



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**Faculty of Health, Applied Sciences and Natural Resources**

## Research Day 2022

**Theme: Realigning and Consolidating Research Capacity for  
Relevance in Health, Applied Sciences and Natural Resources**

**Date:** Wednesday, 11 May 2022

**Time:** 08:20 - 13:00

**Venue:** HAS Auditorium



## Overview of the Faculty of Health, Applied Sciences and Natural Resources

The Faculty of Health, Applied Sciences and Natural Resources offers programmes aimed at the production of graduates for the Public Health, Agriculture and Natural Resources, Applied Sciences and Applied Mathematics and Statistics economic sectors of the country. The Faculty consists of four (4) departments viz. Agriculture and Natural Resources (ANR), Health Sciences (HS), Mathematics and Statistics (MAS) and Natural and Applied Sciences (NAS). The Faculty currently offers Bachelor of Science professional degree programmes (NQF level 8) in Medical Laboratory Sciences (formerly Biomedical Sciences), Environmental Health Sciences and Human Nutrition; Bachelor's degrees (NQF level 7) in Applied Mathematics and Applied Statistics, Emergency Medical Care, Health Information Systems Management and Natural Sciences. It also offers Honours (NQF level 8) in Science with specialisations in Applied Biology, Biotechnology, Applied Chemistry and Applied Physics and Honours in Applied Mathematics and Applied Statistics. At Masters' degree (NQF level 9), the Faculty offer MSc degrees in Applied Mathematics and Applied Statistics, Natural and Applied Sciences and Master of Health Sciences. Currently offered Doctor of Philosophy degrees (NQF level 10) are in Applied Mathematics, Applied Statistics and Health Sciences.

## Introduction to the Faculty's Research

Research areas of the Faculty revolve around relevant societal and industrial investigations that are expected to contribute to the scientific and technological development of the country. Research activities in the Faculty is conducted within five (5) niche areas namely, Environmental and Human Health; Indigenous Knowledge and Medicinal Plants; Mathematical and Statistical Modelling, Nanotechnology and Advance Materials and Agriculture and Natural Resources. Other research activities that are not aligned directly with the above niche areas are also accommodated.

The Faculty encourages both community-based reflective and Multi-, Inter-, and Trans-disciplinary (MIT) research activities. The former ensures the translation of research knowledge for the benefit of people in our communities. The latter forms the basis of development and contemporary problem solving in line with the provisions of NDP-5 and vision 2030. From the above, the Faculty aims to conduct quality and outcome-based applied research for the benefit of people. This will focus primarily on national priorities followed by regional, continental, and global needs.

**Vision:** Spearheading knowledge creation in Agriculture, Health, Natural Resources and Applied Sciences for innovation, technological, and entrepreneurial nation

**Mission:** A dynamic and responsive Faculty, meeting the needs of stakeholders through excellent education, applied research, innovation, and service.

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## Programme

Director of Ceremonies

**Prof Omotayo Awofolu**

*Associate Dean: Research and Innovation*

**Dr Julien Lusilao**

*Senior Lecturer: Department of Natural and Applied Sciences*

Time	Activities / Topics	Presenter
8:20	Registration	<b>Ms Muriel Mouton</b>
8:30	Welcome Remarks	<b>Dr Onesmus Shuungula</b> Dean: Faculty of Health, Applied Sciences & Nat. Res.
8:40	Opening Statement	<b>Dr Colin Stanley</b> Ag. DVC: Research, Innovation & Partnership
9:00	Creating an enabling environment for Research and Innovation	<b>Dr Anna Matros-Goreses</b> Exec. Dir., RIP
<b>Session I: Invited Speaker</b> Chairperson: Prof Morgan Hauptfleisch		
9:20	Collaborative approaches to addressing applied conservation and natural resource management challenges in diverse and dynamic landscapes	<b>Mr Kenneth Heinrich /Uiseb</b> Dep Dir., Wildlife Monitoring & Research, Directorate of Scientific Services, MEFT
10:00 - Break		
<b>Session II: Faculty Presentations</b> Chairperson: Prof Rakesh Kumar		
10:20	Identification of differentially expressed genes in tolerant and susceptible potato cultivars in response to <i>Spongospora subterranean</i> f.sp. <i>subterranea</i> tuber infection	<b>Dr Norman Muzhinji</b> Snr. Lecturer, Dept. of Nat. & Applied Sciences, NUST
10:35	Penalised Portfolio of Optimization Models with Augmented Lagrangian	<b>Ms Kornelia David</b>
10:50	Investigating Foetal Maternal Haemorrhage in Stillbirths, Windhoek Central Hospital, Namibia	<b>Ms Edwig Hauwanga</b> Junior Lecturer, Medical Lab Sciences, DHS, NUST

<b>Departmental Research Outlook</b>		
11:10	<ul style="list-style-type: none"> <li>· Agric &amp; Nat. Res Sciences</li> <li>· Health Sciences</li> <li>· Natural &amp; Applied Sciences</li> <li>· Mathematics &amp; Statistics</li> </ul>	<b>Dr Mwala Lubinda</b> <b>Dr Maurice Nyambuya</b> <b>Prof Dipti Sahu</b> <b>Dr David Iiyambo</b>
<b>Session III: Faculty Presentations</b> Chairperson: Dr Yapo Aboua		
11:50	Plant influences on the taxonomic and functional diversity of soil microbial communities in the hyper-arid Namib Desert, Namibia	<b>Ms Elise N. Nghalipo</b> Jnr. Lecturer and PhD Candidate
12:05	Investigating T-helper 2-mediated immune response in children with type 1 hypersensitivity	<b>Ms Elina Nepolo</b> Supervisor, Immunochemistry department NIP, Windhoek
12:20	Investigating the radiological safety of uranium ore deposits from a uranium mine in Namibia	<b>Mr Vaino Indongo</b> Lecturer, Dept. of Nat. & Applied Sciences, NUST
12:35	Closing Remarks	<b>Prof Percy Chimwamurombe</b> Prof. Applied Sciences, NUST

## Presentation Abstracts



### Collaborative approaches to addressing applied conservation and natural resource management challenges in diverse and dynamic landscapes

Author

Kenneth Heinrich /Uiseb

Deputy Director, Wildlife Monitoring and Research, Directorate of Scientific Services, Ministry of Environment, Forestry and Tourism (MEFT)

#### Abstract

State agencies are responsible for wildlife conservation and for the management of protected areas. Approaches to management of wildlife and protected areas has changed over the years in Southern Africa requiring participation of non-state actors in wildlife conservation and protected area management. Sound research and monitoring systems are required to better understand the complex interactions between wildlife and their habitats to ensure sustainable resource management that meets the ecological as well as societal objectives. A mutually beneficial collaboration between academic institutions and government conservation agencies offers opportunities for sustained long-term ecological research forming foundation for applied conservation management of the complex but dynamic systems.



### Identification of differentially expressed genes in tolerant and susceptible potato cultivars in response to *Spongospora subterranea* f.sp. *subterranea* tuber infection

Authors

Muzhinj N<sup>1</sup>., Lekota M<sup>2</sup>., van der Waals J. E<sup>3</sup>

<sup>1</sup>Department of Applied and Natural Sciences, Namibia University of Science and Technology, Private Bag 13388, Windhoek, Namibia

<sup>2</sup>Department of crop Sciences, National University of Lesotho, Maseru, Lesotho

<sup>3</sup>Department of Plant Sciences, University of Pretoria, Pretoria, South Africa

#### Abstract

Powdery scab caused by *Spongospora subterranea* f. sp. *subterranea* (Sss) has recently become one of the most devastating potato diseases of economic importance globally. The use of resistant cultivars has long been considered the most effective and sustainable strategy to manage the pathogen; yet little is known about the molecular mechanisms underlying resistance of potato tubers to Sss. Using RNA-sequencing (RNA-seq), 2058 differentially expressed genes (DEGs) were identified from two potato cultivars (tolerant and susceptible) in response to Sss infection. Analysis of the expression patterns of 10 selected defence-response genes was carried out at two different stages of tuber growth using RT-qPCR to validate the RNA-seq data. Several defence-related genes showed contrasting expression patterns between the tolerant and susceptible cultivars, including marker genes involved in the salicylic acid hormonal response pathway (StMRNA, StUDP and StWRKY6). Induction of six defence-related genes (StWRKY6, StTOSB, StSN2, StLOX, StUDP and StSN1) persisted until harvest of the tubers, while three other genes (StNBS, StMRNA and StPRF) were highly up-regulated during the initial stages of disease development. The results from this study suggest that the tolerant potato cultivar employs quantitative resistance and salicylic acid pathway hormonal responses against tuber infection by Sss. The identified genes have the potential to be used in the development of molecular markers for selection of powdery scab resistant potato lines in marker-assisted breeding programmes.



## Penalised Portfolio of Optimization Models with Augmented Lagrangian

Author

Ms Kornelia David

Dept. of Mathematics and Statistics, Faculty of Health, Applied Sciences & nat. Res. Sciences, Namibia University of Science & Technology, Windhoek, Namibia

### Abstract

The research focuses on formulating three portfolio optimisation models, namely the Markowitz portfolio model, the index tracking model, and the enhanced indexation model. Our portfolio consists of a set of financial assets from different financial markets including the local Namibian market. Historical market prices of these assets are used to formulate the three models and these models are solved using the Augmented Lagrangian method. The research investigates how the Augmented Lagrangian method together with the use of penalty parameters improves solutions to portfolio optimisation models in terms of asset allocation, minimising risk and maximising returns, which are all major aspects of portfolio optimisation. The Generalized Reduced Gradient (GRG) optimization method is employed in the study to solve the models and the results are compared to that of the Augmented Lagrangian method. From the results of our study, the index tracking model tends to improve the global minimum obtained by the Markowitz portfolio model by reducing the risks and increasing the expected returns while providing a fair distribution of assets within the portfolio. The study's results prove that the index tracking model is best recommended over the Markowitz portfolio model. Although the index tracking model provides better results when compared to the Markowitz portfolio model, it can further be improved by enhancing the returns of the benchmarks which leads to a new model known as the enhanced indexation model. By using the three above-mentioned models of portfolio optimisation, the study proved some general assumptions on investors' behaviours made by the pioneer of portfolio optimisation Harry Markowitz.



## Investigating Foetal Maternal Haemorrhage in Stillbirths, Windhoek Central Hospital, Namibia

Author

Ms Edwig Hauwanga

Dept. of Health Sciences, Faculty of Health, Applied Sciences & Nat. Res. Sciences, Namibia University of Science & Technology, Windhoek, Namibia

### Abstract

**Background:** Two point six million stillbirths occur annually with most cases being from low to middle-income countries (LMICS) of Sub-Saharan Africa. Foetal maternal haemorrhage (FMH) is associated with poor pregnancy outcomes such as maternal alloimmunisation, foetal anaemia, haemolytic disease of the foetus and new-born (HDFN) and stillbirths. Therefore, this study primarily aimed to determine whether FMH is associated with inflammation, maternal alloimmunisation and altered hepatorenal function.

**Methods:** This was a descriptive cross sectional study involving mothers who gave birth to stillborn babies at the Windhoek Central Hospital between August 2019 to February 2020. A total number of 60 samples were randomly collected. Blood samples were drawn from these patients were assessed for FMH. The demographic information, inflammatory profiles, haematological indices, hepatorenal function and antibody screening and identification were also obtained.

**Results:** The prevalence of FMH in the included patients was at 25% (n = 15). Comparisons of FMH positive and negative cases on sociodemographic characteristics were comparable (p>0.05). The mean cell volume (MCV) (86.10 ± 3.53) and mean cell haemoglobin (MCH) (29.00 ± 1.34) were significantly lower in the FMH positive group in comparison to that of the FMH negative cases (94.03 ± 5.56), p = 0.0043 and (31.76 ± 2.07), p=0068, respectively. High C-reactive protein (CRP) 23.8 [6.9 - 52.6] levels were seen amongst participants. Notably, women with FMH had significantly higher levels of WCC (p=0.0143) and lymphocytes (p=0.0237). Assessment of renal profiles showed significant differences in sodium, urea, creatinine, and glomerular filtration rate (eGFR) (p<0.05) amongst the two groups.

**Conclusions:** Foetal maternal haemorrhage is associated to poor foetal outcomes, at times even stillbirths. Foetal maternal haemorrhage predisposes expectant mothers to alloimmunisation of significant red cell antibodies such as anti-D and anti-E that can cause serious foetal haemolysis in subsequent pregnancies. Foetal maternal haemorrhage is associated with inflammation that can worsen the anaemic condition in pregnancy. Apart from inflammation, FMH also alters the renal function.



## Plant influences on the taxonomic and functional diversity of soil microbial communities in the hyper-arid Namib Desert, Namibia

Author

EN Nghalipo<sup>1</sup>, HL Throop<sup>1,2</sup>, DA Cowan<sup>3</sup>, RW Becker<sup>4</sup>

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<sup>3</sup>Centre for Microbial Ecology and Genomics, University of Pretoria, South Africa

<sup>4</sup>Biodiversity Research Centre, Namibia University of Science & Technology, Namibia

### Abstract

The hyper-arid Namib Desert is an extreme environment. Soils have little organic matter, as primary productivity is limited, and vegetation cover is present primarily in isolated 'hummocks' where shifting sands accumulate around vascular plants. Plants influence soil microbial communities via litter and root exudate inputs, and by regulating the temporal and spatial patterns of microbial activities through control of moisture content, solar radiation, and temperature. Given the important roles of soil microbes in hyper-arid systems, it is critical to understand how plants influence the soil microbiome in order to predict how ecological functions may be altered under future climate-change projections. This study evaluates the soil microbiome in plant hummocks in the coastal Namib Desert by 1) investigating microbial communities associated with plant hummocks, 2) establishing how microbial communities compare between plant hummocks and bare soils, and 3) investigating the functional roles of these microbial communities. We sequenced the 16S rRNA gene V3-V4 and ITS regions on an Illumina MiSeq platform. 16S rRNA amplicon data showed that Firmicutes, Actinobacteria, Bacteroidetes and Proteobacteria are dominant in both plant hummocks and bare soils. We calculated  $\alpha$ -diversity based on the Shannon diversity index, there was no significant difference in  $\alpha$ -diversity between the hummock and bare soils. To assess community dissimilarities, samples were clustered using weighted Unifrac distances on a principal coordinate analysis (PCoA) plot. Samples showed preferential clustering based on sample source (hummock or bare soils) (PERMANOVA,  $p < 0.01$ ). The hummock soils supported more functional diversity in metabolic pathways relative to bare soils. The hummock soils had significantly enriched genes involved in nitrogen fixation, ammonification, denitrification, polyphosphate biosynthesis and degradation, and methane metabolism. Overall, these results demonstrate that plant hummock soils are hotspots of genes, providing a selective microbial environment and allowing for more potential functionality, particularly N fixation, ammonification, and methane.



## Investigating T-helper 2-mediated immune response in children with type 1 hypersensitivity

Author

Penomwaameni Nepolo

Medical Laboratory Scientist, Namibia Institute of Pathology, Windhoek, Namibia

### Abstract

**Background:** The global prevalence of type 1 hypersensitivity is becoming more prevalent in recent years, particularly among children in developing countries. This has been attributed to rapid modernization in low-to-middle income countries which promotes the manifestation of allergy risk factors. Type 1 hypersensitivity reactions are exaggerated immune responses to allergens that would not usually elicit immunological response. These allergic reactions are primarily characterized by T helper (TH2) - mediated inflammation modulated by interleukin (IL)-4 and elevated immunoglobulin (IgE). Therefore, this study aimed to evaluate TH2 immune responses in children with atopy.

**Methods:** This was an observational study involving children (< 18 years old) with allergies tested at Windhoek Central Hospital, Namibia. A total of sixty participants ( $n = 60$ ) (fifty with allergy ( $n = 50$ ) and ten controls ( $n = 10$ ) were recruited for the purposes of this study between October 2020 and May 2021

**Results:** The levels of total IgE were elevated in children with the allergies ( $298.40 \pm 104.3$ ) when compared to those without ( $133.70 \pm 50.61$ ),  $p = 0.0312$ . The levels of IL-4 were comparable between the patients and the control group ( $p = 0.7836$ ). Further assessment of total IgE levels in children with allergies showed varying levels across the type of allergen ( $F(5, 84) = 7.28$ ,  $p < 0.0001$ ). The levels of IL-4 in children with an allergy were comparable amongst the groups ( $F(5, 84) = 1.31$ ,  $p = 0.2667$ ).

**Conclusion:** Although the levels of IL-4 were comparable across the allergens, total and allergen-specific IgE levels were dependent on the type of allergen in children with allergies. Moreover, these IgE levels were associated with the levels of IL-4. As a result, treatment options that inhibit IgE activity should be prioritized in Namibian children with allergies. Most significantly, while establishing treatment dosages for allergic reactions, the kind of allergen should be examined.



## Investigating the radiological safety of uranium ore deposits from a uranium mine in Namibia

**Author**

Vaino Indongo

Dept. of Natural and Applied Sciences, Faculty of Health, Applied Sciences & Nat. Res. Sciences, Namibia University of Science & Technology, Windhoek, Namibia

### Abstract

Namibia is one of the leading African countries in uranium mining production which results in huge tailing deposits. The main aim of this study was to assess radiological hazards posed to employees by uranium ore deposits from a uranium mine in the Erongo Region. Gamma spectrometry was used to determine the radiological health indices of primordial radionuclides of  $^{238}\text{U}$  ( $^{226}\text{Ra}$ ),  $^{232}\text{Th}$  and  $^{40}\text{K}$  in samples. The weighted mean of activity concentrations of  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$  and their Indices were all above the WHO stipulated limits. The findings of this research indicate that uranium mining activities pose a high risk of radiation hazards to employees.

**Keywords:** gamma Spectrometry, WHO, uranium ore, radiological health indices, employees

## Presenter Profiles

**Dr Norman Muzhinji** holds a PhD in Plant Pathology from the University of Pretoria. He then worked for Tobacco Research Board as a Plant Pathologist/Molecular Biologist before returning to University of Pretoria as a postdoctoral fellow and later as a lecturer. He is currently a lecturer in the Department of Natural and Applied Sciences, NUST, teaching Biotechnology and Genetics. His main research interest is in disease epidemiology, plant breeding, genomics, and bioinformatics. He has published more than 20 articles in peer-reviewed journals.

**Ms Kornelia David** is the Coordinator of the Mathematics Tutoring Centre in the Department of Mathematics and Statistics, Namibia University of Science and Technology. She received a Bachelor of Science in Applied Mathematics and Statistics (2014), a Bachelor of Science Honours in Statistics (2015), a Bachelor of Science Honours in Applied Mathematics (2018), and a Master of Science in Applied Mathematics (2022) from the Namibia University of Science and Technology. Her research interest is in the areas of finance and investments.

**Ms Edwig Hauwanga** is a Junior Lecturer in the Department of Health Science, Medical Laboratory Sciences programme. Before her academic career, Ms Hauwanga worked as the head of Windhoek Blood Bank for the Namibia Blood Transfusion Services. She is an Immunohaematology specialized Medical Laboratory Scientist and recently graduated with Master of Health Sciences from NUST. Her research interest areas are neonatal and paediatric Haematology and Immunohaematology.

**Elise N. Nghalipo** is a Ph.D. student in Natural Resources Sciences, studying Soil Microbial Ecology in the Skeleton Coast Park. Her research contributes to a better understanding of how soil microbial communities associated with vegetation in hyper-arid systems may respond to the predicted climatic changes. Additionally, this research allows us an opportunity for a deeper exploration of relevant biological questions in microbial ecology such as "who are the members of the community? What are their functional roles in the community"?

**Ms Elina Penomwaameni Nepolo** is a Medical Laboratory Scientist at Namibia Institute of pathology (NIP) Windhoek Central Reference Laboratory (WCRL) where she works as a supervisor for Immunology and Serology department. She worked in Clinical pathology field for over 10 years of which 7 years she has been managing a lab/ department. She holds a Master of Health Sciences from NUST, and she is one of NUST Biomedical science pioneers. Her area of research interest is Investigating T-helper 2-mediated immune response in children with type 1 hypersensitivity in Namibia.

**Mr Vaino Indongo** is the Lecturer in the Department of Natural and Applied Sciences. He has been a lecturer for more than 7 years at NUST. He teaches Basic Science, Health Science Physics/ Medical Physics, Thermal Physics and Biomedical Physics modules in the department. He is currently a registered PhD student in the North-West University, Republic of South Africa. His area of research interest is environmental radiation science in the area of Erongo region.





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