for orbicular formation remain unclear. The study, utilising petrographic and in-situ geochemical methods, examines Southern African examples to address this geological problem.

Supervisors: Professor G Bybee and Professor P Nex

**GADU**, Siyaxola Ernest

*Geography, Archaeology and Environmental Studies*

*THESIS:* Shooting at a moving target.

The complexity of evaluating and monitoring the adaptive capacity to climate change of local government institutions in South Africa: a study of the Eastern Cape province

This study explored the complexities of evaluating the adaptive capacity and resilience to climate change of selected local municipalities in South Africa's Eastern Cape Province. The candidate argued that to develop comprehensive responses to climate change, local government institutions should themselves be adapted to climate change. The findings have been shared in two publications in international peer-reviewed journals.

Supervisor: Professor MD Simatele

**GATSI**, Nyepudzai Charline

*Physics*

*THESIS:* Optimisation of gallium oxide ( $\text{Ga}_2\text{O}_3$ ) nanomaterials for gas sensing applications

This study involved synthesis of  $\text{Ga}_2\text{O}_3$  nanostructures by the microwave-assisted hydrothermal method and their optimisation for gas sensing application. Optimisation of sensor performance was through optimisation of crystal structure, morphology, and surface modification of the  $\text{Ga}_2\text{O}_3$  nanostructures.  $\text{Ga}_2\text{O}_3$  nanostructures presented capabilities for the precise, real-time, and economical detection of carbon monoxide, isopropanol, and ethylene gases, which could be beneficial for monitoring indoor air quality and fruit production/storage processes.

Supervisors: Professor OM Ntwaeaborwa, Associate Professor R Erasmus, Professor N Moloto and Professor G Mhlongo

**GWAXA**, Bongumusa

*Mathematics*

*THESIS:* A symmetry perspective of third-order polynomial evolution equations

This study considered the Fujimoto-Watanabe equations - highly nonlinear third-order and fifth-order equations. Symmetry transformations of a one-dimensional system of optimal subalgebras, in combination with power series were applied to solve for exact solutions of the models. In addition, conservation laws were determined.

Supervisor: Associate Professor S Jamal

**HASSAN**, Buhari Arin

*Geography, Archaeology and Environmental Studies*

**THESIS:** Assessing livelihood vulnerability and adaptation to climate variability and change among farming households in Plateau State, north-central Nigeria

This study explores climate change adaptation strategies by smallholder subsistence farmers in Nigeria with data collected from farmers and other key stakeholders, using questionnaires, interviews, ethnographic observations and analysed statistically. Results show that household vulnerability is linked to low levels of financial, social, and physical assets. Farmers use many on-farm and off-farm adaptation strategies to enhance crop yield and diversify household income. However, farmers' adaptive capacity is limited by social vulnerabilities, lack of training and institutional support, and poor community infrastructure.

Supervisor: Professor J Knight

**ITZKIN**, Adela

*Animal, Plant and Environmental Sciences*

**THESIS:** An essential variable approach for integrated social-ecological systems monitoring to determine sustainability in a South African catchment

This PhD research in South Africa's Tsitsa River Catchment integrates systems thinking and participatory methods to develop an essential variable approach for monitoring social-ecological systems. Through transdisciplinary collaboration, it identifies essential social-ecological system variables for sustainable landscape management. The study's findings highlight the importance of integrated monitoring and offer valuable insights for adaptive management, with broad applicability to diverse contexts.

Supervisors: Professor M Scholes, Dr J Clifford-Holmes and Dr K Coetzer

**JAMES**, Lucien Nicolas

*Geography, Archaeology and Environmental Studies*

**THESIS:** Perspectives on the role of stakeholder engagement and participation in river basin management in South Africa: a study of the Hennops River

This study investigated the role of communities and stakeholder engagement in River Basin Management in South Africa taking the Hennops River as a case study. It was particularly interested in developing a community and stakeholder mobilisation framework for engaged natural resource management of river basins. The findings of the study have been shared through 3 publications in peer reviewed international journals.

Supervisor/s: Professor MD Simatele

**JEJE**, Olamide Adetomi

*Molecular and Cell Biology*

**THESIS:** Elucidating the structure-function relationships of *Enterococcus faecium* Nicotinate-Nucleotide Adenylyltransferase through X-Ray crystallography, computational modelling and binding studies

The threats of drug-resistant pathogens justify the need to develop novel and effective antibacterial agents. In this study, nicotinate nucleotide adenylyltransferase from *Enterococcus faecium* was explored, particularly for its potential to disrupt the survival mechanisms of the bacteria. The enzyme was characterised, its 3D structure determined, and potential inhibitors identified using in silico and empirical approaches, offering insights for drug discovery efforts.

Supervisors: Associate Professor I Achilonu and Dr R Pandian

**JOGEE**, Bibi Ayesha

*Geosciences*

**THESIS:** Trans-crustal and temporal perspectives of Palaeoproterozoic porphyry copper deposit formation (Haib deposit, Namibia)

The Haib copper deposit is a unique, Palaeoproterozoic porphyry copper deposit associated with mafic cumulates - the Kokerboom Intrusion. Various petrological and geochemical analyses particularly novel copper and iron isotope indicate that the Haib deposit represents the deeper parts of the porphyry copper system - a crucial finding for Cu exploration worldwide.

Supervisors: Professor G Bybee and Professor L Robb

**KHANYILE**, Samkelisiwe Ntandoyenkosi

*Geography, Archaeology and Environmental Studies*

**THESIS:** A GIS framework for the integrated conceptualisation, analysis and visualisation of Gauteng's complex historic and contemporary post-mining urban landscape

The research proposes a framework for integrating post-mining and urban landscape characteristics in Gauteng, South Africa, using assemblage theory, spatial and non-spatial data, MCDA and GIS. Findings reveal differences in landscapes, characterisation and spatial footprint based on literature and local expert input, challenging their separation. It recommends ongoing research into contextual landscape representation, emphasising community input and automated alignment with development plans.

Supervisors: Associate Professor A Esterhuysen, Dr C Kelso and Dr L Naidoo

**KHUMALO**, Thuthukile Charmane

*Physics*

**THESIS:** Transfer reactions to populate the pygmy dipole resonance in  $^{96}\text{Mo}$

The study examined the collective nature of the pygmy dipole resonance in  $^{96}\text{Mo}$ . An experiment was carried out at INFN-LNS, Italy using single-neutron transfer reactions on  $^{95,97}\text{Mo}$  with the MAGNEX spectrometer. Analysis of the data and QPM calculations showed strong single-particle excitations within the PDR energy range. However, limitations due to the odd-even nature of the target nuclei hindered a complete exploration of the single-particle wavefunction. This work assesses nuclear structure models and reaction theories, testing their predictability. Additionally, it is the first investigation to probe the excitation energy spectrum above 2.3 MeV in  $^{96}\text{Mo}$  through single-neutron transfer.

Supervisors: Dr L Pellegrini and Dr M Wiedeking

**KOSTAULI**, Mzwabantu Richard

*Geography, Archaeology and Environmental Studies*

**THESIS:** Co-management implementation in protected areas: a study of the Silaka Nature Reserve Wild Coast in the Eastern Cape Province, South Africa

This study examined the sustainability outcomes of the land restitution programme embarked on post 1994 aimed at promoting community empowerment and the co-management of natural resources. Of interest to the study, was understanding the nature of community engagement in decision making in the allocation of land resources. The findings of the study suggests that, while the land restitution programme was well conceptualised, its implementation has been marred by institutional weaknesses and high levels of corruption which have combined to disenfranchise vulnerable groups of people and poor households.

Supervisors: Professor MD Simatele and Dr T Mokotjomela

**LESOTHO**, Ntlama Francis

*Chemistry*

**THESIS:** Design and synthesis of chronic wound healing collagen peptide mimics

The study involved the design, synthesis, and biological assessment of integrin-binding collagen type I peptide mimics intended for chronic wound healing. The peptides comprising of lipophilic moieties, growth factors and collagen-inducing tripeptides demonstrated an ability to induce migration of cells resulting in accelerated wound healing in mice.

Supervisor: Dr M Makatini

**LEVIN**, Jonathan Chaim

*Animal, Plant and Environmental Sciences*

**THESIS:** Tracing multiple aquatic ecosystem stressors across a land-use intensification gradient: a multi-tooled environmental forensic approach

This research developed a novel forensic toolbox to disentangle pollution effects of different land users in South Africa's rivers. The ecohydrological study involved spatio-temporal and statistical analyses of water quality parameters, dissolved and sediment-bound trace metals, as well as sulfur stable isotopes in organic samples. The toolbox enables catchment managers to pinpoint pollution sources in complex multi-user river catchments.

Supervisors: Associate Professor D Woodford and Professor C Curtis

**MABUZA**, Precious Gugulethu Babalwa

*Animal, Plant and Environmental Sciences*

**THESIS:** Understanding disturbance, vegetation density, seed banks and pollination for the conservation of *Protea curvata*

The candidate found that fire and hail affect survival fitness in *Protea curvata*, a serpentine endemic from Barberton. Bird pollination is effective, but seed banks are short-lived and dense surrounding woody vegetation reduces seed germination and seedling recruitment. These insights will guide the conservation of this rare and attractive tree.

Supervisor: Professor K Balkwill

**MADUNA**, Nombuso Gladys

*Geosciences*

*THESIS:* 3D seismic constraints on the strato-structural evolution of the deep-water Orange Basin, South Africa  
The analysis of high-resolution 3D reflection seismic data from the deep-water Orange Basin offshore western South Africa reveals valuable insights into the basin's tectonic setting, depositional environment, and hydrocarbon potential. Key discoveries include a gravitational collapse system in the Late Cretaceous, natural gas and fluid escape features, an Oligocene slope-perpendicular canyon, Miocene slope-parallel channels, and seafloor mass flow features.

Supervisors: Dr Z Jinnah and Professor M Manzi

**MAKGABUTLANE**, Boitumelo

*Chemistry*

*THESIS:* Development of eco-friendly building bricks derived from carbon nanotube-reinforced coal ash and low-density polyethylene waste materials

The study focused on the innovative beneficiation of coal ash and plastic waste for the development of eco-friendly bricks. Carbon nanotubes were used as a reinforcement filler and imparted their superior properties such as high mechanical strength and thermal stability and ensured the bricks met the required standards. Finally, cost-effective bricks with reduced carbon footprint and resource conservation were produced.

Supervisors: Dr M Maubane-Nkadimeng and Professor N Coville

**MAPHAKELA**, Lesiba Joseph

*Mathematics*

*THESIS:* Chromatic polynomials and certain classes of graphs

This study explores the chromatic polynomials of graphs. Starting with its cycle form, introducing formulas, algorithms for computations and examining the coefficients. Thereafter, chromatic polynomials of joins of graphs are studied in detail and the theory applied to chromatic equivalence and uniqueness of bivertex join of trees and cycles.

Supervisor: Professor E Mphako-Banda

**MARAIS**, Chantel

*Mathematics*

*THESIS:* An essay on branching time logics: a comprehensive investigation into axiomatisations and decidability of the logics of different branching time structures

This study investigates the Priorian temporal logics of a range of classes of tree structures, including trees with branches isomorphic to the natural numbers, integers and rational numbers with their natural strict and non-strict orders. It establishes finite, sound and complete axiomatisations for the logics of these classes. It proves the algorithmic decidability of the majority of these logics.

Supervisors: Professor W Conradie and Professor V Goranko

**MASHALE**, Kedibone Nicholine

*Chemistry*

*THESIS:* Quantitative analysis of gold in low-grade tailings from different matrices, coupled with a study into the associated uncertainties

The thesis covers the development and optimisation of methods for gold quantification in mine tailings together with the evaluation of the measurement uncertainty. The methods were: fire assay by gravimetry, acid digestion and wet chlorination with instrumental analysis. In this thesis, the gold from low-grade tailings was quantified successfully, with fire assay by gravimetry offering the least measurement uncertainties.

Supervisors: Professor L Chimuka and Dr J Tshilongo

**MASHATOLA**, Lebohang Happy

*Molecular and Cell Biology*

*THESIS:* A phenotype prediction framework for classifying colorectal cancer patients' response to FOLFOX treatment: an integrated approach

The thesis proposes an integrated approach to predicting FOLFOX response in CRC patients. Contributions include the utilisation of topological overlapping measures to enhance the identification of topological features. Furthermore, using bimodalities in deep learning offers transformative insights for phenotype prediction in cancer gene expression data.

Supervisor: Professor M Kaur

**MASINA**, Sikhumbuzo Mfanawemphi

*Chemistry*

**THESIS:** Fast oxide ion conductors for solid oxide fuel cells: average and local structure - property correlations in solid solutions of Bi<sub>2</sub>O<sub>3</sub>

The thesis has employed advanced methods of structural analysis such as pair distribution function, X-ray absorption spectroscopy and symmetry mode analysis to correlate structure and the physical property conductivity in solid electrolytes of Bi<sub>2</sub>O<sub>3</sub>. This work has resulted in a publication and numerous presentations in international and local conferences.

Supervisors: Professor D Billing and Associate Professor C Billing

**MLALAZI**, Nkanyiso

*Geography, Archaeology and Environmental Studies*

**THESIS:** Compost-assisted phytoremediation of gold mine tailings and tailings footprint areas using *Chrysopogon zizanioides* L Roberts enhanced with Moringa leaf extract biostimulant in the Witwatersrand, South Africa: a multidisciplinary approach

The study investigated the potential of *Chrysopogon Zizanioides* (vetiver grass) enhanced with Moringa leaf extract biostimulant for mine-tailing remediation using phytoremediation as an innovative technology. The findings suggest that in addition to the uptake of heavy metals from contaminated soils, Vetiver is highly tolerant to harsh climatic and substrate conditions and has a high carbon sequestration and bio-energy production potential.

Supervisors: Professor MD Simatele and Professor L Chimuka

**MODUPE**, Abiodun

*Computer Science and Applied Mathematics*

**THESIS:** Regularised deep neural network for post-authorship attribution

The candidate developed a deep neural network model for post-authorship attribution, enabling forensic investigators to visualize author writing styles.

Supervisors: Professor T Celik and Professor V Marivate

**MOL**, Michael

*Molecular and Cell Biology*

**THESIS:** *Parageobacillus thermoglucosidasius* and the water-gas shift reaction: investigating the influences of gas composition and H<sub>2</sub>-uptake hydrogenases

Influences of industrial syngas-mimetic feedstocks, oxygen perturbations and the activity of H<sub>2</sub>-uptake hydrogenases on the activity of the *Parageobacillus thermoglucosidasius* water-gas shift reaction catalysed hydrogen gas production was evaluated. Subsequently, a pan-genomic and comparative-genomic analysis of the genera *Parageobacillus* and *Saccharococcus* was conducted to elucidate their distinct biotechnological potential.

Supervisors: Associate Professor P De Maayer

**MORRISSEY**, Peter

*Geography, Archaeology and Environmental Studies*

**THESIS:** Reassessing the stratigraphy and formation of the basal deposits at Klasies River Main Site with a multiscale and multiproxy approach

This geoarchaeological study of the basal deposits at Klasies River Main site utilised macroscopic field observations and an integrated microcontextual approach. The thesis provides greater insight into the depositional and diagenetic context of highly significant archaeological assemblages and human fossils and highlights the importance of anthropogenic site formation processes. A clearer understanding of the potential and limitations of the stratigraphic evidence has been developed, allowing the clarification of temporal relationships between some finds in different areas of the complex.

Supervisors: Professor S Wurz and Dr S Mentzer

**MTINTSILANA**, Onesimo

*Physics*

**THESIS:** Search for new resonances in the four-lepton channel and implementation of the LED Integrator panel for the Prometeo system in the ATLAS Tile Calorimeter

This thesis explores new physics at the Large Hadron Collider (LHC). It searches for heavy resonances decaying to four leptons, constraining theories like the Randall-Sundrum model. It also investigates the possibility of dark matter production through heavy boson decays. Finally, it highlights advancements made to the ATLAS detector in preparation for the High-Luminosity LHC era.

Supervisors: Professor B Mellado and Dr M Kumar

**MUDAU**, Naledzani

*Geography, Archaeology and Environmental Studies*

**THESIS:** Mapping and assessment of informal settlements using object-based image analysis, a case study of Mamelodi, Tshwane, South Africa

This thesis investigated informal settlement dynamics and spatial characteristics to generate an understanding of housing informality and environmental conditions for designing innovative sustainable solutions. The analysis used very high spatial resolution data and Unmanned Vehicle image products. The study generated new methodologies to detect informal settlements and assess their surface ecological surface and their location characteristics.

Backyard shacks were detected by using UV and assessed their spatial properties against free-standing shacks and formal settlements.

Supervisor: Professor P Mhangara

**MUTSHAFU**, Ndamulelo

*Geosciences*

**THESIS:** Utilising legacy seismics and non-seismic geophysical methods for deep mineral targeting and near-surface characterisation: implications for mine development planning

The thesis demonstrates the significance of reprocessing legacy reflection seismic data with advanced algorithms in enhancing gold exploration and mine development, particularly in hard-rock settings within the Witwatersrand Basin. Additionally, it highlights the crucial role of integrating seismic and non-seismic geophysical datasets for identifying near-surface geological structures like boulders, fractures, and water seepage in mine workings on the western limb of the Bushveld Complex.

Supervisors: Professor M Manzi and Dr M Westgate

**NGQINAYO**, Ntombizanele

*Chemistry*

**THESIS:** The design, synthesis and structure-activity relationship of Antitubercular Lassomycin Derivatives

The study involved the design and synthesis of lassomycin peptide derivatives targeting the caseinolytic protease found in *Mycobacterium tuberculosis*. The derivatives were successfully modified to withstand enzyme degradation and conjugated to lipophilic molecules and nanoparticles to improve drug delivery. The designed synthetic route yielded the desired active threaded 'lasso' conformation.

Supervisor: Dr M Makatini

**NKALA**, Gugulethu Charmaine

*Chemistry*

**THESIS:** Structural characterisation of bimetal-phosphate based solid-state electrolytes: a PXRD, PDF and XAS study

This study has highlighted the importance of applying multiscale structural characterisation techniques such as PXRD, PDF and XAS in revealing information from the average, local and electronic structures that govern structure-property relationships, and influence material design for applications in Energy Materials. This work has been presented at national and international conferences and workshops.

Supervisors: Professor D Billing, Associate Professor C Billing and Dr R Forbes

**OKORO**, Franklin Chimaobi

*Geography, Archaeology and Environmental Studies*

**THESIS:** Social vulnerability in the adaptation of rural communities to climate change in Imo State, Nigeria

This study investigates the social vulnerability in rural communities in Imo State, Nigeria, and how households use their social capital and networks to adapt to climate change. Data was collected using household questionnaires, stakeholder interviews and focus groups. Results show that social vulnerability is a function of different societal and structural factors. Climate adaptation strategies and social resilience were enhanced through support from family members, neighbours and social groups.

Supervisor: Professor J Knight

**OLATOYAN**, Jerry Oluwatobi

*Geography, Archaeology and Environmental Studies*

**THESIS:** Palynological insights into an 11,700-year sequence of vegetation change in Mashishing, Mpumalanga, Northeastern South Africa

Distinguishing between human-induced and climate influences on vegetation change is challenging. By analysing pollen, phytoliths and charred particles, subtle patterns of anthropogenic activities and Holocene climatic fluctuations were uncovered. These studies significantly enriched the understanding of how climate and/or human activities have impacted the vegetation landscapes over time.

Supervisors: Professor M Schoeman and Dr C Sievers

**OOSTHUIZEN, Tasha**

*Animal, Plant and Environmental Sciences*

*THESIS:* Effects and consequences of natural and artificial light at night on small mammals in peri-urban Johannesburg, South Africa

The candidate's PhD considered the impact of artificial light at night (ALAN) on southern African small mammals, focusing on community composition, species abundance, locomotor activity, and foraging behaviour. Her findings highlight the varying effects of ALAN based on species' temporal niches, revealing significant implications for biodiversity conservation amidst increasing urbanisation.

Supervisor: Professor N Pillay

**PEEGA, Tebogo**

*Chemistry*

*THESIS:* Synthesis, characterisation and investigation of the mode of action in the anticancer activity of novel platinum complexes

This research addressed the global health challenge posed by cancer and the limitations of current platinum-based drugs. Alternative platinum(II) complexes bearing diimine and acylthiourea ligands were synthesised and characterised. These complexes showed higher cytotoxicity than cisplatin against colorectal and lung cancer cell lines. They induced intrinsic apoptosis via oxidative stress and DNA damage, highlighting their potential as promising cancer therapeutics.

Supervisors: Dr I Kotze and Dr L Harmse

**PERUMAL, Cardon Maria**

*Molecular and Cell Biology*

*THESIS:* Investigating FOXP2 dynamics, stability, and DNA-binding capabilities

This PhD study provides crucial insights into the structural and functional intricacies of the FOXP2 transcription factor, specifically its forkhead domain and leucine zipper domain. It elucidates the cooperative interplay of these domains in DNA-binding, revealing novel mechanisms of protein folding and emphasising the essential role of the leucine zipper domain on protein stability. This work greatly advances our understanding of FOXP2's structure and paves the way for future investigations in the field.

Supervisor: Dr S Fanucchi

**PRATT, Lawrence**

*Computer Science*

*THESIS:* Solar cell defect detection: deep learning models for defect detection in electroluminescence images of solar PV modules

This thesis introduces multi-class solar cell defect detection (SCDD) in electroluminescence (EL) images of PV modules using semantic segmentation. The unique contributions from this work include two benchmark datasets for multi-class semantic segmentation in EL images of solar PV cells and published articles that document experimental results from various deep-learning models based on fully-supervised, semi-supervised, and self-supervised architectures.

Supervisor: Associate Professor R Klein

**RAPETSOA, Moyagabo Kenneth**

*Geosciences*

*THESIS:* Innovative surface, tunnel, and in-pit geophysical methods for mineral exploration and mine planning: case studies from the Bushveld Complex mines, South Africa

The thesis focuses on integrating numerical modelling, physical property analyses, and geophysical methods (magnetics, electrical resistivity, ground penetrating radar and seismics) for mineral exploration in unconventional environments.

Supervisors: Professor M Manzi and Dr M Westgate

**SEBELE, Temperance**

*Geography, Archaeology and Environmental Studies*

*THESIS:* From coal to renewable energy: perspectives on South Africa's energy transition for a sustainable future

This study was interested in investigating optimal approaches for South Africa's transition from a coal-dependent economy to one driven by renewable energies. It identified contemporary vertical and horizontal systems and processes which can spearhead the Just Transition of the country's economy based on principles of sound socio-ecological and environmental sustainability. The findings have been shared in 2 publications in international peer-reviewed journals.

Supervisors: Professor MD Simatele



**SIBIYA, Nomfundo Patricia**

*Geography, Archaeology and Environmental Studies*

**THESIS:** The role of climate change governance in community adaptation in Kwazulu-Natal: a study of Umkhanyakude District Municipality

The study investigated the nature of how the climate change adaptation landscape in South Africa is formulated and mostly from an angle of understanding the role of government in influencing the propagation of a more engaged and transformative agenda. Of particular interest was to understand; 'whose voices are locked in or out' in climate change discussions, decision making processes and policy formulation. The findings of the study have been shared through 4 publications in international peer reviewed journals.

Supervisor: Professor MD Simatele

**SIHOYIYA, Mpofana**

*Geosciences*

**THESIS:** Cost-effective and novel seismic methods for mineral and coal exploration: examples from Witwatersrand goldfields and Bushveld Complex

The thesis demonstrates the effectiveness of cost-effective and novel reflection seismic acquisition and processing techniques for mineral and coal exploration in hardrock environment. It focuses on in-mine seismic exploration techniques, iterative static corrections, and comparing Kirchhoff-based migration techniques (e.g., PreStack time and depth migration as well as Fresnel volume and coherency migration) for complex structural imaging.

Supervisors: Professor M Manzi and Dr M Westgate

**SINGH, Keshaan**

*Physics*

**THESIS:** Digital toolbox for the generation and detection of vectorial structured light

The candidate has developed and optimised a set of tools for the low-cost, versatile generation and detection of light fields exhibiting structured polarisation, phase, and amplitude. The candidate also demonstrated these tools through the creation of new structured light fields, measurement applications and to achieve robust communication in atmospheric turbulence.

Supervisors: Dr A Dudley and Professor A Forbes

**TAFT, Jody Mathew**

*Animal, Plant and Environmental Sciences*

**THESIS:** Uncovering genetic changes underlying adaptation in southern African dwarf chameleons (*Bradypodion*)

This thesis provides insights into the genetic basis of adaptation in southern African dwarf chameleons (*Bradypodion*) using high-quality genome assemblies. It highlights the role of expanded gene families in adaptive phenotypes and explores evidence of rapid adaptation, particularly in response to urbanisation. The study identifies potential candidate loci as well as summarises the genetic pathways underlying adaptive traits.

Supervisors: Professor G Alexander and Professor K Tolley

**VALLI, Akeel**

*Molecular and Cell Biology*

**THESIS:** Computational modelling approaches to validate the druggability of the 26- and 28-kDa Schistosoma glutathione transferase enzymes using bromosulfophthalein as a benchmark ligand

We document a combined computational chemistry and molecular modelling approach to develop, deploy and evaluate pharmacophore models of the 26- and 28-kDa Schistosoma spp. glutathione transferase enzymes, which have been established as prominent drug targets in the treatment of human schistosomiasis.

Supervisor: Associate Professor I Achilonu

**VAN DER MERWE, Renier Hendrik**

*Geography, Archaeology and Environmental Studies*

**THESIS:** The nineteenth century Matabele settlements on the South African Highveld

In this thesis, historical texts were used to predict the location of nineteenth century Matabele settlement between Zeerust and Mellvale in the North West Province. A subsequent survey of satellite imagery identified 667 potential sites for future ground exploration. This innovative combination of predictive modelling with the use of remote-sensing techniques will improve our understanding of Matabele history in this part of South Africa.

Supervisor: Professor K Sadr