



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and
Agricultural Sciences

Fakulteit Natuur- en Landbouwetenskappe
Lefapha la Disaense tša Tlhago le Temo

Department of Plant and Soil
Sciences

Department of Plant and Soil Sciences

BSc Hons Plant Science
BSc Hons Medicinal Plant Science
BSc Hons Biotechnology

Honours projects 2022

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Information on the Department of Plant and Soil Sciences

The Department of Plant and Soil Sciences is an entity formed out of the merger of the Departments of Plant Science and Plant Production and Soil Science. With over 30 academic staff, the department has a committed team of staff who aim to provide the very best undergraduate and postgraduate education in the broad arena of Plant Sciences, including plant taxonomy, ecology, medicinal plant science, biotechnology, agronomy, plant pathology, horticulture and soil science. In addition, staff carry out locally relevant but internationally competitive research in these fields, and several staff are leaders in these fields.

The department also co-hosts the DTS-NRF Centre of Excellence in Food Security, the SAFCOL Forest Chair and Director of the Forest Programme, and the DST/NRF SARChI chairs in Plant Health Products from Indigenous Knowledge Systems. In addition, several staff are affiliated with the Forest and Agricultural Biotechnology Institute (FABI).

We are housed in two buildings on the Hatfield Campus; the recently constructed Plant Sciences Complex, which is built with pioneering “green” architecture and state-of-the-art research facilities, and the Agricultural Building with associated labs and greenhouse facilities. The Department also has substantial plant growth and field trial facilities on the Hatfield Experimental Farm.

The Department offers the following undergraduate programmes:

- BSc in Plant Science
- BSc in Biotechnology (with the Department of Biochemistry, Genetics & Microbiology)
- BSc in Ecology (with the Department of Zoology and Entomology)
- BScAgric in Animal and Pasture Science
- BScAgric in Applied Plant and Soil Sciences
- BScAgric in Plant Pathology

General Information regarding our BSc Honours Programmes

(Programme coordinator: Dr Johanna Bapela – Johanna.bapela@up.ac.za)

1. Background and Objectives of the Honours programme

Studying the Plant Sciences in South Africa today will open a wealth of discoveries for Honours students. Our country boasts of more than 20 000 plant species, we have spectacular landscapes, and a scientific community committed to conserving our environment for current and future generations. Our botanical wealth is a rich source of medicines, and together with a strong agricultural sector, research in these fields has an exciting future, exemplified by the Bioeconomy Strategy announced by the Department of Science and Technology. The Honours Programme of the Department of Plant and Soil Sciences at the University of Pretoria covers the spectrum of Plant Sciences, allowing students to educate themselves further in the fields of **Plant Diversity, Plant Ecology, Plant Physiology/Biotechnology or Medicinal Plant Science**.

The Department prefers Honours students to register full-time and be present at the Department full-time to complete the Honours course in one year; however, the course is designed to accommodate part-time students who may be employed who are expected to complete in two years. Most of the modules are presented through the Internet, using web-based interactions, complemented by comprehensive campus based practical sessions in specific blocks.

2. Study programme

The course can be completed over one (full-time, recommended) or two years (part-time, allowed only under exceptional circumstances), depending on the time available for study. Modules include theoretical work (presented mostly by means of the internet but also by some contact with lecturers) and practical work, which will be done under guidance during practical blocks on campus (February, April, August). Students are also expected to do a practical project involving either laboratory or field work. The total number of credits should add up to 135. Our Department offers the following Honours courses:

BScHons PLANT SCIENCE (02240707)

(with specialization in one of the following fields)

- Plant Diversity
- Plant Ecology
- Plant Physiology / Plant Biotechnology
- Plant Pathology

BSc (Hons): (Option) MEDICINAL PLANT SCIENCE (02240706)

Suitably qualified students may also enroll for the inter-departmental

BSc (Hons): BIOTECHNOLOGY (02240393)

with a Study Leader in the Department of Plant and Soil Sciences. Please contact Prof D Berger (email dave.berger@up.ac.za tel: 012-420 3770) for further details and consult the section **BSc (Hons): Biotechnology** at <https://tinyurl.com/DePSS-honours>

3. Outcomes

Outcomes are determined by the combination of modules selected. Students may be qualified to do environmental impact assessments (EIA), identify plants, use and develop plant classification systems, extract and isolate bioactive compounds from medicinal plants, employ molecular biological techniques for the breeding of new crops or advanced crop protection, appreciate the complex phytodiversity of southern Africa and its economic potential, advise on the wise and sustainable utilisation of the diversity, become entrepreneurs, consult on matters ranging from environmental impact studies and wildlife management to genetically modified (GM) plant. An Honours degree in Plant Science or Medicinal Plant Science or Biotechnology enables students to subsequently register for a masters and eventually a doctorate degree, and so enhance their understanding and appreciation for the extraordinary world of plants.

4. Aim of the degree

After completion of the Honours degree the student must have sufficient intensive theoretical subject knowledge to be able to apply it independently, to show insight and be capable of discussing the subject with confidence. The student must be able to identify and formulate a problem, compile a project proposal with the necessary literature survey, conduct research under guidance and present a report in the form of a mini-dissertation.

4.1. Prerequisites

A BSc-degree with several Plant Science modules on third year level is a requirement. It is a strong recommendation for applicants to have obtained at least 60% for 300 level Plant Science modules, though this is not an absolute requirement to be accepted for the Honours study. Each application will be considered individually, and the Head of Department will, after an academic staff meeting, make a final decision on whether an applicant will be accepted for the Honours course in Plant Science.

4.2. Closing date

All applications for admission to the BSc Honours degree must preferably reach the course co-ordinator BEFORE, OR ON THE **31st of OCTOBER** of the year preceding the intended study.

4.3. Duration of the degree

The degree extends over one academic year for **FULL-TIME STUDENTS** and over one and a half to two consecutive years for **PART-TIME STUDENTS**.

4.4. Nature of the Honours programme

The theoretical component of most modules are web-based. All the study objectives and outcomes, literature references and assignment information for each module are available on the web modules' sites. These sites become accessible to the student once he/she has registered for the particular module. E-mail is used where students can communicate with fellow students and most importantly, the lecturers. The practical component of each module is completed during block sessions (2 to 4 days per module) during the course of the year.

For more information see:

BScHons Plant Science

<https://www.up.ac.za/yearbooks/2021/programmes/view/02240707>

BScHons Medicinal Plant Science

<https://www.up.ac.za/yearbooks/2021/pdf/programme/02240706>

BScHons Biotechnology

<https://www.up.ac.za/yearbooks/2021/programmes/view/02240393>

Prof. Nigel P. Barker

Head of the Department of Plant and Soil Sciences

BSc (Hons) MSc (Wits) PhD (UCT)



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Professor Barker has an interest in DNA-based methods applied to the systematics and population biology of a range of plant (and previously also animal species), including grasses, legumes, Proteaceae and daisies. He established the Great Escarpment Biodiversity Programme (GEBP) in 2006; a multidisciplinary research group which documents the plant and animal diversity, abundance and distribution across the main mountain range of southern Africa, from Angola through Namibia, South Africa Lesotho to Zimbabwe. He is currently creating a similar research platform to document the diversity of the Waterberg in Limpopo province. His current research interests continue to be focused on plant systematics (especially of groups of plants that are orphan crops), montane biodiversity but he also has interests in the mite – plant mutualism as mediated by leaf domatia, and a growing interest in soil microbial biodiversity, plant genomics and orphan crops.

Potential honours projects:

The genetic diversity of species complexes in the genus *Berkheya* (Asteraceae) (in collaboration with Dr Robert McKenzie and Prof. Per-Ola Karis (Stockholm University)).

Berkheya comprises about c. 80 species distributed throughout South Africa. During sampling for an ongoing unpublished molecular phylogenetic study of *Berkheya* and an assessment of fruit morphology in the genus, it became apparent that the delimitation of two species, namely *B. heterophylla* (Thunb.) O.Hoffm. and *B. pinnatifida* (Thunb.) Roessler, was flawed. Preliminary field work and examination of herbarium specimens suggested that both species concepts include multiple, morphologically diverse elements that may merit taxonomic recognition. Therefore, a thorough reassessment of the two species complexes is required using DNA and morphological data.

Taxonomy of *Greyia*. Co-supervisor: Prof. Braam van Wyk

This small genus of 3 (4?) small tree species is in need of taxonomic revision. This project will study herbarium specimens and undertake a formal taxonomic revision requiring such studies as a numerical taxonomic assessment, as well as possibly a little bit of DNA / molecular systematics to assess species relationships. Possibly some field work to collect additional material. However, this is largely a lab / herbarium based project.

Cytology of marama bean (*Tylosema*). Co-supervisor: Dr K. Oberlander

The chromosome counts in marama beans are varied, with both tetraploids and hexaploids being reported. Little is known about population level variation of chromosome number. This project will obtain chromosome data using flow cytometry with a view to adding to the known literature and cytological data on this potentially agro-economically important plant.

Floristic diversity of Miertjie le Roux farm. Co-supervisors: Dr K. Oberlander & Mr A. Frisby

The university has plans to develop the Miertjie le Roux farm near Cullinan into a new experimental farm. In order to assist with the planning for this farm, a comprehensive plant species list, and perhaps a vegetation classification map, alien invasive assessment, etc. is required.

Section: Medicinal Plant Sciences

Prof. Namrita Lall

Professor

BSc (Hons) MSc (WSU) PhD (UP)

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<https://www.up.ac.za/plant-and-soil-sciences/article/44825/prof-namrita-n-lall>

Professor Lall completed her PhD on the Medicinal Plant Science in 2000, and has published widely in this field since then. She was a visiting Scientist at Kings College London, University of Illinois, Chicago, USA and at CNRS, France. She started working as a lecturer at the University of Pretoria in 2001 and is one of the founders for the development of a new specialized field, called “Medicinal Plant Sciences” at postgraduate level in January 2007 at the University of Pretoria, which is one of its kind in South Africa. Prof Lall has been working on medicinal plants for over 20 years and has succeeded in validating traditional knowledge using science to prove the efficacy of these plants. Prof Lall’s research area involves antituberculosis natural product leads from medicinal plants, cytotoxicity of plant extracts/compounds, anticancer activity of medicinal plants, medicinal plants for skin-disorders, periodontal diseases and isolation and purification of bioactive chemical compounds from plants. One pharmaceutical product has been commercialised and another 13 pharmaceutical and cosmeceutical products which have resulted from her research programme are close to commercialization. She has supervised 25 MSc students and 21 PhD students. Majority of them were South Africans and a few with other nationalities (German, Cameroonian, Mozambican, Indian, Iranian and Egyptian). At present, she is the main supervisor of seven Masters, six PhD-students and co-supervisor of two PhD-student. She is a National Research Chair in Plant Health Products from IKS, which was awarded by the NRF/DST in 2016. She has received funding from the National Research Foundation, Medical Research council, Water research commission and Department of Science and Technology for many years. She currently holds a C1 rating.

Potential honours projects:

The efficacy of medicinal plants for pharmaceutical (Tuberculosis, Cancer, periodontal diseases) and Cosmeceutical (skin-disorders, pigmentation, acne, anti-ageing) purposes.

Identification of bioactive compounds using chromatography.

Mechanism of action of selected lead candidates.

Prof. Marion Meyer

Professor

BSc (Hons) MSc PhD (UP)

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Prof Marion Meyer's research team has made a good contribution to phytochemistry and medicinal plant science, not only in South Africa, but also internationally. They have identified many important novel compounds and developed bioassays not previously used in South Africa.

He introduced the field of Medicinal Plant Science at UP in 1993 and published the first paper (from UP) on this topic in the Journal of Ethnopharmacology in 1995. Since then this research field has grown progressively and many papers have been published and many students have graduated in this field from several Faculties at UP.

Potential honours projects:

Elicitation (stimulation) of an indigenous *Erythroxylum* (coca tree) callus culture for the production of cocaine derivatives.

The indigenous *Erythroxylum emarginatum* doesn't synthesise cocaine like its South American counterpart, *E. coca*. Tissue cultures of the local species have been induced and the aim of this project will be to stimulate the cultures to produce medicinally valuable tropane cocaine derivatives.

Determining the cause and mechanism of the creation of the fairy circles of Namibia.

The working hypothesis of this project is that the milky latex of decaying succulent *Euphorbia* species of the Namibian desert causes the formation of fairy circles. Experiments will be conducted with the latex and desert sand to determine if the latex can cause the sand to become hydrophobic.

Dr Quenton Kritzinger

Senior Lecturer

BSc (Hons) MSc PhD (UP)

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Dr Kritzinger completed his PhD in 2005 with a thesis “Antimicrobial activity and fumonisins associated with cowpea (*Vigna unguiculata*)”, and continued to integrate plant pathology and medicinal plant science into his main research focus areas namely mycotoxins and natural (botanical) pesticides. He leads the MycoBio research group. The overarching aim of his research endeavours is to promote food security amongst small-holder and emerging farmers.

Seed and leaf samples from rural communities from cowpea-producing areas in South Africa and other African countries are being analyzed for fumonisin and other mycotoxin contamination. This is needed to establish whether a problem does indeed exist with regards to contamination of cowpea by mycotoxigenic fungi and their associated mycotoxins, which could lead to potential health problems for both humans and animals. With this information at hand, necessary control and prevention strategies can be developed. Current research activities include studies on mode of action of mycotoxins in cowpea on a molecular, physiological and biochemical level. This research focus area has now included other crops like bambara groundnut and marama beans.

Studies in alternative, cost effective and more environmentally safer ways to control pathogens has gained much interest over the past few years. Our indigenous flora contains a wealth of compounds that have potential to inhibit the growth of harmful plant pathogens. Screenings in our research group have identified a number of plants that have shown promising activity *in vitro* and in greenhouse trials. Further investigations include evaluating the phytotoxic and cytotoxic nature of the plant extracts as well as the isolation and identification of potential active compounds. An exciting field is the reduction potential of plant extracts on mycotoxin production.

Dr Kritzinger has a C2 NRF rating and he has supervised / co-supervised 19 honours students, 13 MSc students and 4 PhD students.

Potential honours projects:

- * Antimicrobial and medicinal activity of cowpea extracts
- * Plant pathogens and mycotoxins associated with traditional medicinal plants and orphan crops
- * Efficacy of plant extracts from indigenous South African plants against economically important plant pathogens (various kinds of projects - *in vitro* assays, greenhouse trials, toxicity trials, product formulation)
- * Growth of medicinal plants and cowpea in an aeroponics system, and effect on biological activity

Dr Emmanuel Tshikalange

Senior Lecturer

BSc (Hons) MSc PhD (UP)

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Dr Tshikalange is a senior lecturer and honours programme co-ordinator in the Department of Plant Science in the Faculty of Natural and Agricultural Sciences. He is particularly interested in ethnobotanical medicinal plants used traditionally in the treatment of sexually transmitted diseases (including HIV/Aids), oral pathogens and wild, edible plants. His current research is focused on investigating biological activity of medicinal plants as possible treatments for Sexually transmitted diseases. Bioassay-guided fractionation of medicinal plants containing promising activity are followed by in vitro mechanistic, toxicological, formulation and Quality control studies.

He has published articles in peer-reviewed national and international journals, such as the South African Journal of Botany and the Journal of Ethnopharmacology and has co-authored chapters in the book Medicinal plant research in Africa: pharmacology and chemistry. He is currently an associate editor of BMC Journal, Evidence-based Complementary and Alternative Medicine. Several postgraduate students have completed their studies under his supervision. He currently holds an Y2 rating for the National Research Foundation.

Dr Johanna Bapela

Lecturer

BSc (Hons) MSc PhD (UP)

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Dr. Johanna Bapela was appointed as a lecturer in the Department of Plant Science at the University of Pretoria in 2011. Her PhD degree was conferred in 2016 with her thesis titled 'NMR-based metabolomic study of medicinal plants used against malaria and the isolation of bioactive alkaloids'. Her research area is mainly focused on bioprospecting indigenous plants for antiprotozoal and antimicrobial plant products, in close co-operation with the French, Swiss and South African collaborators. South Africa, with its rich biodiversity and cultural diversity, could serve as a resource base of therapeutic plant leads with new mechanisms of action. Screening plants based on ethnopharmacological approaches seems to increase the likelihood of finding novel compounds due to their long history of safe use and may therefore increase the prospects of finding novel chemotherapeutic agents. Current projects include, ethnobotanical surveys of medicinal plants used by indigenous South Africans, *in vitro* screening of the selected plants against the pathogens of interest and phytochemical analyses of the bioactive principles in herbal remedies. In addition, metabolomics is being explored as a valuable tool for rapid discovery of phytotherapeutics.

Dr. Bapela has published articles in peer-reviewed journals and is supervising / co-supervising postgraduate students. She is also a member of University of Pretoria Institute For Sustainable Malaria Control (UP ISMC).

Potential honours projects

1. Isolation of antimalarial compounds from *Pappea capensis* (Sapindaceae)
2. Antiplasmodial activity of a polyherbal formulation from *Pyrenacantha grandiflora* (Icacaceae) and *Sclerochiton ilicifolius* (Acanthaceae)

Dr Angelique Kritzinger

Lecturer

BSc (Hons) MSc (UP) PhD (UP)

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Angelique Kritzinger was appointed as a lecturer in the Department of Plant and Soil Sciences in 2016. She completed her MSc in Botany in 2008 her PhD in Science Education in 2018.

First year is the year with the highest dropout rate in higher education and the ability to catch students early in their higher education career and intervene, holds the promise of increase throughput and success. Her research focusses on student success and retention in large enrolment undergraduate courses, with a focus on biology and plant sciences first year courses. She uses learning analytics to assess student characteristics and engagement patterns that are predictive of success in a blended learning environment with the aim of improving student advising and course design to promote success. In addition her research also aims to improve course design in such a way that students become interested in the sciences, especially plant sciences.

Potential honours projects

Sciences education is a relatively new field of study and the options for projects are numerous. Students who are interested in doing “science education” will do Plant Sciences Honours course work with a project that is educational in nature. Projects include themes such as:

- Data mining for student success
- Alleviating plant blindness in society
- Improving undergraduate plant science curriculums

Other projects topics relating to education may be available in discussion with Angelique.

Dr Gary I Stafford

Senior Lecturer

BSc (Hons) MSc (UKZN) PhD (UKZN)

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Dr Stafford completed his PhD in Ethnobotanical Sciences on '*Southern African plants used to treat central nervous system related disorders*' in 2009. He has been awarded two prestigious international postdoctoral fellowships, a Marie Curie Incoming Fellowship, which was held jointly at the Department of Medicinal Chemistry and the Natural History Museum, University of Copenhagen (2010 - 2013), where he help run a new, highly interdisciplinary research project aimed at exploring the potential for using plant phylogenies to predict pharmacological activity, and a one year Swiss Government Excellence Scholarship at the Institute for Systematic Botany, University of Zurich (2014 - 2015). He has also held two South African fellowships, including an NRF Scarce Skills Postdoctoral Fellow at the Department of Botany and Zoology, Stellenbosch University.

Dr Stafford was appointed as a Senior Lecture (Phytomedicine) in the Department from August 2017. He is currently an NRF C-rated researcher and has published 46 articles and 2 book chapters, which according to Scopus, have been cited over 1250 times. He also sits on the editorial board of the South African Journal of Botany and reviews for several international journals. He currently collaborates with researchers at 12 institutes and research groups in Africa, China, Europe and USA. His current research explores three main areas:

- The evolution of plant secondary metabolites through studies of potential correlations between phylogeny, population genetics, and biological interactions, such as herbivory or endosymbionts, on the quantity and quality of natural products (chemical functional traits).
- The ethnobotany, chemistry and biological activity of plant-derived smoke.
- The ethnobotany, chemistry and biological activity of plants used to treat central nervous system-related ailments, such as epilepsy, anxiety, depression, Alzheimer's and Parkinson's disease.

Dr Stafford has supervised/co-supervised several BSc Hons and 3 MSc students.

He will not be taking on students in 2021.

Section: Plant Physiology and Biotechnology

Prof. Dave Berger

Professor

Forestry and Agricultural Biotechnology Institute

BSc (Hons) PhD (UCT)

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Prof Berger's general research field is molecular plant pathology. His research seeks to gain a molecular understanding of host-pathogen interactions in crops important for food security in Africa. He is principal investigator of the Molecular Plant-Microbe Interactions (MPPI) research group which is also affiliated with the Forestry and Agricultural Biotechnology Institute (FABI) at the University of Pretoria.

His current research programme is focused on foliar diseases of maize, particularly grey leaf spot (GLS) of maize caused by the fungus *Cercospora zeina*. GLS is a globally important disease prevalent in the Americas, Asia, and throughout sub-Saharan Africa including South Africa.

The MPPI research group is intrigued by the question "What is the molecular basis of resistance to GLS in maize?" We take a systems genetics approach to answer this question. We collaborate with maize breeders and field pathologists to understand the disease in its Agricultural context, with the long term aim of developing tools for maize improvement, such as marker assisted selection.

Research on the pathogen addresses the question: "What is the diversity and molecular basis of pathogenicity in the fungus *Cercospora zeina*?" Our strategy includes population genetics, comparative genomics and functional genomics approaches with the aim to develop innovative control methods.

Honours projects are designed to contribute to answering these two questions.

Our research has a strong collaborative element, both locally and internationally, and this extends to projects on important crops outside the maize-GLS research programme.

Prof Berger was recipient of the National Science and Technology Forum (NSTF) – South32 award in "Crop Science and Food Security" in 2016, and two awards for Capacity Building in Biotechnology from the Department of Science and Technology, and the Gauteng Provincial Government.

His research has been published in the scientific journals PNAS, Journal of Molecular Biology, The Plant Journal, New Phytologist, Molecular Plant-Microbe Interactions, Molecular Plant Pathology, Theoretical and Applied Genetics, BMC Genomics, to name a few. More than 50 postgraduates have graduated under this supervision, and he has hosted 13 Postdoctoral Fellows. He holds a National Research Foundation B2 Rating that reflects the international recognition for his research.

MPPI research group website: <http://tinyurl.com/FABI-MPPI>

Dr Nicky Creux

Senior Lecturer

BSc (Hons), MSc, PhD (University of Pretoria), Postdoctoral Fellowship
(University of California, Davis)

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Dr Nicky Creux completed her PhD in 2014 in the Department of Genetics at the University of Pretoria, under the supervision of Prof Zander Myburg. Her dissertation focused on the transcriptional regulation of cellulose synthase genes in *Eucalyptus*. This research followed on from her MSc and together these projects resulted in a patent and three publications. After her PhD, Dr Creux started a fully funded NSF postdoctoral fellowship at the University of California, Davis under the supervision of Prof Stacey Harmer. Dr Creux recently joined the Department of Plant and Soil Science and the Forestry and Agriculture Biotechnology Institute (FABI) as a Senior Lecturer. Here she combines both molecular genetics and plant physiology to understand how crop biology is influenced by and responds to environmental cues in a changing environment. Dr Creux's research focuses on understanding how these environmental changes will impact the timing of flower maturation, pollinator visits, pollination and ultimately crop yield both on a physiological and molecular level.

The main honours projects currently available in Dr Creux's research programme for 2021:

1. **Maize speed breeding optimization and determination of environmental factors impacting different growth stages of top maize hybrids.** *Training includes:* speed breeding technologies, plant phenotyping (including growth development, flowering, yield quality and quantity), statistical analysis, plant-environment modelling
2. **Effects of planting date on anthesis, pollination and seed development in sunflower.** *Training includes:* Field research, time-lapse photography, Flower physiology (including pollen viability, stigma receptivity, timing of anthesis events), plant-pollinator interactions.
3. **Describing sunflower gene families and investigating their role in sunflower floret response to temperature stress.** *Training includes:* Bioinformatic analysis (including BLAST, Phylogenies, in Silico gene expression analysis), RNA extraction, cDNA synthesis, Primer design and RT qPCR for gene expression analysis.

Please contact Dr Nicky Creux if you have any questions about these projects or are excited to learn more about crop floral biology and environmental interactions.

<https://www.fabinet.up.ac.za/index.php/people-profile?profile=1031>

Prof Juan Vorster

Associate Professor

BSc (Hons), MSc (*Cum laude*), PhD (UP)

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I did my undergraduate degree in plant physiology and an MSc in molecular biology at the University of Pretoria. During my PhD I spent more than a year conducting research in whole genome comparisons at Case Western Reserve University in Cleveland, Ohio in the USA, before returning to the University of Pretoria to complete my PhD in 2008. This was followed by a Postdoctoral Fellowship at the Université Laval in Quebec City, Canada that focused on recombinant protein expression as well as protein modelling and rational design of proteins for improved function.

I currently lead the Plant Molecular Physiology group and our main focus is on understanding plant stress. We focus in particular on the interaction between cysteine proteases and cysteine protease inhibitors and the involvement of this protease-protease inhibitor system in soybean nodule development. Root nodules are important to fix nitrogen in legumes such as soybean. Since cysteine proteases have been previously identified to play an important role in plant senescence, a specific research target is the identification of inhibitor involvement in preventing cysteine protease activity in particular during premature stress-induced nodule senescence.

I am also a co-lead in the South African Herbicide Resistance Initiative where we investigate herbicide resistance mechanisms in different weeds towards the commonly used herbicide Glyphosate as well as other herbicides. Currently we have a strong focus on the newly invasive weed *Amaranthus palmeri* that has been shown to be resistant to multiple herbicides.

I have supervised and co-supervised 15 completed MSc and 6 PhD studies and I am currently president of the South African Society of Crop Production (<https://sascp.org.za/>).

Dr David Livingstone Nsibo

Lecturer

BSc Agric (Hons) (Makerere University)

MSc (Wageningen University and Research Centre)

PhD (UP)

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Dr Nsibo completed his PhD in 2019 in the Department of Plant and Soil Science, University of Pretoria under the supervision of Prof. Dave K. Berger and Prof. Irene Barnes. His dissertation focused on the population genetics of the maize foliar pathogen *Cercospora zeina* in Kenya, South Africa, Uganda, Zambia, and Zimbabwe using microsatellite markers. Throughout this study, there was cumulative evidence that *C. zeina* is highly diverse, owing to cryptic sexual recombination, migration, and gene flow. Due to its high evolutionary potential, it is likely to become one of the most prevalent airborne and splash-dispersed foliar pathogens of maize in addition to *E. turcicum* and *B. maydis*, causing severe epidemics in Africa and globally. For its effective management, therefore, the study recommended the deployment of a mixture of resistant maize genotypes and the usage of fungicides in either varying combinations or in rotations depending on their mechanisms of action.

Dr Nsibo recently joined the Department of Plant and Soil Science and FABI as a Lecturer. His research is aimed at determining the extent and patterns of genetic variation in populations of foliar pathogens of cereals and to understand how these pathogens cause disease using an array of innovative molecular-based and genomics-based tools. Currently, he is working on the genetic diversity of *Exserohilum turcicum*, a foliar fungal pathogen of maize and sorghum and is taking a multifaceted approach utilizing genetics, molecular biology, and evolutionary biology to understand its population genetic structure. Questions explored relate to the evolutionary factors influencing the pathogen's genetic diversity; dispersal mechanisms; migration patterns; and genetic diversity. Ultimately these studies will foster the development of efficient management strategies of the pathogen, thereby promoting increased maize production.

Possible Honours projects for 2022

- The population structure of *Exserohilum turcicum* of maize across a hierarchy of micro-geographical spatial scale
- Novel fungicidal activity against *Exserohilum turcicum* on maize

Section: Plant Biodiversity

Prof. Paxie W Chirwa

SAFCOL Forestry Chair

BSc For. (Hons) Bangor, UK

MSc Gainesville, Florida, USA

PhD Nottingham, UK.

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Professor Paxie Chirwa is Professor of Forest Science and the SAFCOL Forest Chair & Director of the Forest Programme in the Department of Plant and Soil Sciences. He has BSc For. (Hon) from Bangor University (Wales, UK), MSc. Forest Science from University of Florida (Gainesville), USA and a PhD in Plant Sciences from University of Nottingham, UK.

Paxie has over 30 years of experience working in forestry research covering most fields of forestry research: notably site characterization, tree-crop interactions including soil water and nutrient dynamics in agroforestry systems and socio-ecology in the miombo forest ecosystems. He also works on community forestry and forest development in South Africa.

Paxie has an Africa-wide experience in forestry with collaboration with many international forestry institutions and organizations. His work in Africa includes forest restoration and rehabilitation, forest ecology and management, forests and climate change.

Paxie has supervised to completion a number of postgraduate students in forest related research. He has published widely in peer-reviewed journals and in books (book chapters). He has also been a Guest Editor on journals like International Forestry Review, Southern Forests, and Agroforestry Systems Journal. He is also one of the editors for a book on Miombo Vegetation titled **“Miombo Woodlands in a Changing Environment: Securing Resilience and Sustainability of People and Woodlands”** Springer. His current research areas of interest include socio-ecology, forest management and ecology, climate change and forestry, forestry development and land claims. He is also an associate editor for the Agroforestry Systems Journal, Southern Forests: A Journal of Forest Science, Journal of Forestry Research (Elsevier), and Scientific African Journal. Paxie has a C2 NRF Rating.

Paxie is also a member of the Southern African Institute of Forestry (SAIF), member of the African Forest Forum and serves on the reference groups of South African Water Research Commission and on different forest related panels of the NRF.

Dr Michelle Greve

Senior Lecturer

BSc (Hons) MSc (Stellenbosch University)

PhD (Aarhus University)

Michelle.greve@upac.za



Dr Michelle Greve is a senior lecturer at the Department of Soil and Plant Sciences at the University of Pretoria. She completed her PhD on the patterns of diversity and distribution of African vegetation at macroecological scales at Aarhus University in Denmark. Her research reflects her interest in biogeography, i.e. understanding how patterns of diversity and distribution of organisms have come about, what these patterns tell us about the evolutionary drivers of these patterns, and how we can use this information for conservation prioritisation, with a particular focus on the Southern Hemisphere. She also had an interest in savanna ecology, and invasion ecology, with a specific focus on the interaction between biological invasions and climate change in the region.

Dr Greve has published in journals such as *Nature Communications*, *Global Ecology and Biogeography* and *Journal of Biogeography*, and her work has been featured in *Science* and in the popular media. She currently holds a grant from the South African National Antarctic Programme aimed at understanding the determinants and risks of alien invasions across the islands of the Sub-Antarctic region. Another focus is understanding the interaction and interdependence between trees and birds at different scales across southern Africa. Dr Greve has a Y1 rating from the NRF.

Prof Peter C. le Roux

Senior lecturer

BSc (Hons) (UP) MSc PhD (Stell.)

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Prof le Roux completed his PhD in 2008, and undertook two post-doctoral fellowships (at the Centre for Invasion Biology at Stellenbosch University, and at Helsinki University) before starting at the Department in 2013.

His research chiefly focuses on understanding the biotic and abiotic determinants of species distributions, with a particular interest in how interspecific interactions might mediate, and be affected by, the ecological impacts of climate change. His research has largely been conducted within abiotically extreme environments, including sub-Antarctic islands, sub-Arctic tundra and alpine grasslands. This research has resulted in 3 book chapters and 59 publications in ISI-accredited journals (August 2020).

Some potential Honours projects for 2021 from Prof Peter le Roux and collaborators:

- 1) Examining variation in the abundance, morphology and functional traits of a succulent species across a grazing gradient. This project will test if a widespread succulent species varies in abundance, morphology and the expression of above-ground functional traits under differing grazing intensities, comparing two areas of differing aridity.
- 2) Test if seed bank composition constrains passive restoration of old fields. This project will compare seed bank characteristics between adjacent natural savanna vegetation and abandoned fields to understand if seed limitation traps old fields in early succession stages, or whether other mechanisms are potentially inhibiting restoration.
- 3) Testing if the outcome of a pairwise plant-plant interaction on Marion Island can be better predicted using proximal (e.g. soil moisture and temperature) or distal (altitude and aspect) environmental variables. This work will build on a recent MSc project that examined the entire plant community, and will focus on one well-studied grass species.

Data for projects (1) and (3) have already been collected, but students will have opportunities to assist with other fieldwork, and will be required to contribute to the collection and processing of other datasets being developed in the research group.

Dr Kenneth Oberlander

Senior lecturer

BSc (Hons) MSc PhD (Stell.)

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Dr Oberlander is a senior lecturer in the Department of Plant and Soil Sciences, UP, as well as the curator of the H.G.W.J. Schweickerdt Herbarium in the same Department.

Kenneth completed his PhD thesis entitled "Molecular Systematic Study of southern African Oxalis (Oxalidaceae)" in 2009, focussing on the phylogenetics of this large and biogeographically interesting African genus. He completed two post-doctoral fellowships, one on the conservation genetics and biogeography of Cape vernal pool aquatics in 2009-2010 at Stellenbosch University, South Africa, and another on the evolutionary importance of polyploidy in the Cape Flora (2012-2013) at the Institute of Botany of the Czech Academy of Sciences, Czech Republic.

His research focus is on the phylogenetics and evolutionary history of the Cape Flora of South Africa, a globally recognised centre of plant diversity and endemism and one of the countries greatest biological assets. The Flora as a whole holds nearly a quarter of Africa's vascular plant diversity in 1 % of its area and has been a source of fascination to biologists for centuries. He is an expert in the biologically fascinating plant family Oxalidaceae. He is the author of 34 peer-reviewed papers and has supervised 1 PhD, 2 Masters and 5 Honours/4th-year students.

Key additional areas of interest are:

Polyploidy (whole genome duplication) - this biologically important process is of massive economic importance (a large proportion of humanities crops are polyploid), but only in recent decades has realisation of its evolutionary impact experienced a renaissance. The impact of flow cytometry on genome size estimation has greatly accelerated the depth and breadth to which polyploidy can be studied. The Cape Flora appears to be surprisingly depauperate in polyploids despite its immense species richness, but many key groups remain unexplored for ploidy variation. The African Flora as a whole is very poorly explored for ploidy variation, and this is an area of great promise for future research.

Phylogenomics - the current sequencing revolution has greatly impacted the study of phylogenetics (study of evolutionary relationships between species), and species trees based on hundreds or thousands of genes are becoming routine. The benefits and challenges of this tsunami of data are an exciting field going forward, and one in which very few of South Africa's plant lineages have been involved.

Taxonomy - the basic and essential methodology of naming a lineage. Africa is desperately understaffed and underfunded for this most fundamental part of biology, and many plant groups urgently require systematic attention.

Prof. Lise Korsten

Professor

PhD (UP)

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Prof Korsten is currently responsible for the food safety and regulatory control programmes within the DST Centre of Excellence Food Security. She is also responsible for the food safety programme within the Institute for Food Nutrition and Well-Being. She is a chief editor of Crop protection and is chairing the International Society for Plant Pathology Task Force on Global Food Security.

Prof Korsten developed South Africa's first biocontrol agent for fruit and established a biocontrol research group at the University of Pretoria that has published extensively. Prof Korsten has also established a fruit health group that focuses on food safety of fresh produce and on Sanitary and Phytosanitary aspects related to international trade.

Prof Korsten has focussed her research mainly on complementary fields of postharvest technology and food safety as related to international trade in fresh produce. She has been able to establish research teams in food safety, postharvest technology, biocontrol and mushroom health. As a team they have been able to develop several innovative technologies to reduce disease and prevent product contamination. The value of her research programmes can best be illustrated by the consistent industry financial support. She has been able to attract extensive funding over her entire academic career. The high number of papers presented or published reflects the impact of her research work. Prof Korsten has had two projects funded by the Water Research Commission, titled "Evaluation of the risks associated with the use of rain water harvested from roof-tops for domestic use and homestead food gardens, and groundwater for domestic use and livestock watering", and "An investigation into the link between water quality and microbiological safety of fruit and vegetables from the farming to the processing stages of production and marketing".

Commercialisation of research outputs: Prof Korsten has also developed one of the first biocontrol products in South Africa that was patented, registered and commercialised and that is still used in the South African fruit industry. A similar citrus fruit disease biocontrol agent has been developed and is now in the process of being registered for commercial use. An alternative mushroom casing material has been developed from waste products and a technology to produce mushrooms in containers. The alternative mushroom casing material is now licenced to Mabu Casing and produced as a commercial product for the mushroom and nursery industry.

She has supervised 48 MSc students, 15 PhD students and 7 Post Docs.

Prof. Jacquie van der Waals

Associate Professor

BSc (Agric) MSc, PhD (UP)

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Prof van der Waals began research on potatoes in 1998, with her PhD on the epidemiology of early blight on potatoes, and then established the Potato Pathology Programme @ UP (PPP @ UP). The ongoing and planned future focus of the PPP @ UP is detection and monitoring of potato pathogens in South Africa, understanding resistance mechanisms, integrated management strategies, and effects of climate change; using cutting edge technology to align with the international phytobiome vision. The main pathogens of interest in this programme are *Pectobacterium carotovorum* subsp. *brasiliense* (blackleg and soft rot), *Rhizoctonia solani* (black scurf and stem canker), *Spongospora subterranea* f. sp. *subterranea* (powdery scab of potatoes), *Sclerotinia sclerotiorum* (stem rot of various crops, including soybeans) and *Plasmodiophora brassicae* (clubroot of cabbage) . As the soil environment is considerably more complex than the foliar environment of the plant, it is important to ensure a multi-disciplinary approach when dealing with soilborne pathogens. Prof van der Waals thus collaborates with agronomists, soil scientists, molecular biologists and biochemists to elucidate the effect of soil physical and chemical properties on the microbiome of healthy and diseased plants. Another focus of her research is evaluation of the effects of rotation crop selection and sequences on soil health and thus crop productivity and health. She believes that management of soilborne pathogens relies on an integrated approach with a strong focus on incorporation of biological products in the programme. Results from the research in this programme will further our understanding of biology, epidemiology and spread of the respective pathogens, while providing South African and international growers with advice on sustainable production of this staple food crop.

Prof van der Waals has consistently received funding from the NRF and Potatoes South Africa (PSA) since 2005 and the PPP @ UP is now one of the flagship research programmes funded by PSA, receiving approximately 10% of their total research budget. She also received funding from the Sasol Agricultural Trust and the Protein Research Foundation of South Africa.

Prof van der Waals is an associate editor for Crop Protection, Phytoparasitica, Phytopathology and European Journal of Plant Pathology. She has supervised or co-supervised >20 BSc Hons / BSc (Agric) final year; 18 MSc and 5 PhD students, and is currently supervising two BSc (Agric) final year, one BSc Hons, four MSc and seven PhD students. She has authored or co-authored >48 peer-reviewed articles; written chapters or sections for three books and >45 lay articles.

Possible Honours projects for 2021:

- Host status of selected cover crop species to important soil-borne pathogens
- Microbial functional diversity in rhizosphere soils infected with *Rhizoctonia solani* in KwaZulu-Natal and Sandveld potato production regions in South Africa (EcoPlate) (field sampling)

Section: Crops and Agronomy

Prof Wayne F Truter

BSc (Agric) MSc (Agric) PhD (UP) MGSSA, IAEA Pri. Sci. Nat

Associate Professor

Forage, Pasture and Land Reclamation Sciences (FPLRS) Programme

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Research Programme Website: www.fplrs.com



Prof Truter is currently employed by the University of Pretoria as an Associate Professor and researcher, in the Department of Plant and Soil Sciences, in the Faculty of Natural and Agricultural Sciences. He holds a B.Sc. Agric degree in Animal / Pasture Science, M.Sc. Agric in Rangeland and Forage Science, Ph.D in Integrated Agricultural and Environmental Sciences. Wayne's main field of specialization is to understand the interrelationships between soil, vegetation, water and animals in the agricultural discipline and the discipline of Land Reclamation (Rehabilitation) of mined and disturbed agricultural land.

This work also includes:

- The growth enhancement, management and development of forage and pasture species
- The agricultural use of agricultural and industrial by-products (waste), coal combustion by-products, poor quality mine water and effluents, especially in land reclamation to establish sustainable agricultural systems on such land.
- Revegetation of rehabilitated soils to establish specialized agricultural (pasture) production systems.

Professional responsibilities: (Forage, Pasture and Conservation Agricultural Sciences and Management)

- **Board Member** of The Ministerial Conservation Advisory Board to the Department of Agriculture, Fisheries and Forestry (DAFF)
- **Universities South Africa representative** at Department of Agriculture - National Agricultural Research Forum (NARF)
- **Research Programme Director** of the Forage, Pasture and Land Reclamation Sciences Unit at the University of Pretoria
- **Director:** African Forage Quality Reference Laboratory at University of Pretoria
- **Principal Advisor** to South African House of Traditional Leaders and United Royal Kingship Holdings
- **Past President** of the Grassland Society of Southern Africa (GSSA) and
- **Associate Editor:** African Journal of Range and Forage Science
- SANSOR: Forage Division Committee Member

Professional responsibilities: (Land Rehabilitation)

- **Chairman:** Phakisa Government Working Group on Ash in Water and Land Reclamation

- **Principal Advisor** to Department of Environmental Affairs, Forestry and Fisheries – Working for Land Reference Group
- **Steering committee member** (DEA) Department of Environmental Affairs National Terrestrial Carbon Sinks 2013-2015
- **Non-Executive Director** – Coal Mined Land Rehabilitation Centre of Excellence (CMR2)
- **Programme Leader:** Land Rehabilitation Services Unit at Enterprises Division of the University of Pretoria
- **The Founder Member and 1st President** of the Land Rehabilitation Society of Southern Africa (LaRSSA),
- Life Member of the American Society of Mining and Soil Rehabilitation (ASMR).
- Member of TCTA (Trans Caledon Tunnel Authority) panel of experts on land rehabilitation of installed pipelines.
- Member of the International Working Group on Ash in Agriculture
- **Vice President** of the South African Coal Ash Association (SACAA).

Current Research Projects: Visit <https://www.fplrs.com/research/>

Current Research Outputs: https://www.researchgate.net/profile/Wayne_Truter
<https://orcid.org/0000-0001-7701-3481>

Possible Honours projects for 2021:

- The determination of forage quality value of pasture cover crops interseeded or planted in rotation with maize and soya.