

2021 FACULTY OF SCIENCE, AGRICULTURE AND ENGINEERING VIRTUAL SYMPOSIUM

Symposium Program & Book of Abstract

Theme: The Opportunities of Crisis: Resilience and Change in the 21st Century

Hosted by the Human Movement Science Department

20-21 October 2021

Preface

It is a pleasure to welcome you to the 2021 Faculty of Science, Agriculture and Engineering Virtual Symposium of the University of Zululand, 20-21 October 2021. This symposium is hosted by the Department of Human Movement Science under the theme 'The Opportunities of Crisis: Resilience and Change in the 21st Century'. The main aim of the symposium is to create a platform for an interdisciplinary analysis around resilience in the face of global challenges in the 21st Century. In this vain, the Faculty of Science, Agriculture and Engineering invites academic staff and postgraduate students to submit papers that respond and interrogate, but are not limited to the following:

- *Climate change*
- *Food insecurity*
- *Food production/supply*
- *Public health*
- *Digitalization*
- *Fourth Industrial Revolution*

The 2021 Faculty of Science, Agriculture and Engineering Symposium promises to be both stimulating and informative, with a combination of research academics and young emerging scientists from the University of Zululand.

We wish you all a wonderful scientific experience and look forward to a fruitful symposium!

2021 Departmental Organizing Committee

Departmental Organizing Committee Members

Dr Anneke Van Biljon

Dr Chantell Gouws

Dr Gerrit Jan Breukelman

Dr Lourens Millard

Session Chairs

Prof Brandon S. Shaw

Dr Henrico Erasmus

Prof Leon Vivier

Prof Ina Shaw

Prof Vetrimurugan Elumalai

Dr Nontuthuko Rosemary Ntuli

Programme Director

Dr Fabian Fon

Technical Director

Ms Ayande Zwane

Editor

Dr Pravina Pillay

Web Designer

Mr Sakhile Fatyi

Keynote Speaker: Prof Bhekisipho Twala (20/10/2021)

Biography: Prof Bhekisipho Twala is the Executive Dean of Engineering and Built Environment and Professor in Artificial Intelligence and Data Science at the Durban University of Technology, South Africa. Before then, he was the Director of the School of Engineering at the University of South Africa and founder of the Institute for Intelligent Systems at the University of Johannesburg. He completed his PhD at the Open University (UK) in 2005, and was a post-doctoral researcher at Brunel University in the UK, mainly focussing on empirical software engineering. Before then, he did his MSc (Statistics) from Southampton University (UK) and a BA (Economics & Statistics) at the University of Swaziland in 1992. Prof Twala's current research includes promoting and conducting research in Artificial Intelligence within the Big Data Analytics field and developing novel and innovative solutions to key research problems in this area. Prof Twala has a world-class track record of high-quality research and scholarship as evidenced by 180 publications in internationally leading journals and conferences. He is currently an associate editor of the Information Sciences Journal, Intelligent Data Analysis Journal, Journal of Computers, International Journal of Advanced Information Science and Technology, International Journal of Big Data Intelligence, Journal of Image and Data Fusion, Journal of Information Processing Systems, and a fellow of the Royal Statistical Society. Other professional memberships include the Association of Computing Machinery (ACM); the Chartered Institute of Logistics and Transport (CIT), South Africa and a Senior Member of the Institute of Electrical and Electronics Engineers (SMIEEE). Twala is the recipient of the TW Kambule research and its outputs award, the highest honour bestowed by the South African government on outstanding scientists for up to fifteen years after the award of a PhD or equivalent.

Keynote Speaker: Dr Betty Kibirige (21/10/2021)

Biography: Dr Betty Kibirige has served as an academic in the Department of Physics and Engineering, at the University of Zululand (UNIZULU) since 2001. Recently, her services were transferred to the newly introduced Department of Engineering. She holds a PhD and an MSc in Electrical Engineering from the University of Witwatersrand (Wits), Johannesburg, South Africa and a BSc Electrical Engineering from Makerere University Kampala. She is a member of the Wits Chapter Golden Key International Honours Society, South African Institute of Physics (SAIP) and the International Solar Energy Society (ISES). Her engineering carrier was kicked off by working with the control systems used in the elevator industry. This triggered her interest in the investigation of possible software techniques that can be developed to enhance automation and control. Working as an academic has afforded her opportunities to interact with various research groups, collaborating on interdisciplinary issues involving development of predictive models for various applications. This has enlarged her domain in science and its applications. Renewable Energy is one of the research fields that hold her interest. The Materials group at the Physics Department, University of Zululand research on the synthesis of gas sensors initiated her interest in intelligent gas sensors. This involves the marrying of both materials as sensors and instrumentation as application extender. Her collaboration with SA-CERN ATLAS group on instrumentation requirements for the Tile Calorimeter and her involvement with the deployed High Performance Computing Cluster by the Centre for High Performance Computing Cape Town, has provided possibilities of research involving Big Data analysis, Machine Learning and Deep Learning. To balance life, she enjoys playing the piano, guitar and pipe organ. She considers herself an amateur painter who loves depicting wildlife and flowers. She enjoys scenic walks and reading about esoteric subjects. Recently she took on the hobby of building and flying radio-controlled aeroplanes, it has been a refreshing challenge to her.

UNIVERSITY OF ZULULAND

Faculty of Science, Agriculture and Engineering

Virtual Symposium

20–21 October 2021

Programme

Symposium Day One: 20 October 2021 Venue: Online			
Time:			
08:00-08:10	Opening and Welcoming Remarks: Dr Anneke van Biljon		
08:10-08:20	Dean's Address: Prof Khoboso Lehloenya		
08:20-09:00	Keynote Address: Prof Bhekisipho Twala 'Does academia matter?'		
09:00-09:30	Tea Break		
Breakaway sessions			
09:30-09:40	**Breakaway Group 1 Chair: Prof Brandon S. Shaw**	**Breakaway Group 2 Chair: Prof Ina Shaw**	**Breakaway Group 3 Chair: Prof Leon Vivier**
09:40-10:00	Effect of Se supplementation on oestrous response and fertility of Merino ewes - **M. Hlatshwayo**, K.C. Lehloenya	Water Provision Planning on the Basis of Human Population Growth Forecasts of the City of uMhlathuze, KwaZulu-Natal Province, South Africa – **T. Mokoma**	Exposure assessment of microplastic contamination in surface waters of Thukela and Mhlathuze river – **L. Nsibande,** N. Masikane, M. Thwala, H. Mzimela.
10:00-10:20	Machine Learning approach to reading level assessment of South African text – **M. Mampshika**	Support of security and privacy for IoT devices in fog computing	Evaluating the Effect of Mobile Applications on Cloudlet

		– **SJ. Mthembu**, I. Mba & MO. Adigun	Placement - **BG. Simelane**, MO. Adigun, IM. Adebayo
10:20-10:40	Evaluating Named Data Networking (NDN) forwarding strategies in different IoT topologies - **CS. Langa**, P. Tarwireyi, MO. Adigun	Methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats - ND**. Cele**, T Nyawo, K Ziqubu, S Mbeje, SE. Mabhida, RA. Mosa, AR. Opoku, EN. Mthimunye	Kombucha Tea: Mini Review – **E. Mthimunye**, A. Basson, R. Pullabhotla, M. Mthembu, N. Cele, E. Mantshi, J. Shandu
10:40-11:00	The detection and monitoring of H2S gas at high concentration is very crucial since this gas is highly toxic and can affect tissues and organs especially in occupational settings – **T. Mpanza**	Effect of selenium supplementation on phenotypical parameters of Merino ram lambs - **NE. Makhado**, KC. Lehloenya	Malware Analysis of Windows PE using API calls: Evaluation Study – **X. Sibisi**
11:00-11:20	Visio-spatial Expertise in Athletes: Comparison of Field Hockey Players and Non-Athletes - **T. Sneyimani**, GJ. Breukelman, ML. Mathunjwa, L. Millard	Effects of different intensity of aerobic exercise in modulating body composition and physical characteristics among obese young adults - **NT. Ncama**, ML. Mathunjwa, A. Van Biljon	Biological synthesis and characterisation of copper nanoparticles using a bioflocculant from Microbacterium paraoxydans and its application – **NP. Myeni**, AK. Basson, VSR. Pullabhotla, ZG. Ntombela
11:20-11:40	Synthesis and characterization of Ni1-xCuxCo2S4 ($0 \geq x \geq 1$) solid solutions using dithiocarbamate complexes as molecular precursors via heat-up route for effective supercapacitance – **M. Khumalo**	Methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats – **E. Mthimunye**	The Comperative Study of the Stylized facts of South African and Indian Stock market – **L. Mbhense**

11:40-12:00	Exercise and mental and physical well-being in smokers: A systematic review – **NM. Shandu**, ML. Mathunjwa, BS Shaw, I. Shaw	Effect of duration of progesterone treatment on synchronizing oestrus outside the natural breeding season in Merino ewes - **NS. Zulu**, KC Lehloenya	Household deprivation and multidimensional poverty aftermath on children six to 13 years in rural Queenstown, Eastern Cape – **P. Kupiso**, CE. Napier, U. Kolanisi
12:00-12:20	Diabetes Mellitus is Associated with Severe Covid-related Complications: A Systematic Review of African Studies – **T. Thaane**	Benefits of physical activity on stroke recovering patients – **N. Bhengu**	The Prevelance of Cardiometabolic disease risk factors in different ethnicity groups among South African adults – A. van Biljon, **SZ. Maphumulo**, MM Chauke
12:20-12:40	Exploring factors that influence organ donation consent in a rural community of Limpopo province in South Africa – **PM. Dimo**, EI. Smit	Rooibos flavonoids, aspalathin, isoorientin and orientin ameliorate mitochondrial dysfunction by improving mitochondrial bioenergetics in cultured skeletal muscle cells – **SXH. Mthembu**	Understanding the experiences of small scale commercial afforestation farmers in Manguzi, South Africa **- LD. Sibiya**, I. Moyo
12:40-13:00	The Heat rate kinetics on the liquefied hydrocarbon gases sensing **– S. Ogundipe**	Diversification of Ferredoxins across Living Organisms – **N. Nzuza**, T. Padayachee, W. Chen, D. Gront, DR. Nelson, K Syed	Promoting Resilience through Life-style modification and Healthy Living for People Living with Diabetes Mellitus – **NS. Linda**, HC. Schoeman, P. Ndlovu, K. Ndwandwe, RG. Mkhasibe, S. Nkwanyana, BT. Gamede, MM Mathunjwa
13:00-13:20	**Lunch Break**		
13:20-13:40	Data-driven time series forecasting of COVID new cases in South Africa using Hybrid	A Blockchain-Based Firmware Update Architecture for Long-Range Wide Area Network (LoRaWAN) – **N. Mtetwa**	Evaluation of image processing techniques to detect malicious Portable Executable files – **MS. Radebe**

	deep learning recurrent neural network – **N. Mbatha**		
13:40:14:00	Detecting malware in Portable Executable file using Spectrograms – **T. Mbuthu**	Chaplygin gas as a model for dark energy – **N. Mtetwa**	Consumer acceptability and perception of ProVitaminA Bio-fortified maize and maize based products: A review – **Q. Nothando**, U Kolanisi
14:00-14:20	Effect of poultry and goat manures on agro-morphological traits of Sesamum alatum leafy vegetable – **KC. Mbatha**	Dynamical System Analysis in Cosmology – **A. Vusani**, A. Beesham	Toxicity of sodium dodecyl sulphate in estuarine amphipod Grandidierella lignorum – **SC. Mkhabela**, NF. Masikane
14:20-14:40	Prevalence, serotypes, and characteristics of Shiga cytotoxin Escherichia coli from meat and meat products in African countries: A review – **N. Zondo**	Evaluation of detection of malicious URLs – **S. Masinga**	Tutor identification using a real-time dashboard – **S. Ndlovu**
14:40-15:00	Genome data mining annotation and comparative analysis of P450s and their secondary metabolites in the bacterial phylum Bacteroidetes – **B. Nkosi**, DR. Nelson, T. Padayachee, K. Syed	Improving the Gateway Placement Algorithm in Long Range Wide Area Network (LoRaWAN) – **S. Mnguni**	The effect of photoperiod in acute toxicity testing using endemic amphipods Grandidierella lignorum – **M. Xulu**
15:00-	Day One Complete		

Symposium Day Two: 21 October 2021 Venue: Online			
Time:			
08:00-08:40	Keynote Address: Dr Betty Kibirige 'Man and Machine'		
Breakaway sessions			
08:40-08:50	**Breakaway Group 1 Chair: Dr Henrico Erasmus**	**Breakaway Group 2 Chair: Prof Vetrimurugan Elumalai**	**Breakaway Group 3 Chair: Dr Nontuthuko Rosemary Ntuli**
08:50-09:10	Reflections of the impact of COVID-19 on food production and supply: An industry perspective – **A. Sibisi**	Evaluation of tasks scheduling algorithms with energy efficiency in IoT networks – **K. Mkhonza**	Occurrence, Serotypes and Antimicrobial Resistance of Salmonella species from Beef in Retail Outlets from KwaZulu-Natal Province, South Africa – **S. Naidoo,** P. Butaye, S. Maliehe, K. Magwedere, AK. Basson, E. Madoroba
09:10-09:30	Method development and optimization for boar seminal plasma proteomic profiling – **PW Mokwena**, S. Stoychev, S. Buthelezi, FV. Ramukhithi, KC. Lehloenya	Survival analysis of consumer's bank loan and credit risk - **MX Khethukuthula**, WJ Dlamini	Stock Closing Price Forecasting using GARCH and Multilayer Perceptron (MLP): A comparative Study – **N. Nsibande**
09:30:09:50	Load Forecasting using a Hybrid model for ARIMA and ANN – **N. Mthembu**, S. Sibiya, F. Silwimba	Morpho-agronomic and genetic variation, and segregation patterns of Phaseolus vulgaris landraces from selected provinces of South Africa – **VV. Ndlangamandla,** NR Ntuli	Effects of a four-week high intensity interval training (HIIT) program on body composition and physical fitness of young female adults at the University of Zululand – **PBM. Ndlovu**, S. Zwane, BJ. Oosthuizen
09:50-10:10	Essential skills – The Covideo project **– D. Fish**	Isolation, screening, identification and optimization of microorganisms with	The relationship between perceived and actual motor competence in children

		bioflocculant-production potential from Kombucha tea Scobies and its application in wastewater treatment – **PH. Tsilo**, AK. Basson, Ntombela ZG	diagnosed with stutter between the ages of 2-13 years: Systematic Review – C. Gouws, **N. van Dam, S Thessner**
10:10-10:30	Synthesis of transition metal doped chalcopyrite (CuFeS2) and chalcostibite (CuSbS2). nanoparticles by solution thermolysis of single source precursors – **S. Mqadi**, MD. Khan, N. Revaprasadu	An action research towards improving the food plate of the university students - **Y. Nokokoba**, E. Ntanjana, A. Nzimande, S. Mtloung, K. Palmer, N. Ngwane, U. Kolanisi	Upper Troposphere-Lower Stratosphere Ozone Trends over Marambio, Antarctic Peninsula using Ozonesonde Data – **N. Mbatha**
10:30-10:50	Data-driven time series forecasting of COVID new cases in South Africa using Hybrid deep learning recurrent neural network – **F. Silwimba**, N. Mbatha, M. Matadi	Acceptability of Cowpea-based Instant Soup Among Youth in Rural KwaZulu-Natal – **TP. Kheswa**, U. Kolanisi, M. Siwela, L. Sisoka	A review of the essential visual skills required for soccer: Beyond 20-20 optometry – L Millard, GJ. Breukelman, **N. Mathe**, I Shaw, BS. Shaw
10:50-11:10	Isolation and characterization of manganese peroxidase producing ligninolytic bacteria from composting environmental samples – **BP. Ngcobo**, RA. Mosa, AR. Opoku	Catalytic oxyfunctionalisation of 1,2-dichlorobenzene using Mn loaded catalysts – **N. Mkhizea**, RVSR Pullabhotlaa	Combining more methods for acid mine drainage treatment in a fluidized bed-reactor andadsorption using organic matter – **G. Mokoena**, MS. Mthembu, AK. Basson
11:10-11:30	Catalytic oxidative degradation of m-cresol using ozone – **B. Phenyane,** RVSR Pullabhotlaa	Causes and prevalence of Diabetes, Obesity and Physical Inactivity in black women aged 45-65 years in South Africa – **N. Sibeko, N. Mdletshe**	The food and nutrition insecurity status of people living with disabilities in three Local Municipalities of Ugu District, South Africa – **D. Khowa**, U. Kolanisi, C. du Preez, N. Tinta, PN Qumbisa

11:30-11:50	The use of Macrobenthic Biotic Indices to assess the effect of fish-farming in Richards Bay Harbour - **S. Nzama**, L. Vivier, A. De Fortier	The Influence of Objectively Measured Physical Activity and Sedentary Behaviour on Cognition and Academic Achievement in South African Primary School Children – **S. Luyanda**	A systematic review of physical activity, lifestyle, well-being, and selected indices of cardiovascular function in South African university athletes – H. Erasmus, A. Van Biljon, **MR. Mohlakoana**
11:50-12:10	Improving intrinsic motivation for physical activity (PA) among 6-14 years old children with asthma: A qualitative study – **A. Dube**	Impact of Land-Use and Land-Cover Change due to urban development: A case study of Durban, Kwazulu-Natal – **M. Dlanga**, Vetrimurugan Elumalai	Identification of potential groundwater recharge zones in Maputaland Coastal plain, South Africa. – **D. Ponnusamy**, Vetrimurugan Elumalai
12:10-12:30	Assessment of nutrients and trace metals in groundwater of Luvuvhu catchment, South Africa **Madondo Patience,** Vetrimurugan Elumalai	Land use and land cover changes in Mhlathuze catchment of Kwazulu-Natal, South Africa – **P. Nikani**, Vetrimurugan Elumalai	
12:30-12:35	Word of Thanks – Dr Chantell Gouws		
12:35-12:45	Closing of Symposium and Wrap-up – Dr Fabian Fon		

Note of thanks

Dear Attendees

On behalf of the Human Movement Science Department, University of Zululand, we want to thank you for attending the Annual Faculty Symposium on 20 & 21 October 2021.

2021 Departmental Organizing Committee

Abstracts

Title: Mr

First Name: Sibonelo

Last Name: Hlatshwayo

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Phone No: (078)251-9526

Department: Agriculture

Level: Masters

Research Title: Effect of Se supplementation on oestrous response and fertility of Merino ewes

Abstract: S.M. Hlatshwayo[1] & K.C. Lehloenya[1]
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Poor nutrition and heat stress contributes largely to poor reproductive performance and fertility as a whole. Severe heat stress leads to oxidative stress. Selenium (Se) is one of the micronutrients that is essential for reproductive activities because of its antioxidant activity. The aim is to evaluate the effect of Se supplementation on oestrous response and fertility of Merino sheep. Ethics clearance was obtained from the University of Zululand Research Ethics Committee for this study. There were sixty ewes used to conduct the experiment. Thirty ewes from the treatment group received sodium selenate 0.34 mg selenium (Se) /kg body weight and thirty ewes from control group received saline water. Data for oestrous response, conception, gestation length and lambing rate were subjected to statistical analysis at ($P< 0.05$) using SPSS version 20. Se supp (supplemented) ewes numerically had high (83.33%) oestrous response compared non-supp (73.33%) without any statistically significant difference ($P>0.05$). The conception rate for Se supp was 96.67% and for non-supp was 93.33%. The gestation length was similar ($P>0.05$) for both groups (Se supp; 155.41±1.85 and non-supp; 153.04±1.4 days). Se supplementation had no significant difference on onset of oestrus ($p=0. 9778$); (37.56±2.12 hours for Se supp and 37.64±1.82 hours for non-supp). Similarly, oestrous duration was 24.48-±1.90 hours for Se supp and 26.73±2.80 hours for non-supp with no statistical difference ($p=0.4250$). There was 96.67% lambing rate in Se supp and 93.33% in non-supp without significant difference ($p>0.05$). Se supplementation had no effect on oestrous response, onset of oestrus, duration of oestrous, conception, pregnancy and lambing rate.

Key words: Selenium, Oestrus and Merino.

Title: Mr

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Department: Mathematical Sciences

Level: Doctoral

Research Title: Water Provision Planning on the Basis of Human Population Growth Forecasts of the City of uMhlathuze, KwaZulu-Natal Province, South Africa

Abstract: Significant increases in human population raise many concerns since human population growth without corresponding expansion of the number of water reservoir tanks might cause a shortfall in terms of water provision and distribution in the future and**,** therefore**,** limit the water available per person per day. In view of the above projected shortage, the present study intends to apply four different automated time series forecasting methods to predict the growth in human population of the City of uMhlathuze over the 2017 - 2067 period. On the basis of human population growth forecasts, the use of a linear programming model was demonstrated to determine the total number of reservoir tanks to be built for half a century in advance. The datasets used were drawn from the City of uMhlathuze, Statistics South Africa, and Human Science Research Council. The study forecasted that the City of uMhlathuze's human population will triple by 2067, albeit at a more moderate pace than at any period since 1996, therefore**,** 687 additional water reservoir tanks with a capacity of 47500 kilolitres should be built annually within the period of 50 years in order to meet the water demand from the human population.

Keywords: automated time series forecasting methods, human population, linear programming model, reservoir tanks, water distribution.

Title: Miss

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Department: Zoology

Level: Masters

Research Title: Exposure assessment of microplastic contamination in surface waters of Thukela and Mhlathuze river.

Abstract: Lungelo Nsibande[1], Ntuthuko Masikane[1], Melusi Thwala[2], Hendrick Mzimela[1]
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The presence of microplastics in surface waters, sediment, organisms, as well as in drinking water, raises many concerns on possible implications for the aquatic environment and public health. Thus, there is a dire need for microplastic research particularly in freshwater systems in the Northern regions of KwaZulu Natal (KZN). These systems are notable carriers and sinks of microplastic contamination mainly derived from surrounding anthropogenic activities since they flow within municipalities that are earmarked for expansion of industrial zones and agricultural activities. The present study aimed to characterize microplastics, for the first time in surface waters of Thukela and Mhlathuze River systems. Water samples were seasonally collected in both systems. The dissecting microscope and FTIR were employed for morphotype and polymer characterization. Seasonal microplastics abundance did not differ significantly across all sites and between study systems and they were composed of fibres (accounting for 97 - 99%) and films (accounting for 1-3%). The dominant polymers (Ëƒ60%) were polypropylene, poly (ethylene vinyl acetate) + poly (cyclohexanone), nylon and polyethylene terephthalate in both systems. The white particles dominated over the blue, red, green, purple, and black particles. The breakdown of larger particles, surface runoff, effluent from municipal and industrial waste are probable sources of microplastics. The present work provides important baseline results for future studies in Thukela and Mhlathuze River and is an important first step for future assessment focusing on the characterizing sources, fate, transport, and seasonal dynamics of microplastics in the KZN small tributaries and rivers.

Keywords: Northern KZN rivers; microplastic contamination, abundance, type, colour.

Title: Mr

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Department: Computer Science

Level: Honours

Research Title: A book levelling App to improve reading in the South African context

Abstract: Reading level assessment involves the organization of books into levels of difficulty, that is from books that are easier to read to books that are more complex. The system developed by Fountas and Pinnell uses high-level characteristics which include vocabulary, grammatical structure of sentences and phrases, illustration and layout of the page to produce a reading level assessmen. This information cannot be captured by an automated tool. Machine learning uses combination of hierarchical machine learning and natural languages processing to predict the levels of difficulty. Research has shown success with the English language using statistical language processing tools in which machine learning models are trained with the English language to determine the difficulty of the text. The need for a model in the South African context becomes important given the nature of our multilingual education system, as language plays an important role in reading development and communication with the education sector. It also shapes the social and cultural identity of learners. Models that can identify the difficulty of texts within South African context can improve learning abilities within our educator sector and improve pass rates as we have seen with English based models that have been implemented. This paper uses support vector machines in combination with language translation models and traditional reading level measures to produce a method of assessing reading level assessment of South African text.

Keywords:

Title: Mr

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Department: Computer Science

Level: Masters

Research Title: Support of security and privacy for IoT devices in fog computing

Abstract: Sabelo J Mthembu, Ijay Mba & Matthew O. Adigun
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Fog computing paradigm extends the storage, network and computing facilities of cloud computing towards the edge of the network while offloading the cloud data centres, making it ideal for the internet of things (IoT) and other applications that require real-time interactions and reducing services latency to the end-users. However, from the implementation of fog computing arises new security and privacy issues. These problems may have an effect on IoT devices and other deployed applications. In this paper, we evaluate security protocols, which are MQTT and HTTP to facilitate and support security for IoT devices without compromising latency. Performance measurement, such as response time and packet loss supported for MQTT and HTTP protocols based on Fog servers with a wide amount of emulated traffic generator data running alongside a real sensor. The MQTT showed to have a better response time for a connection cycle over the HTTP protocols. It also used its MQTT security features to strengthen its security through its authentication, authorization and identification.

Key Words: Message Queue Telemetry Transport, Hypertext Transfer Protocol, Internet of Things

Title: Mr

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Department: Computer Science

Level: Masters

Research Title: Evaluating the Effect of Mobile Applications on Cloudlet Placement

Abstract: B.G. Simelane, M.O. Adigun & I.M. Adebayo
University of Zululand, Computer Sciences Department
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Given the fact that mobile devices have limited processing capacity and battery life, mobile edge computing was introduced as a paradigm for providing extra computing resources for constrained devices. To this end, small-scale servers known as cloudlets need to be placed within close proximity to edge devices. Nonetheless, determining the appropriate number of cloudlets required depends on the type of mobile application requesting additional computing resources. Hence, in this study, we investigate the effect of mobile applications on cloudlet placement and varying traffic load respectively. Specifically, we first develop a mathematical model that helps to determine the minimum number of cloudlets to be placed as well as the amount of traffic load that is required to support four types of mobile user applications. Simulation results generated from experiments conducted in this study indicate that the number of cloudlets to be placed and traffic load required to support offloading tasks depends on the type of mobile application concerned and maximum consumable energy. With this discovery, envisaged cloudlet owners should be able to make informed decisions concerning related cloudlet placement issues.

Keywords: cloudlet placement, mobile edge computing, mobile applications, offloading tasks

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Department: Computer Science

Level: Masters

Research Title: Evaluating Named Data Networking (NDN) forwarding strategies in different IoT topologies.

Abstract: C. S. Langa; P. Tarwireyi; M. O. Adigun
Department of Computer Science, University of Zululand, South Africa.
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The Internet of Things (IoT) is a growing paradigm which has seen multiple number of devices getting connected. From smartphones to smartwatches, smart agriculture and smart HVAC (Heating, Ventilation, and Air-Conditioning) systems, schools, businesses and homes are trying to reduce human efforts and better lives through technology. IoT devices are known to be resource constrained, that is, they have low power, low processing capabilities and low memory. With the increasing number of these devices, an internet architecture which will consider these limitations should be investigated as soon as possible because the current architecture was not designed to consider the aforementioned. NDN (Named Data Networking) internet architecture has shown to be one of those architectures which**,** according to research thus far, has more advantages over the well-known TCP/IP architecture present. NDN has forwarding strategies/schemes which are rules that tell NDN nodes how to forward interests and data packets from consumers to producers and back. This study aims to evaluate some of the forwarding strategies available in NDN, that is, best-route, broadcast, multicast and client-control strategy in different topologies which are star, mesh, ring and a hybrid topology composed by mesh and star topology. The study is conducted by varying the number of producers in each topology and the results found show that multicast strategy outperforms the other strategies in a mesh, ring, and hybrid topology.

Keywords: Named Data Networking, forwarding strategies, Topologies-Internet of Things (IoT).

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats.

Abstract: Nkosinathi D. Cele, Thembeka Nyawo, Khanyisani Ziqubu , Sthabile Mbeje , Sihle E. Mabhida, Rebamang A. Mosa, Andy R. Opoku, Ewert N. Mthimunye

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Erectile dysfunction (ED) due to diabetes mellitus remains difficult to treat medically despite advances in pharmacotherapeutic approaches in the field. This study investigated the methanolic extract of Maytenus procumbens roots in type 2 diabetes induced erectile dysfunction in rats. The plant material was extracted with methanol and fructose model was used to induce type 2 diabetes in male rats. The diabetic rats were treated daily with a single oral dose of the crude extract (250 mg/kg) for 28 days. The methanolic extract was evaluated on blood glucose, serum testosterone levels, mount frequency and fructosamine content as well as on AChE, ACE and arginase activities. The effect of the extract on the expression of PDE-5, RhoA and eNOS was also evaluated. Increased testosterone level, mounting frequency, reduced blood glucose levels and serum fructosamine content were observed after 28 days of treatment. Methanolic extract also exhibited an inhibitory effect on arginase, AChE and ACE activities. The crude extract further downregulated proteins PDE-5, RhoA and increased expression of eNOS in diabetic-ED treated rats. Results from the current study indicate that methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats.

Key words: Erectile dysfunction, diabetes mellitus, Maytenus procumbens, phytotherapy

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Kombucha Tea: Mini Review

Abstract: Ewert Mthimunye (a), Albert Basson (a), Rajasekhar Pullabhotla (b), Matthew Mthembu a, Nathi Cele (a), Elijah Mantshi (a), Jason Shandu (a)
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Kombucha tea is a sour-sweet beverage produced by fermenting sweetened tea with a symbiotic consortium of bacteria and yeast or SCOBY. The sour-sweet taste is attributed to organic acids**;** the overall sugar content is generally very low. The tea is widely consumed around the world, though its origin is not well understood. Kombucha is heralded for its health promoting benefits. It has been reported to alleviate an array of ailments such as diabetes and cancer. The SCOBY modifies normal tea polyphenols coupled with microbial organic acids, enhancing the bioactivity of tea against disease risk factors. The nature of chemical conversions that occur during Kombucha fermentation have not been properly elucidated. The bioactivities of Kombucha constituents have been demonstrated in both vitro and in vivo studies. However, to date**,** no clinical trials have been conducted. The Kombucha SCOBY has been attributed biotechnological applications ranging from complex biomedical systems architecture to wastewater bioremediation. Kombucha tea is a beverage enshrouded in significant uncertainties. This review provides for general consensus on what is known and accepted about the beverage to date.

Key words: Kombucha tea; chemistry; ecology; health-benefits; antimicrobial resistance

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Level: Doctoral

Research Title: The detection and monitoring of H2S gas at high concentration is very crucial since this gas is highly toxic and can affect tissues and organs especially in occupational settings

Abstract: This work will report on the synthesis of WO3 nanostructures based sensor for selective and detection of H2S at low operating temperatures. These WO3 nanostructures were synthesized using pressurized hydrothermal process. Different acids from weak to strong (HNO3, H2SO4, and HCl) were employed as precipitants to form supposedly hierarchical nanostructures of WO3. These WO3 hierarchical nanostructures were characterized by XRD, TEM and XPS analysis. The fabricated WO3 sensors were exposed to different target gases at different concentrations (H2, CH4, NH3, LPG, H2S, and CO2). They were found to be selective to H2S with the WO3 precipitated with HCl found to be highly sensitive (S = 1394 at 150 ppm) to H2S at 125 ËšC. The WO3 precipitated by H2SO4 showed a response (S) of 142 at the same temperature. The HNO3 precipitated WO3 recorded a H2S response of 126. Therefore, the WO3 precipitated by HCl sensor seems to be one of the most promising samples for highly sensitive and selective detection of H2S. It remains to be known the surface or morphological effect of these acids on the formation of the WO3 nanostructures.

Key words: Gas sensor, Hydrogen sulfide (H2S), Hydrothermal syntheses, Nanostructures, WO3 nanostructures

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Department: Agriculture

Level: Masters

Research Title: Effect of selenium supplementation on phenotypical parameters of Merino ram lambs

Abstract: N.E. Makhado & K.C. Lehloenya
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Deficiency of trace minerals such as Se has been found to reduce growth, reproduction and immunity. Selenium deficiency leads to growth retardation which can affect the development of male sheep and eventually delays the attainment of puberty. Marginal to acute selenium (Se) deficiencies have been stated to occur in the Midlands region and mountainous areas of the KwaZulu-Natal (KZN) province. To evaluate the effect of Se supplementation on phenotypical parameters of Merino ram lambs. Forty Merino ram lambs aged 3 months were divided into two equal groups (20 per group). The Se supplemented group had sodium selenite orally at a two-week interval. Body weight was measured weekly, using an electronic scale. The scrotum circumference was measured weekly, using flexible measuring tape. Testicular measurements were measured weekly using vernier calliper. Analyses of Variance (ANOVA) was performed using repeated measurements with SAS version 9.4 statistical software (SAS, 2012). Means ± SE were compared using Student's t-LSD at 5% significance level. The testes measurement including the breadth, length and scrotal circumference increased numerically without significant difference ($p > 0.05$) in Se treated group compared with the control group. Supplementation of ram lambs with Se had no effect ($P > 0.05$) on body weight. In Midlands region and mountainous areas of the KwaZulu-Natal province where selenium is deficient, its supplementation is recommended in Merino sheep to improve growth rate. The duration of Se supplementation and interval between supplementation might have contributed to the lack of significance of Se on phenotypical parameters.

Key words: Selenium, Testes, Merino, Body weight, Scrotum

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Level: Honours

Research Title: Malware Analysis of Windows PE using API calls: Evaluation Study

Abstract: In the Internet world, the spread of malware in applications such as web browsers, media players and many other applications is increasing dramatically. Malware detection has always been a challenging topic and a huge privacy concern. Many signature-based malware detection methods were introduced that work to a certain level and cannot detect unknown executable malware files. Therefore, the goal is to investigate a novel approach that can detect new and invisible malware with reduced strong features which could perform the same as the one which used many features. In this paper an efficient malware detection model which differentiates between benign and malicious executable files by performing feature extraction from the Portable Executable headers is introduced. The cnn-lstm model**,** which also involves using cnn layers for feature extraction on input data**,** is used with various Machine Learning algorithms such as K-Nearest Neighbors, Decision Tree, Naive Bayes, Random Forest, Support Vector Machines, Extreme Gradient Boosting and Logistic Regression for classification. The experimental results is still a work in progress with Support Vector Machine so far proving to have outperformed other classifiers with an accuracy of 98.53% and scanning rate of 0.55 seconds in our testing environment. The results we have for now are better than the results from other research that used more features in the literature.

Key words: Portable Executable(PE), Features, API calls, Malware, Benign

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Department: Human Movement Science

Level: Masters

Research Title: Visio-spatial Expertise in Athletes: Comparison of Field Hockey Players and Non-Athletes

Abstract: T. Sneyimani, G.J. Breukelman, M.L. Mathunjwa & L. Millard
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Vision is an integral part of human existence, where it simplifies an innate ability to identify colours, patterns and visual-memories, through an integrative centre of the brain called the visual system. It is recorded that vision enables the mapping of mapping surroundings in an athlete's brain, distance to be covered and most importantly it enables an athlete not to lose sight of the opponent and target, as such visio-spatial intelligence when adequately stimulated can result in neurological improvements. To date, few studies have focused on field hockey players' visio-spatial intelligence and non-athletes utilizing sport specific test battery which includes peripheral awareness, speed of recognition, reaction time, saccadic eye movements, accommodation facility and visual perception. The aim of this study is to discern whether a difference exists between the visio-spatial expertise in field hockey athletes and non-athletes. There will be control (non-athletes) and experimental (athletes) groups comprised of 40 participants aged 17-34 years. Each participant will undergo a Visio-spatial intelligence test battery that will measure 6 Visio-spatial skills identified as being crucial for field hockey players namely, accommodation facility, saccadic eye movements, peripheral awareness, speed of recognition, hand/eye coordination and visual memory. To measure the differences that exist between the two groups, the Mann-Whitney U test will be utilised should the data not be continuous and not normally distributed. Post-hoc, a rank-ordered analysis will also be applied to determine which group displays superior visual skills.

Key words: vision, sports vision, field hockey vision

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Level: Masters

Research Title: Effects of different intensity of aerobic exercise in modulating body composition and physical characteristics among obese young adults

Abstract: Nkosingiphile T. Ncama[1], Musa L. Mathunjwa[1], Anneke Van Biljon[1]
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Moderate intensity is recommended for previously sedentary individuals for preventing, managing obesity and providing health benefits. However, high-intensity exercise protocol has shown similar results with less than 40% time spent on Moderate intensity. The aim of the present study was to compare the effects of different aerobic exercise intensities on body composition, blood lipids and physical characteristics on sedentary obese University students at the University of Zululand. Ninety (N=90) obese participants [body fat percentage 32%, mean age of 22 ± 2 (18-26) years] were randomly assigned into three equal groups (n=30): High Intensity (HIG) 76%-95% heart rate maximum (HRmax)]**;** Moderate intensity (MIG), 60%-75% HRmax **and** no exercise training (Control) (CG; n=30). The training programme lasted for 8 weeks and included three sessions of aerobics per 60 minutes for MIG and 30 minutes for HIG per week. Body composition, blood lipids and physical parameters were measured at baseline and after 8 weeks. Data were analysed using one-way ANOVA. At baseline, the body composition, blood lipids and physical parameters did not differ significantly among the three groups ($p > 0.05$). After 8 weeks of exercise intervention, both HIG and MIG groups significantly reduced and enhanced body fat percentage ($p=0.000$) and VO2max ($p=0.000$). There was a significant improvement observed in HIG in total cholesterol ($p=0.047$), and glucose ($p=0.044$). There was no significant difference observed in BMI ($p=0.581$) HIG and ($p=1.00$) MIG. The results over the eight weeks of aerobic training confirmed that both HIG and MIG groups were effective in reducing body composition and lipid profile in obese women. This study suggests that high-intensity training can be used to replace traditional exercise modality (moderate-intensity continuous training) as the primary mode of exercise in reducing body composition in young obese women.

Key words: Obesity, high-intensity interval training, Moderate intensity continuous training Aerobic, and resistance training.

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Research Title: Biological synthesis and characterisation of copper nanoparticles using a bioflocculant from Microbacterium paraoxydans and its application.

Abstract: Myeni N.P[1]., Basson A.K.[1], Pullabhotla V.S.R[1] and Ntombela Z.G.[1]

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The development of inexpensive and eco-friendly methods in nanoparticle synthesis is important to inflate their application potential. Various methods, including physical and chemical methods, have been used in the synthesis of copper nanoparticles (Cu NPs) because they are fast and effective. However, these methods have their limitations such as the use of toxic chemicals, consumption of a large quantities of energy and the expense. These limitations were overcome by using biological methods in the synthesis of copper nanoparticles because they are eco-friendly, biodegradable and lack secondary pollution. Therefore, in this study copper nanoparticles (Cu NPs) were synthesized using a bioflocculant from a bacterium and Microbacterium paraoxydans as a capping and reducing agent. The study was aimed at biosynthesising and characterisation of Cu NPs using a bioflocculant from a bacterium isolated from Tendele coal mine wastewater. The synthesized copper nanoparticles and the bioflocculant were characterized using X-ray powder diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Scanning electron microscopy (SEM), Elementary analysis and Thermo gravimetric analysis (TGA). The XRD analysis for both a bioflocculant and CuNPs showed that they are crystalline in nature. SEM image showed a cloud-like shape that is grey in colour. The elementary analysis of CuNPs showed the presence of copper (20 .96%) oxygen (34.28%) and carbon (30.23%). The optimal flocculating efficiency of a bioflocculant was observed at optimal of dosage (0.6 mg/ml), cation (Ca2+), thermal stability (50 ℃) and pH, 12. The flocculating activity of copper nanoparticles was optimal at dosage of (0.006 g/L), cation (Ca2+), pH 7, shaking speed (0 rpm) and temperature (50 ℃). The synthesized CuNPs and the bioflocculant had high removal efficiency in different staining dyes including methyl orange (89%), safranin (88%), congo red (84%), and methylene blue (79%) using a CuNPs, the bioflocculant had the removal efficiency of methylene blue (89%), safranin (84%), congo red (89%) and methyl orange (79%). CuNPs appeared to have the highest removal efficiency of BOD (91 %) and COD (66 %) when compared with the removal efficiency of the bioflocculant and commercial flocculant. The removal efficiency of CuNPs, bioflocculants and FeCl2 were determined in kaolin clay, Tendele coal mine and in the waste water of Vulindlela.

Key words: Bioflocculation, biosynthesis, copper nanoparticle, Microbacterium paraoxydans and Flocculating Activity

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Research Title: Synthesis and characterization of Ni1-xCuxCo2S4 ($0 \geq x \geq 1$) solid solutions using dithiocarbamate complexes as molecular precursors via heat-up route for effective supercapacitance

Abstract:

The increasing demand of energy and depletion of fossil fuel requires alternative sources of energy. Energy generation and storage methods such as water splitting and supercapacitors provide sustainable and green solutions to the energy problem. Currently, noble metals have shown the bench mark electrocatalytic activity, however, their cost and scarcity are serious drawbacks. Therefore, non-toxic, cost effective and sustainable materials are required for energy applications. Transition metal sulfides are potential candidates as their electrocatalytic activity can be tuned by the formation of ternary and solid solution materials. The ternary and quaternary nano-metal sulfides have shown a substantial enhancement in electric conducting, surface morphology and long term durability which are beneficial for energy conversion and storage applications. The heat-up route, whereby nanomaterials are synthesized via colloidal thermolysis of molecular precursors, have shared interest lately. The synthetic route is known to be greener, economically friendly and scalable. This work presents the investigation of effectiveness of heat-up route in synthesis of solid solutions using metal alklydithiocarbamates as a molecular precursor. The metal complexes of diethyldithiocarbamate of Ni, Cu, and Co were employed to synthesize substitutional solid solutions of Ni1-xCuxCo2S4 in a compositional range of ($0 \geq x \geq 1$). The synthesized solid solutions were analysed using p-XRD, SEM, TEM and EDX for structural properties and morphology. The attainment of Cu incorporated into NiCo2S4 crystal structure was observed by a slight shift of XRD peaks to lower Bragg's angles. The solid solutions were observed to have a pseudo-spherical morphology and showed agglomeration according to SEM and they were mixture of cluster-rod like and pseudo-spherical according to TEM. All the elemental composition observations from EDX reveals that the pure Ni1-xCuxCo2S4 ($0 \geq x \geq 1$) solid solutions preparation was achieved successfully. Thus**,** the p-XRD, SEM, TEM and EDX results indicate that pure Ni1-xCuxCo2S4 was successfully prepared.

Key words: Thiospinel, solid solutions, molecular precursor, Heat-up route

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Research Title: Methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats

Abstract:

Erectile dysfunction (ED) due to diabetes mellitus remains difficult to treat medically despite advances in pharmacotherapeutic approaches in the field. Aim: This study investigated the methanolic extract of Maytenus procumbens roots in type 2 diabetes induced erectile dysfunction in rats. Methods(s): The plant material was extracted with methanol and fructose model was used to induce type 2 diabetes in male rats. The diabetic rats were treated daily with a single oral dose of the crude extract (250 mg/kg) for 28 days. The methanolic extract was evaluated on blood glucose, serum testosterone levels, mount frequency and fructosamine content as well as on AChE, ACE and arginase activities. The effect of the extract on the expression of PDE-5, RhoA and eNOS was also evaluated. Result(s): Increased testosterone level, mounting frequency, reduced blood glucose level and serum fructosamine content were observed after 28 days of treatment. Methanolic extract also exhibited an inhibitory effect on arginase, AChE and ACE activities. The crude extract further downregulated proteins PDE-5, RhoA and increased expression of eNOS in diabetic-ED treated rats. Conclusion: Results from the current stud, indicate that methanolic extract of Maytenus procumbens roots ameliorates erectile dysfunction in type 2 diabetes induced erectile dysfunction in rats.

Key words: Erectile dysfunction, diabetes mellitus, Maytenus procumbens, phytotherapy

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Department: Mathematical Sciences

Level: Masters

Research Title: A comparative study of stylized facts of South African and Indian stock markets

Abstract: This study investigates different stylized facts within the South African market (JSE Top 40 Index) and the historically data from the finance.Yahoo.com was employed for analysis. A closer look at the behaviour of the South African market is something that attracts interest since this is one of the developing markets which gives the perfect opportunity for researchers to develop reliable models for forecasting returns and hence price derivation. The findings indicate that most of the stocks in JSE Top 40 Index showed larger upward movements than draw-downs similar to the Indian stock market, which makes the South African market a promising market in which to invest. Some of the stocks revealed the presence of auto-correlation which can be a tool for predicting future prices which favours the investors. The behaviour of the South African market is almost the same as that of Indian stock market regarding stylized facts.

Keywords:

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Department: Human Movement Science

Level: Masters

Research Title: Exercise and mental and physical well-being in smokers: a systematic review

Abstract: Nduduzo Msizi Shandu[1], Musa Lewis Mathunjwa[1], Brandon Stuwart Shaw[1] and Ina Shaw[1]
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Smoking is one of the leading global threats with high incidences of preventable pre-mature mortality, morbidity and various chronic diseases. To date, limited knowledge has been gathered for identification of the suitable training methods yielding greater health benefits over a short period of time with less physical and psychological exertion. The aim of the investigation was to conduct a systematic review determining the effect of exercise specificity and components to improve mental and physical well-being in smokers. Electronic databases were originally searched in September 2021 (Web of science, CINAHL, PsychInfo, Scopus, Cochrane and SPORTDiscus). The population was apparently healthy, sedentary male smokers aged 18-30 years. The exposure/interventions was objectively and/or subjectively measured exercise. The comparator was various frequencies, durations, patterns, intensities and types of exercise. The systematic review was organised around the following key areas: impact of exercise on psychological mental well-being and impact of exercise on physical well-being. The Grading of Quality of Evidence Assessment Development and Evaluation (Grade) framework was used to assess the quality of evidence for both mental and physical well-being parameters by each study design. Specific types, volumes and amounts of at least moderate to vigorous-intensity consistently showed a dose-response relationship with multiple mental and physical well-being parameters. While aerobic exercise can improve the psychological and physical well-being extensively**,** there is a need to determine the effects of other modes of exercise training on these same variables since this would allow for programme design considerations that increase adherence and improve outcomes, possibly yield even greater health benefits in a shorter space of time and in resource-constrained environments.

Keywords: Exercise, smoking, mental well-being and physical well-being

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Level: Masters

Research Title: Effect of duration of progesterone treatment on synchronizing oestrus outside the natural breeding season in Merino ewes.

Abstract: N.S. Zulu & K.C. Lehloenya
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The aim of this study was to evaluate the effect of the duration of progesterone treatment on the reproductive performance of Merino ewes during the spring breeding season. The study compared the effect of long and short-term progesterone (P4) treatment and their combination with either equine chorionic gonadotropin (eCG) or without eCG on oestrous response and hormonal profiles. Seventy-six (76) Merino ewes aged 2-5 years were allocated into two groups (40 for long-term progestagen and 36 for short-term progestagen). For long-term progesterone treatment group, controlled internal drug release (CIDR) devices were inserted for 14 days and for 11 days in the progesterone treatment group. At CIDR withdrawal half of each group were injected intramuscularly with 300 IU of eCG, leading to four groups. Oestrous response was monitored using teaser rams. Blood samples were collected to measure serum progesterone (P4) and estradiol (E2) concentrations. One-way ANOVA of SPSS was used for statistical analysis (Version 23.0, 2015, Armonk, NY. IBM Corp). The means were considered significant at $P<0.05$. The overall oestrous response obtained was 96%. A greater proportion of ewes showed oestrous signs at 36, 48 and 60 h post CIDR withdrawal. There was no significant difference ($P>0.05$) in oestrous response and duration of oestrus between treatment groups. Overall mean interval to onset of oestrus in this study was 46.8 ± 4.8 h. Most ewes began exhibiting oestrus at 24 and 36 h post CIDR withdrawal. There was no significant difference ($P= 0.07$) in the mean interval to onset of oestrus between treatment groups. Progesterone and estradiol hormones did not differ significantly ($P > 0.05$) between treatment groups at CIDR insertion, CIDR removal and at 48 hours post CIDR removal. However, estradiol was significantly higher at CIDR insertion ($P < 0.05$) than at 48 hours post CIDR removal. It is, therefore, concluded that the use of progesterone synchronization protocol regardless of duration or in conjunction with eCG can effectively synchronize oestrus during spring breeding season in Merino ewes. For farmers who use spring breeding season in South Africa, progesterone oestrous synchronization protocol is recommended in Merino ewes to improve reproduction activity.

Keywords: Oestrous synchronization, Long-term progesterone, Short-term progesterone, controlled internal drug release, eCG.

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Department: Consumer Sciences

Level: Masters

Research Title: Household deprivation and multidimensional poverty aftermath on children six to 13 years in rural Queenstown, Eastern Cape

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Children aged zero to 17 years in South Africa (SA) are at risk of being multi-dimensionally poor due to the households experiencing both relative and absolute poverty. The consequential effect of child poverty results in multiple deprivations with consequential outcomes which compromise the physical, cognitive and social-emotional development of a child. A quantitative, descriptive research design was applied to determine the household deprivation and multidimensional poverty of households of children in rural Queenstown, Eastern Cape. A purposive sampling technique was used to recruit 200 participants. Anthropometric measurements were obtained by measuring the child's weight and height in order to determine height-for-age and BMI-for-age, analysed using the WHO Anthroplus. Simultaneously, structured interviews were conducted with consenting parents/ caregivers and children. A low Acute-Multidimensional Poverty Index (AMPI) score of 24.72 out of the 30% cut-off point further indicated that 82.4% of the households were acute-multi-dimensionally poor. About 74.0% of the households were recorded to have a monthly income of less than R3500, the majority of the houses were dependent on social grants. The social grants are poverty the food security buffers, but not do not serve the same for nutrition security. The BMI-for-age in children aged five to nine years showed that 14.5% (n=9) girls were overweight and 4.8% (n=3) were obese in comparison to boys of the same age with 7.5% (n=4) boys overweight and 5.7% (n=3). The effect of poverty on a household's food and nutrition security is becoming complex, as obesity is also emerging as an indicator for food and nutrition insecurity.

Key words: Child poverty, Household deprivation, Multi-dimensional poverty, AMPI

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Department: Human Movement Science

Level: Researcher

Research Title: Diabetes Mellitus is Associated with Severe Covid-related Complications: A Systematic Review of African Studies

Abstract:

Emerging research shows that comorbid conditions result in severe covid-related complications. Research was undertaken to systematically synthesize available literature to determine the association between non-communicable diseases (NCDs) and severe covid-related complications in sub-Saharan Africa (SSA). PubMed/MEDLINE was searched using medical subject headings (MeSH) terms risk factors or associated factors and noncommunicable diseases AND COVID-19 OR SARSCov-2 and sub-Saharan Africa. The search was limited to articles written in English and published between 2019 and 2021. The reference list of included articles was searched to further identify relevant articles. Ten (n=10) full-text articles were included in the final synthesis. Majority (30%) of the studies emanated from Nigeria. Study participants across all included studies were between 29 and 54 years old. Diabetes mellitus was the most reported comorbid condition among cases of severe covid-related complications (n=8). Hypertension and obesity were reported across seven (n=7) and three (n=3) studies, respectively. Diabetes mellitus is associated with severe covid-related complications in South Africa. We envisage our findings will inform policies that guide allocation of resources towards prevention and management of covid-related complications as well as comorbid conditions including diabetes and hypertension.

Key words: Africa South of the Sahara; Chronic diseases; Coronavirus

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Level: Honours

Research Title: Benefits of physical activity on stroke recovering patients

Authors: Dr Breukelman, Dr Millard, Ms Joyisa, Ms Bhengu

Abstract:

Stroke is one of the world's most serious social and health problems. The incorporation of tailored physical activity and exercise into the rehabilitation process and post-rehabilitation phase could portray a successful action primarily directed at the cognitive and functional recovery of brain-injured individuals following a stroke. Exercising has been shown in studies to have both physical and psychosocial benefits for post-stroke patients. This meta-analyses have shown that aerobic exercise is helpful for increasing VO2 and peak working loads in medium to large-size stroke patients. Exercise has been shown to provide both physical and psychological benefits for post-stroke patients in studies. As a result, this scientific statement gives an overview of stroke recovering patients. To support this overview, we looked at systematic literature reviews, clinical and epidemiological reports, published morbidity and mortality research, clinical and public health guidelines, patient files and authoritative pronouncements. The use of different types of exercise training (e.g., aerobic, strength, flexibility, neuromuscular, and traditional Chinese exercise) for stroke survivors is firmly supported by evidence. Exercise training enhances functional capacity, daily living ability and quality of life while also lowering the risk of cardiovascular events. To maximize long-term adherence, stroke survivor's physical activity goals and exercise prescriptions should be tailored to them individually.

Key words: Stroke**,** Brain-injuries, exercise, physical activity, recovery

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Research Title: The prevalence of Cardiometabolic disease risk factors in different ethnic groups among South African adults

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Cardiometabolic risk factors is the number one cause of death in the world. A large body of evidence indicates that lack of physical activity, obesity, hypertension, diabetes mellitus, lipid burden, smoking and unhealthy diets are the major contributors to cardiometabolic disease risk factors. Selective prevention of CMDs by health care professions could help reduce the burden on cardiometabolic diseases risk factors in South Africa. The aim of this study was to determine whether the modifiable risk factors of cardiometabolic diseases differed in ethnic groups amongst South African adults. A systematic literature review**,** including a detailed search strategy**,** was developed to search PubMed and other research data bases (web of science and google scholar). The inclusion and exclusion criteria were used to identify observational and intervention studies using qualitative and/or quantitative methods reporting on cardiometabolic/cardiovascular disease risk factors among ethnicity groups in South Africa. The study revealed that the prevalence of CMD varied greatly in different ethnicities. According to existing reviews the differences are due to genetic and environment factors, diet, sociodemographic characteristics and lifestyle. However, studies also indicate that risk factors can be modified by an increase in physical activity and that exercise helps reduce morbidity and mortality associated with cardiometabolic diseases. The results of this review indicate that the positive trend in CMD risk factors observed in the last decades in all countries of Southern Africa is still strongly present in South Africa. Health care professionals can use intervention strategies such as exercise and diet to help those who are at high risk, as well as well as, reduce the burden of CMDs in general populations.

Key words: Prevalence, Cardiometabolic diseases, cardiovascular diseases, diabetes, obesity, and hypertension

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Department: Social Work

Level: Doctoral

Research Title: Exploring factors that influence organ donation consent in a rural community of Limpopo province in South Africa.

Abstract: Peter Masibinyane Dimo & Elizabeth I Smit
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The purpose of the present study is to explore factors that impede black South Africans from granting consent for the harvest of organs from their deceased family members. South Africa has a considerable demand for human body organs for transplant and this demand outstrips the critically insignificant supply of available organs. Organ transplantation remains a definitive therapy for patients suffering from a wide range of end-stage diseases. However, many patients die before they could receive life-saving organs. In its quest to achieve its mission, the paper adopted a qualitative approach and an explorative research design. Purposive sampling and snowball sampling were used to recruit fifty people from a rural community in the Limpopo Province in South Africa. Unstructured interviews were used to collect data that was analysed through a thematic content analysis. The family system theory and the theory of planned behaviour (TPB) were used as theoretical frameworks for this study. The study found that refusal to consent, misunderstandings about brain death, a lack of communication about organ donation, a lack of understanding about organ donation and inaccurate information, socio-cultural factors, attitudes toward organ donation and mistrust of medical professionals all influence organ donation consent. The study recommends further research, public education and the evaluation of current organ donation legislation. Results of the study indicate that there is positive correlation between low consent rates and socio-cultural aspects. It is vital to take socio-cultural aspects into consideration when designing organ donation marketing strategies.

Key words: Exploring, factors Influence, Consent, Organ, donation

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Department: Biochemistry and Microbiology

Level: Doctoral

Research Title: Rooibos flavonoids, aspalathin, isoorientin and orientin ameliorate mitochondrial dysfunction by improving mitochondrial bioenergetics in cultured skeletal muscle cells

Abstract: Mitochondrial dysfunction is recognized as a characteristic feature of type 2 diabetes (T2D). Identification of cellular processes and gene networks contributing to impaired mitochondrial function might offer new drug targets and therapeutic strategies for T2D. Here, we have investigated the physiological effects of flavonoids found in increasingly consumed rooibos tea, aspalathin, isoorientin, and orientin on improving processes involved in mitochondrial function in C2C12 myotubes exposed to a mitochondrial channel blocker, Antimycin A. To achieve this, we induced mitochondrial dysfunction by exposing C2C12 myotubes to 6.25-µM Antimycin A for 12 hrs. Thereafter, cells were treated with aspalathin, isoorientin, and orientin (10-µM) for 4hrs, while metformin (1-µM) and insulin (1-µM) were used as comparators. Relevant bioassays and real-time PCR were conducted to assess the impact of treatment compounds on some markers of mitochondrial function. Our results showed that Antimycin A induced alterations in the mitochondrial respiration process and reduction of mRNA levels of genes involved in energy production. However, aspalathin, isoorientin, and orientin showed an ability to reverse such effects leading to the reduced production of intracellular reactive oxygen species. These flavonoids further enhanced the expression of genes involved in mitochondrial function such as Ucp2, Complex 1/3, Sirt1, Nrf1, and Tfam. Overall, the current study showed that these dietary flavonoids have the potential to be as effective as established pharmacological drugs such as metformin and insulin in protecting and improving mitochondrial function in a preclinical setting. However, such information should be confirmed in well-established in vivo disease models.

Key words:

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Department: Geography and Environmental Studies

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Research Title: Understanding the experiences of small scale commercial afforestation farmers in Manguzi, South Africa

Abstract: Lindokuhle D. Sibiya and Inocent Moyo
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The small-scale commercial afforestation has always played a vital role in stimulating the livelihoods in rural areas**,** not only in South Africa**,** but across the globe. Th**is** paper explores the lived experiences of small-scale commercial afforestation farmers in Manguzi. The purpose of this paper is to understand the factors that influence these farmers to get involved in this afforestation and explore the impacts on their livelihoods. It also unpacks the conflict between the farmers and the Department of Water and Sanitations over the policies that control afforestation practices in South Africa. This study adopted a qualitative approach and purposive sampling. Semi-structured interviews were conducted with the farmers who are directly involved in small-scale commercial afforestation in Manguzi. The findings indicate that in Manguzi, this afforestation is the only economic activity that has proven successful in improving the lives of rural dwellers and this has been the case for over 20 years. It is recommended that more rural development strategies must be implemented in Manguzi to provide diverse opportunities for the sustainable livelihoods.

Key words: Small-scale commercial afforestation; sustainable livelihood; policies; conflicts

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Department: Physics department

Level: Masters

Research Title: The Heat rate kinetics on liquefied hydrocarbon gases sensing

Authors: Mr Sunday A. Ogundipe, Dr S. S. Nkosi

Abstract:

The sensing and monitoring of liquefied hydrocarbon gases in the petroleum industries has been crucial to prevent casualties. Many sensors have been fabricated to detect these flammable petroleum gases such as the liquefied petroleum gas (LPG). It has been shown that the sensor's operating temperature is a key in determining its sensitivity. In many instances, this temperature is kept as a fixed parameter during the gas sensing measurements. That is the optimal operating temperature where sensors' performances are significantly high. However, this parameter becomes unstable on exposure of the sensor to liquefied petroleum gas depending on the gas concentration. This fluctuation in operating temperature results in the sensor's electric current or resistance oscillating indefinitely for as long as gas is present. Herein, a new simple mathematical expression following the Fourier's conduction law is devised to explain this anomaly. The relation between the heat transfer kinetics and the semiconducting metal oxide (SMO) sensor's electrical conduction is also established.

Key words: Heat transfer, LPG sensing, chemoresistive sensors, electrical conduction, Fourier equation.

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Diversification of Ferredoxins across Living Organisms

Abstract: Nomfundo Nzuza[1], Tiara Padayachee[1], Wanping Chen[2], Dominik Gront[3], David R Nelson[4] and Khajamohiddin Syed[1]

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Ferredoxins and iron-sulfur (Fe-S) cluster proteins play a key role in oxidoreduction reactions. To date, evolutionary analysis of these proteins across the domains of life have been confined to observing the abundance of Fe-S cluster types (2Fe-2S, 3Fe-4S, 4Fe-4S, 7Fe-8S (3Fe-4s and 4Fe-4S) and 2[4Fe-4S]) but the diversity of ferredoxins within these cluster types was not studied. To address this research gap, we propose a subtype classification and nomenclature for ferredoxins based on the characteristic spacing between the cysteine amino acids of the Fe-S binding motif as a subtype signature to assess the diversity of ferredoxins across the living organisms. To test this hypothesis, comparative analysis of ferredoxins between bacterial groups, Alphaproteobacteria and Firmicutes and ferredoxins collected from species of different domains of life that are reported in the literature has been carried out. Ferredoxins were found to be highly diverse within their types. Large numbers of alphaproteobacterial species ferredoxin subtypes were found in Firmicutes species and the same ferredoxin subtypes across the species of Bacteria, Archaea, and Eukarya, suggesting shared common ancestral origin of ferredoxins between Archaea and Bacteria and lateral gene transfer of ferredoxins from prokaryotes (Archaea/Bacteria) to eukaryotes. This study opened new vista for further analysis of diversity of ferredoxins in living organisms.

Key words: Domains of life; evolution; ferredoxins; lateral gene transfer; iron-sulfur proteins

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Level: Researcher

Research Title: Promoting resilience through life-style modification and healthy living for people living with Diabetes Mellitus

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Effective strategies for healthy living and modification of lifestyle for people who are living/diagnosed with Type 2-Diabetic Mellitus (DM) can assist in preserving their health status. It can also reverse the disease progression, thereby preventing complications and unnecessary premature death. To collaboratively develop a community-centred intervention strategy for modification of lifestyle in people with Type-2-DM in selected rural communities in King Cetshwayo District. To collaboratively develop a socially and individually acceptable intervention strategy for Type-2-DM**.** Qualitative approach using a participatory-action learning action research (PALAR) design.**:** A Nominal Group Technique (NGT) strategy will be used to collect and analyse data. Individuals who would have participated in phase1 data collection through questionnaires and face-to-face interviews of the study. Individuals who would either be diagnosed with Type-2DM or caring for individuals who are suffering from Type-2 DM. Signed informed consent. Intervention of the developed strategy through seminars and workshops on healthy food types and preparation areas, lifestyle modification, and active participation in physical exercises. The findings will be credible due to scientific methods that are selected for the study. However, the credibility of is based on mutual partnership and respect that the researchers will postulate when co-creating the intervention strategy. The co-constructed socially and individually acceptable strategy for management of Type-2 DM will assist in promoting self-reliance and self-sufficiency in managing the disease process. The strategy will be readily acceptable to communities because they would also have been part of its construction.

Key words: Diabetes Mellitus, Healthy living, Lifestyle Modification, Resilience, self-reliance

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Department: Geography and Environmental Studies

Level: Doctoral

Research Title: Data-driven time series forecasting of COVID new cases in South Africa using Hybrid deep learning recurrent neural network.

Abstract:
In early 2020, the World Health Organisation declared the unprecedented 2019 novel coronavirus as a global pandemic. This coronavirus disease (COVID-19) is a highly infectious disease caused by the SARS-CoV-2 virus that was first detected in Wuhan, Hubei province in China in December 2019 and spread to many other countries of the world within few weeks. In this study, hybrid data-driven forecasting models, based on long short-term memory networks (LSTM), recurrent neural networks (RNNs) and Temporal Convolutional Networks (TCN) are developed and tested on publicly available new cases COVID-19 data. Robust data-driven hybrid time series-forecasting models that are based on signal decomposition techniques such as Ensemble Empirical Mode Decomposition (EEMD), Empirical Wavelet Transforms (EWT) and Variational Mode Decomposition (VMD) are developed using python. The performance of these models is done in terms of various forecasting performance evaluation criteria such as the root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE) and correlation coefficient (R). In order to compare the modelled data to the ground truth, the COVID-19 data is divided into 70% training time series and 30% testing time series.

Key words:

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Department: Computer Science

Level: Masters

Research Title: A Blockchain-Based Firmware Update Architecture for Long-Range Wide Area Network (LoRaWAN)

Abstract:
The Internet of Things (IoT) is impacting the way people, consumers, businesses and governments interact with the physical and cyber worlds. More often than not, IoT devices are designed for specific functional requirements or use cases without paying too much attention to security. Moreover, the expanding use cases and the exponential growth in smart connected devices significantly widens the attack surface. The security of IoT devices and the privacy of the data they collect and process is still an area of active research. Interconnected devices with lax security can be compromised by attackers to retrieve sensitive information such as encryption keys, user passwords, sensitive URLs and so on. When vulnerabilities have been discovered, device manufactures are expected release patches or new firmware to fix bugs and vulnerabilities. However, delivering and deploying the new firmware securely on the affected devices remains a challenge. In this study we develop and evaluate a secure blockchain-based firmware update mechanism that is suitable for low-powered devices over a low data rate and constrained LoRaWAN network. The proposed mechanism ensures integrity, confidentiality, availability and authentication to strengthen or add an extra layer of security on LoRaWAN firmware update by utilizing Blockchain and InterPlanentary File System (IPFS). A proof of concept was implemented and evaluated using LoRa end devices to show the utility and applicability of the proposed mechanism. The results conclude that the proposed model is feasible for the constrained and low-powered devices in LoRaWAN network. This conclusion is obtained by evaluating the cryptographic techniques used to secure firmware update over LoRaWAN.

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Department: Computer Science

Level: Honours

Research Title: Evaluation of image processing techniques to detect malicious Portable Executable files

Abstract:
One of the major challenges in the field of security threats is malicious software which is also referred to as malware. The daily creation of new malicious software (malware) show a significant dispute to anti-virus vendors since anti-virus tools, using manually created signatures, are only competent in identifying malicious software instances and only their relative variants. The main focus of malware is to damage, disrupt and or gain unapproved access to a computer system. Detection of malware in portable executable files has remained an open problem for several years because attackers are always finding a better or smarter way of evading the security mechanisms that was used to root out malicious files. Hence, there is still a need to look for more innovative solutions. This current signature-based antivirus programmes solution is failing because what the malware attackers are doing is to modify the malware and signature. Once the signature changes, the antivirus no longer has the capability to detect the malicious filewhich continues attacking. This research is to evaluate image processing algorithms (Linear Regression, SVM, RandomForest, Naive Bayes, Decision Tree, etc.) on how they perform towards processed PE files as images. The performance of the above mentioned algorithms will then determine which algorithm is more accurate and has fast execution time in order to determine which is more suitable to be implemented. The experimental results are still a work in progress. Thus far, decision tree algorithm is dominating with accuracy of 96.97% and a precision of 97% and Naive Bayes has lowest accuracy of 32.35% with a precision of 27%.

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Department: Computer Science

Level: Honours

Research Title: Detecting malware in Portable Executable file using Spectrograms

Abstract:
Detecting the Malware from the P.E(Portable Executable) using Spectrograms. Malware is an umbrella term used for any software designed to cause harm. Short for Malicious Software, malware can damage files, steal sensitive data and even take your device hostage. Malware is a collective term used to describe viruses, ransomware, spyware, Trojans and any other type of codes or software that is built with malicious intent. Advanced malwares are posing a severe threat **to** computer systems. Signature-based antivirus products can only be able to detect those malwares that has already caused damage and are registered. With the growth of technology, the number of malware are also increasing day by day. Malware now are designed with **a** mutation characteristic which causes an enormous growth in number of the variation of malware. On the other hand, machine learning methods for malware detection are proved ineffective against new malwares. At the same time, machine learning methods for malware detection have a high false positiv**ity** rate for detecting malware. This study seeks to investigate on how to implement machine learning to malware detection in order to detect unknown malware and to validate that malware detection that implement machine learning will be able to achieve a high accuracy rate with low false positive rate. Spectrograms will be used to detect malware concurrently with image detection. The algorithm will be used to convert audio file to Spectrum Images.

Key words:

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Department: Mathematical Sciences

Level: Honours

Research Title: Chaplygin gas as a model for dark energy

Abstract:
Understanding what dark energy is, understanding what it is that is making the universe expand faster is an incredibly important thing for understanding the future of the universe. Dark energy is the new terminology for cosmological constant. Right now, the evolution of the cosmos is dominated by this mysterious dark energy, which makes up about 70 percent of the universe, 25 percent is dark matter and only 4 percent normal matter. Many models have been proposed before for dark energy. In this work we would like to introduce Chaplygin gas (CG) model as an alternative to dark energy and its versions. There are many versions of Chaplygin gas models that have been proposed so far but we will focus on three versions of it. Those versions we mainly focus on are Generalized Chaplygin gas, Modified Chaplygin gas and lastly Extended Chaplygin gas. The main aim of CG model is that it appears as an alternative to the cosmological constant to explain the stage of accelerated expansion of the universe today.

Key words: Chaplygin gas model, Dark energy, Cosmological constant, Universe, Cosmos

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Department: Consumer Sciences

Level: Doctoral

Research Title: Consumer acceptability and perception of ProVitaminA Bio-fortified maize and maize based products: A review

Abstract: Qumbisa Nothando & Unathi Kolanisi
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In many underdeveloped nations, vitamin A deficiency (VAD) continues to endanger the lives of countless children and adults. While numerous interventions have been implemented, such as vitamin A supplementation and food fortification, the reduction in VAD has been gradual, with only minor improvements in some countries. This is due to a lack of coverage and compliance among the targeted population. Bio-fortification addresses these shortfalls by focusing on crops that are already consumed by the bulk of the population such as maize, giving it a broader reach. Despite the success in maize bio fortification with ProVitamin A in terms of improved crop value, the consumption and utilization of this crop amongst people has been very low. The aim of this study is to review literature to analyse the acceptability and utilisation potential of ProVitamin A bio fortified maize (PABM) in alleviating VAD and forming base for further food product development. Publications that are related to the objective of this study were filtered and included in this review. Literature shows that PABM has the potential to help alleviate VAD due to its increased nutritional content**,** however, factors such as unfamiliarity of the yellow crop colour, perceptions (common use for animal feeding) and flavour profile of the by-products have all contributed to the low acceptance and consumption. PABM has a potential to generate new products but the unpleasant flavour profile remains a difficult task that must be addressed. The by products are then recommended to be fortified with ingredients that can mask the strong flavours of PABM and increase overall acceptability.

Key words: ProVitamin A, Bio fortification, Maize, Consumer Acceptability, Malnutrition

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Department: Botany

Level: Masters

Research Title: Effect of poultry and goat manures on agro-morphological traits of Sesamum alatum leafy vegetable

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Abstract:
Sesamum alatum is an essential nutraceutical wild**,** leafy vegetable used in Africa and other parts of the world. It contains an excellent amount of macro and micronutrients. Cultivating such agronomic potential valued scarcely known vegetables is limited by inadequate soil fertility and agronomic guidelines. To improve the agro-morphological productivity and promote the cultivation of S. alatum organic manure was applied. Pot trails were conducted at the University of Zululand during the spring-summer months (September-December) of 2018 and 2019. The aim was to do a comparative assessment of the effect of poultry and goat manure on the vegetative growth and reproductive yield of S. alatum. The experiment was laid out in a completely randomized design (CRD) with four replicates (0, 1, 2, and 3 t/ha). Manure application improved growth and yield of S. alatum. Goat manure had the greatest effect in most measured agro-morphological traits than poultry manure. Treatment rates â‰¥ 2 t/ha of goat manure gave the best vegetative growth. Recommended rates for optimum plant productivity were â‰¥ 2 t/ha for both manures except for the seed mass which was not affected by manure application. However, no substantial variances in performances were noticed between the manures. Therefore, both manures could be equally used in the absence of one or the other.

Keywords: wild leafy vegetables, organic manures, agro-morphology

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Department: Mathematical Sciences

Level: Honours

Research Title: Dynamical System Analysis in Cosmology

Abstract: Athule Vusani & Prof. A Beesham

Modern scientific cosmology is valuable in itself for what it reveals about the nature we inhabit. It is a demonstration of the power of modern science to transform our understanding of who we are and from where came. In physics, cosmology is a well-established research subject, while in mathematics, dynamical systems are well-established. Dynamical system techniques turn out to be ideal for studying many elements of cosmology. The goal of this research is to give the reader a quick overview of cosmology and dynamical systems. Particularly**,** when the governing equations are a finite system of autonomous ordinary differential equations, dynamical systems theory is well-suited for calculating the probable asymptotic states (at both early and late timeframes) of cosmological models.

Key words: Cosmology, Dynamical systems, Asymptotic states

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Department: Zoology

Level: Masters

Research Title: Toxicity of sodium dodecyl sulphate in estuarine amphipod Grandidierella lignorum

Abstract: Mkhabela, SC & Masikane, NF
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Abstract

Amphipods are frequently and widely used in assessing the health status of sediments in estuarine and marine aquatic systems. *Grandidierella lignorum* is one of the amphipods that are currently being developed as a toxicity test organism for estuarine and marine pollution. One of the criteria for choosing a toxicity test organism is its sensitivity to common toxicants. *G. lignorum* is sensitive to metals such as cadmium but its sensitivity to organic compounds (e.g. personal care products, pesticides and pharmaceutical) is however not known. This study therefore, investigated the sensitivity of *G. lignorum* to sodium dodecyl sulphate (SDS), a common reference toxicant. Juveniles were exposed to increasing SDS concentrations (range: 3.75-80 mg l^{-1}) at different salinities (7, 21 and 35), following a standard procedure for an acute 96hr water only test. Sensitivity to SDS was highest at salinity 7 (2.87 mg/l) and lowest in salinity 21 (15.5 mg/l). This sensitivity is similar to that of species being developed as toxicity test organisms elsewhere in the world (e.g. *Corophium orientale* and *Allorchestes compressa*). This study therefore suggests that in addition to testing the toxicity of metals, *G. lignorum* may also be used to test for dissolved organic compounds.

Keywords: sodium dodecyl sulphate, reference toxicant and acute.

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Prevalence, virulence factors and antimicrobial susceptibility of shiga toxin producing E. coli (STEC) in beef products from retail stores of selected Municipalities in KwaZulu Natal

Prevalence, serotypes, and characteristics of Shiga cytotoxin Escherichia coli from meat and meat products in African countries: A review

Abstract:

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Shiga toxin producing Escherichia coli (STEC) are zoonotic pathogens that produce clinical infections characterized gastro-intestinal infections. The clinical infections range from mild diarrhoea to bloody diarrhoea, therefore**,** leading to more complicated infections of the haemorrhagic colitis and haemolytic uremic syndrome (HUS). Virulence genes play a vital role in the initiation of STEC infection. Although beef is usually the predominant source of STEC-induced infections, **however,** other foods have also been reported to pose a risk of infection. Administration of some antibiotics during acute phases of STEC-induced infections has been reported to affect the disease outcome. Antimicrobial resistance genes in STEC is of concern due to the possibility of transfer to other microorganisms through horizontal gene transfer. A cross-sectional study was conducted to determine the prevalence of STEC virulence genes in meat, meat products and organ meat. The samples were screened for the presence of STEC non-0157 and STEC 0157. Total aerobic plate count (TAPC) per gram was also determined**;** the viable count was expressed using the procedure ISO 4833:2003. STEC was isolated using an ISO: 16654: 2001 standard method. The samples were further analysed using standard microbiological techniques. Serological identification was conducted using latex agglutination test to identify E. coli 0157. The average of 41.25% of the samples had a higher TAPC, which exceeded the standard for microbial standard for meat (5. 0 log CFU/g) of South Africa. The prevalence of STEC 0157 was 0,75%. The data indicates an estimate health risk to the consumers of meat and meat product from KwaZulu Natal.

Key words:

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Department: Computer Science

Level: Honours

Research Title: Evaluation of detection of malicious Uniform Resource Locators (URLs)

Abstract:
The information and communication technology (ICT) has changed significantly from the traditional approach of treating information around the world to taking advantage of this innovation. It is noteworthy that many people actually use it to carry out their daily activities while others use it to perform nefarious activities to the detriment of other cyber users. According to various reports of previous researchers, millions of people have been victims of fake uniform resource locators (URLs) sent to their emails by spammers. Financial institutions are not left out of the monumental loss suffered over the years by this illegal act. According to various research published in the literature, researchers have shown how machine learning algorithms could be used to verify and confirm compromised and spoofed URLs in cyberspace. However, inconsistencies have been found in the researchers' results and their corresponding results are not reliable based on the values obtained and the conclusions drawn from them. In this context, the authors carried out a comparative analysis of five learning algorithms (Naive Bayes, Decision Tree, SVM, Random forest and Logistics Regression Model) to verify compromised, suspicious and spoofed URLs and used them for evaluation based on the metrics (F-score, Accuracy, Precision, Recall and training time). Based on the measurement of the confounding metrics, the result obtained shows that the Random forest algorithm achieves the highest values of accuracy, precision and f-score. Without a doubt, it is an effective and credible means of maximizing the detection of compromised and malicious URLs.

Key words:

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Department: Computer Science

Level: Masters

Research Title: Tutor identification using a real-time dashboard

Abstract:
Education sectors use dashboards to monitor and visualize the data that is generated during the learning and teaching processes. When students' performances are low, dashboards can easily show that information at a glance and tutors can then be hired to help to bring the grade up. Tutors are hired without the prior knowledge of their present performance but with the history of how they use to perform on the module as a whole and an assumption that they know everything that they covered in the module which is the part that raises concern. This study focuses on building a real-time dashboard that monitors student performance based on topics covered in the module, with the aim of simplifying the process of choosing the best tutor for each topic covered in the module. At the end of this study and its prototype development, a survey of 20 lecturers were conducted to validate and comment on the dashboard prototype. Analysis of the responses demonstrated that most of the lecturers were not happy not knowing the performance of their tutors on the topics they are covering. The results indicated that dashboards that monitor tutors are necessary to keep the lecturer in control of how important the tutor is for their student.

Key words:

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Genome data mining annotation and comparative analysis of P450s and their secondary metabolites in the bacterial phylum Bacteroidetes

Abstract: Authors: Bridget Nkosi, David R. Nelson, Tiara Padayachee and Khajamohiddin Syed brilenhle@gmail.com

Cytochrome P450s are regarded as biocatalysts with a vast number of functions. Bacterial P450s are found to play critical roles in the biosynthesis of secondary metabolites which are compounds that are not directly involved in the normal growth, development or reproduction of the organism with potential biotechnological applications in drug discovery. Bacteroidetes are found in the human gut and are known to be involved in secondary metabolite production. Despite knowing that P450s are involved in the production of secondary metabolites, to date, genome wide datamining, annotation and phylogenetic analysis of P450s in Bacteroidetes has not been reported. Thus, this study aimed to address the aforementioned research gap. Comprehensive analysis of P450s in the phylum Bacteroidetes was performed. Genome-wide analysis of 334 consisting of 130 general revealed 98 P450s in 77 species. Hymenobacter genus had the most P450s. 21 P450 families were discovered with CYP1103 being the most dominant P450 family. Cluster analysis revealed 1298 clusters with terpene being the most dominant. Out of the 98 P450s found in 77 Bacteroidetes species, only 8 P450s (8.2 %) of 7 Bacteroidetes species were found as part of the secondary metabolite BGCs. This study is the first comprehensive analysis of P450s in Bacteroidetes.

Key words: Cytochrome P450s, Bacteroidetes, Secondary metabolites

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Department: Computer Science

Level: Masters

Research Title: Improving the Gateway Placement Algorithm in Long Range Wide Area Network (LoRaWAN)

Abstract:
Internet of Things (IoT) is a fast and rapidly growing environment with LoRa technology as a leading Low Power Wide-Area Network (LPWAN). It is of paramount importance to understand the LoRaWAN limitations or drawbacks and capabilities in terms of its scalability, coverage, probability and network throughput while LoRa networks are being rapidly deployed across the globe. Therefore, this paper intends to evaluate the LoRa network performance using improved LoRa gateway algorithm for a Long-Range transmission technology and FLoRa (Framework for LoRa) which is a simulation framework for carrying out end-to-end simulations for LoRa networks. More specifically, this study analyses and presents the results of data collected from the FLoRa simulator after implementing the gateway placement algorithm optimized. To characterize the coverage of every LoRa nodes in the network, packet delivery ratio (PDR) for each node has been calculated. The extensive results obtained shows that as few as two gateways deployed in the network is sufficient to cover approximately 10 km radius of a dense urban area.

Key words:

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Level: Masters

Research Title: The effect of photoperiod in acute toxicity testing using endemic amphipods Grandidierella lignorum.

Abstract:
Photoperiod is the important environmental factor that affects G.lignorum physiology mechanism and behaviour and it has the potential to have an effect on toxicity of cadmium to Grandidierella lignorum. There are different photoperiods used to conduct toxicity testing using G.lignorum, but there is no understanding what effect these photoperiods have on the overall results. The photoperiods used for toxicity tests focus on the impact that they have on the behaviour of the G.lignorum rather than their impact on cadmium toxicity. The understanding of photoperiod influence on the toxicity of cadmium will enable correct result interpretation. This study assesses how the different photoperiods impacts on toxicity testing using cadmium. The G.lignorum was exposed to three photoperiod regimes, 12L:12D, 16L:8D and continuous light, each photoperiod regime had cadmium concentrations (mg/l) of 0, 0.4, 0.8, 1.6, 3.2 and 6.4, each concentration had two replicates in each photoperiod the acute toxicity testing was conducted for 96 hours and mortality was recorded and expressed as LC50s. The photoperiod has an impact on the toxicity susceptibility of G.lignorum and it is important to understand the photoperiod impact on the results before selecting photoperiod.

Key words: Photoperiod, physiology and Acute.

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Department: Consumer Sciences

Level: Masters

Research Title: Reflections of the impact of COVID-19 on food production and supply: An industry perspective

Abstract:
The impact of the global Covid- 19 pandemic affected all business sectors, placing strain on South Africa's economy. Although the Department of Agriculture, Rural Development and Land Reform (DARDLR) guaranteed that South Africa would have adequate food supply during the pandemic, the risk of food insecurity to the poor has been suspected to intensify. The effects of Covid-19 have placed greater pressure on an already challenged supply chain highlighting nervousness on food manufacturing and supply to the public. Furthermore, the uncertainty of Covid-19 cases and the unpredictable and sudden restrictions at different lockdown levels causes frustration to productivity and supply**,** thus**,** unsettling businesses that depend on export and import driven profits. This study aims to identify the challenges and potential opportunities that contribute to a shift in the food industry and the influence this will have on products. A qualitative approach using online interviews comprising of semi- structured questions were conducted with key industry stakeholders with different areas of specialization in the food production industry. Findings from the study will be reported (Oral presentation) in the form of noteworthy themes and sub categories as established from the interviews. The emergence of COVID-19 has disrupted the already constrained food production sector and has spurred a need for accelerated transformation for company survival.

Key words: Supply chain, productivity, Imports, Exports, Pandemic, Productivity.

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Department: Computer Science

Level: Masters

Research Title: Evaluation of tasks scheduling algorithms with energy efficiency in IoT networks

Abstract:
IoT network are experiencing an increase in a number of IoT health care systems. This improvement of IoT technology has brought a challenge in task scheduling and limited energy supply. Vital Signs monitoring (VMS) health care system is one of the commonly used IoT device to record the vital signs data of patients such as blood pressure. This system has an issue of high energy consumption and task scheduling problem. The literature has reviewed numerous numbers of task scheduling algorithms that are not energy efficient but this study entails the rapid rate of energy drainage. It is necessary to implement the task scheduling algorithms that decide which tasks will be allocated /assigned or where to schedule those tasks. These study will model the task scheduling problem of the VSM system. This work will further present the task scheduling algorithms to solve the issue of high energy drainage and task scheduling challenges. These series of simulation experiments will be conducted to evaluate the performance of these algorithms. The findings will show that the proposed energy efficient task scheduling algorithm outperforms the existing algorithms.

Key words: IoT, Task scheduling, Energy drainage

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Occurrence, Serotypes and Antimicrobial Resistance of Salmonella species from Beef in Retail Outlets from KwaZulu-Natal Province, South Africa

Abstract: Authors: Naidoo, S., Butaye, P., Maliehe, S., Magwedere, K., Basson, A. K. & Madoroba, E.

Serovars of non-typhoid Salmonella enterica are among the leading causes of foodborne infections worldwide. The emergence of multidrug-resistant strains has complicated the treatment of Salmonella infections, in both animals and humans. The aim of this study was to determine the occurence, serovars, virulence factors and antimicrobial resistance patterns of Salmonella recovered from beef and beef products. Four hundred samples (n = 169 organs, n = 110 processed, n = 53 intact and n = 68 ready-to-eat meats) were collected from 25 retail outlets in 2 districts of KwaZulu-Natal province in South Africa. The International Organization for Standardization 6579-1:2017 method was used for microbiological analysis and presumptive Salmonella isolates were confirmed using matrix-assisted laser desorption ionization time of flight mass spectrometry. Isolated Salmonella spp were serotyped according to White-Kauffmann-Le Minor scheme. Kirby Bauer disk diffusion method was used to determine the antimicrobial resistance profiles of the Salmonella spp against Cefotaxime, Kanamycin, Ampicillin, Amoxicillin, Trimethoprim-Sulfamethoxazole, Ciprofloxacin, Chloramphenicol, Gentamycin and Cefoxitin antibiotic discs. Interpretation of results was performed according to Clinical and Laboratory Standards Institute guidelines. Contamination of the samples with Serovars (Enteritidis, Hadar, Heidelberg and Stanley) was observed in 1.25% (5/400) of samples (mainly organs). Susceptibility against all 9 tested antimicrobials was observed for all tested isolates. The findings indicated that Salmonella prevalence in all categories of selected retail beef samples is low, however, routine monitoring and surveillance to control the risk of potential outbreaks should be maintained. Future work will involve evaluation of Salmonella strains for virulence factors associated with pathogenicity.

Keywords: Salmonella, Occurrence, Serotypes, Antimicrobial resistance, Beef

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Department: Agriculture

Level: Masters

Research Title: Method development and optimization for boar seminal plasma proteomic profiling

Abstract: Pateswana Wilson Mokwena[1,2], Stoyan Stoychev[2], Sindisiwe Buthelezi[2], Fhulufhelo Vincent Ramukhithi[3] and Khoboso Christina Lehloenya[1]
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Only 5 to 7% of boars in AI centres showing normal ejaculates and used in AI doses are sub-fertile, causing productive and economic losses to farmers. This suggests that current semen analysis is unable to identify sub-fertile boars despite the use of innovative technologies like computer aided sperm analysis (CASA) and flow cytometry techniques. Proteomics is critical to identifying properties and functions of proteins regulating fertility and cryopreservation. However, the proteomic analysis of seminal plasma is difficult due to its large dynamic protein concentration. Another challenge in plasma proteomics in previous studies is the low consistency in reproducible observations. This study, therefore, aims to optimize and develop a seminal plasma sample preparation method for better protein coverage and reproducibility for use in biomarker discovery. Eight boars were used for the study (2 large white, 3 kolbroek and 3 windsnyer. Acetone precipitation methods, buffers (TRIS and urea), sample clean-up using MagReSyn HILIC; PAC; C18 tips and gel-based methods were evaluated. The preliminary study examined the proteomic profile of the pooled seminal plasma samples from the 8 animals. 1203 distinct proteins were found from 237 protein groups. Spermadhesins and fibronectins are some of the high abundant proteins found. These have been correlated with sperm fertility. Gene ontology analysis showed proportions of proteins associated with fertility and cryopreservation but most of the proteins have not been implicated in reproductive processes. This study will provide characterization of the boar seminal plasma proteome with more than 1000 proteins reported and will help in the fertility biomarker discovery.

Key words: Proteomics, Boar, Seminal plasma, Mass spectrometry, Biomaker

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Department: Mathematical Sciences

Level: Honours

Research Title: Survival analysis of consumers' bank loans and credit risk

Abstract: Mthembu Xolani Khethukuthula & Mr. W.J Dlamini
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Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. Credit risk is one of the greatest concerns to most lending institutions since nowadays loans are the lifeblood of banks which make much profit through loans. Therefore, developing a model that will minimize credit risk is essential for every financial institution. This project is aimed at coming up with a model that can be used by the banks and other credit advancing institutions to calculate the risk associated with credit advancement. The objective in this project is to estimate the overall credit risk for the bank by estimating the probability of default and time to default for consumers taking the loan. Survival analysis methods are applied to this project to measure credit risk. Firstly, Cox's proportional hazards modelling is applied in the generation of this model since it is the most suitable for survival data when proportional hazards has been proved in various groups. This model also helps in determining how certain covariates affect response variable (default). The Kaplan Meier estimate was also used to analyze probability of default and time to default at specific time.

Key words: Credit risk, default, censoring, credit scoring, default

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Department: Mathematical Sciences

Level: Honours

Research Title: Stock Closing Price Forecasting using GARCH and Multilayer Perceptron (MLP): A comparative **s**tudy

Abstract:
Attaining financial freedom is a goal shared by most people. One way of attaining this is by profiting from well calculated investments on the stock market. Increased access to electronic gadgets and internet connection has increased access to stock markets. Forecasting stock closing price is one of the most effective tools for risk management. Portfolio diversification is useful for making profitable trades. However, closing price forecasting is delineated as one of the most challenging tasks due to most of the data being devoid of linearity, stationarity and having high degrees of uncertainties and hidden patterns. In this context, this study will examine the predictive performance of Multi-Layer Perceptron and GARCH models to find an appropriate model to forecast stock closing price for MTN stocks. The proposed methods are Multi-Layer Perceptron which were identified to be dominant machine learning techniques. The models are evaluated using standard metrics: RMSE and MAPE. In both cases, low values indicate that the models are efficient in predicting stock closing price.

Key words: Closing price, stock, forecasting, Multi-Layer Perceptron and GARCH model.

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Level: Honours

Research Title: Load Forecasting using a Hybrid model for ARIMA and ANN.

Abstract: Nhlanhla Mthembu, Supervisor: S. Sibiya & Co-Supervisor: F. Silwimba
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South Africa is expected to face more demand in electricity due to the significant rise in services and devices that utilize electricity. Furthermore, we are in the era of the 4th industrial revolution, which itself implies more demand for electricity. Electricity demand forecasting is important for planning facility expansion in the electricity sector. It is one of the most important variables required for estimating the amount of additional capacity required to ensure a sufficient supply of energy. Accurate forecasts can save operating and maintenance costs, increase the reliability of power supply and correct decisions for future development. This study aimed to examine the predictive performance of Autoregressive integrated moving average (ARIMA) and Artificial Neural Network (ANN) and Hybrid models (ARIMA+ANN) to find an appropriate model to forecast electricity demand. The objective of this study is to propose hybrid models using addictive and linear regression methods to combine linear and nonlinear models. Thus**,** the research methodology will be ARIMA, ANN and hybrid ARIMA+ANN. The expectation is that the forecasting accuracy will be improved when using the hybrid model as compared to individual models. The best-performing model on forecasting will be the model with the smallest mean absolute percentage error (MAPE).

Key words: Electricity demand; ARIMA; ANN; MAPE

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Department: Botany

Level: Masters

Research Title: Morpho-agronomic**,** genetic variation and segregation patterns of Phaseolus vulgaris landraces from selected provinces of South Africa.

Abstract: Valencia Vuyisile Ndlangamandla & Nontuthuko Rosemary Ntuli
Variation in seed traits of F1 progeny that segregated from the selected parents of Phaseolus vulgaris landraces
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Phaseolus vulgaris of central and South American origin is an important legume that forms an essential part of people's diet. The seed of P. vulgaris has numerous varieties classified by seed size, seed coat colour and shape. The seeds are still planted and harvested in large by small-scale farmers. Studies on the seed coat colour segregation among these landraces are not documented in the country. Thus, this study aimed to characterize P. vulgaris using variations in seed coat colour and size. The twelve parents were self-pollinated in a randomized complete block design, had their variation in seed coat colour and size determined. The parents yielded numerous progenies that varied in seed colour, pattern and shape. The segregation in seed coat probably had multiple genes (P, C, T, G, B, Rk, and [C-R]) involved. The clustering system, biplot, and dendrogram revealed the clustering of parents and progenies was based on their seed size and mass. Landrace E-100Bk-Cl, which produces a 100 percent black seed coat colour, may be crucial for large-scale farming in the future because it produces a wide range of seed coat colours. Different bean types/colours are preferred by farmers in different environments. The selection of large-seeded landraces M-90LB10M-Cl, N-100LP-K and P-50C50M-O in the current study can lead to optimal seed growth and large-scale agriculture and breeding in the future.

Key words: Parents, F1 progenies, Seed colour genes, Segregations, Seed size.

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Department: Human Movement Science

Level: Researcher

Research Title: Effects of a four-week high intensity interval training (HIIT) programme on body composition and physical fitness of young female adults at the University of Zululand

Abstract: Authors: P.B.M Ndlovu (Msc), S zwane (Hons), & B. J Oosthuizen (Hons)

Human Movement Science, University of Zululand, Private Bag X1001, KwaDlangezwa, 3886: email: ndlovup@unizulu.ac.za; samke4644@gmail.com; bekkeroost9@gmail.com

High intensity interval training (HIIT), a form of aerobic training, has emerged as a time efficient and viable method for inducing potent physiological, cardiovascular, metabolic and functional capacity. Young adults at tertiary level usually cite a lack of time as a barrier to their participation in physical activity as they have to focus on their work. The purpose of this study was to investigate the effects of a four week HIIT programme on the body composition and physical fitness of young female adults from the university of Zululand. A total of fifty-seven female participants were recruited from the University of Zululand but twenty-four were eligible for the study. Participants were divided into the HIIT group (n=12) and Control group (n=12). Each HIIT session consisted of 10 X1 minute workout bouts (at 85%-100% Harman) separated by 10X1 minute rest periods (at 50-60%HRmax). The HIIT programme consisted of twelve sessions over a period of four weeks at three sessions per week. The participant's blood pressure (BP), resting HR, BMI, body fat percentage, flexibility and HR response using 3minute step test were assessed. The HIIT groups systolic SBP (109.58-102mmHg), DBP (72.16-68.83 mmHg), HR (79.17-69.08 bpm), body fat percentage (30.54-22.52%) and HR response (162.08-121.66 bpm) significantly improved. The present study revealed that twelve sessions of supervised HIIT programme improved BP and HR response, decreased body weight and body fat percentage of young female adults.

Key words: high intensity interval training, body composition, physical fitness

Abbreviations: SBP-Systolic Blood Pressure, DBP-Diastolic Blood Pressure, HR-Heart Rate

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Department: University of Zululand Science Centre

Level: Researcher

Research Title: Essential skills – The Covideo Project

Abstract:
Unizulu Science Centre (USC) has been running face to face matric science workshops for 25 years, presenting practicals and sharpening the skills of over 200 000 matric science students. The 2020 lockdown presented a dilemma: learners in matric needed assistance more than ever, but schools were closed and large gatherings were impossible. Many institutions around the world went online, making digital content available through the internet. Very few of the schools in which USC works have reliable internet and almost none of the homes, so this route was not possible. USC worked to convert a 4-hour contact workshop into 8 one-hour videos, highlighting the essential skills for Matric Science Paper 1 – the Physics paper. While these videos were made available on the internet for downloading or streaming, they were physically distributed on memory sticks to teachers, along with an accompanying 48-page workbook. Industry funding provided for the King Cetshwayo district and SA Institute of Physics funding (with support from Allan Gray) saw a further 20 000 booklets printed and 500 memory sticks manufactured for schools in 3 other provinces and used as the basis for teacher training. Now, in 2021, the booklet and videos have been extensively rewritten and re-filmed, adding about 50 % more content and updated with 2020 examination papers. In addition, projects are underway to make a video series for Life Science and Chemistry. While this project was aimed at matric learners, it would work well in a tertiary setting and valuable lessons learnt in the process will be shared.

Key words: Matric Science, Skills, Video, Offline, Outreach

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Department: Biochemistry and Microbiology

Level: Masters

Research Title: Isolation, screening, identification and optimization of microorganisms with bioflocculant-production potential from Kombucha tea Scobies and its application in wastewater treatment.

Abstract: Tsilo PH, Basson AK, Ntombela ZG

Microorganisms excretes metabolites during growth. Extracellular polysaccharides, glycoproteins, proteins and nucleic acids contribute to the synthesis of bioflocculants. Through formation of bridges between suspended particles in a solution**,** bioflocculants assist with increase in flocculation, leading to particles precipitation. It is noteworthy that when impurities are flocculated into flocs, they tend to settle down and can be removed easily. In this study, the ability of the yeast Pichia kudriavzevii from Kombucha teas Scoby to produce a bioflocculant was investigated. A Kombucha tea Scoby was brought from Pinetown, KwaZulu-Natal province of South Africa, and bioflocculant-producing microorganisms were isolated from the Scoby. Dilutions of the samples were made and cultivated in nutrients agar plates to obtain pure cultures. Pure cultures were screened for bioflocculant-production potential against kaolin clay suspension (4 g/L) as the test material. The isolate with better bioflocculant production potential was selected for the bioflocculant production. The isolate showed the highest flocculating activity of 84.93%. The identification of the organism using 16S rRNA showed the organism to have 99% similarities with the yeast Pichia kudriavzevii with accession number MH545928.1. The strain was capable of producing a bioflocculant under the optimal production conditions of inoculum size 1% (v/v), glucose (92%) as carbon source, peptone (94%) as a source of nitrogen at a temperature of 35 ºC (97%). At an initial pH 8 of the medium, the maximum flocculating activity was achieved and the shaking speed of 140 rpm resulted into an optimum production of a bioflocculant by P. kudriavzevii. A bioflocculant yield of 2.836 g was produced from 1L fermentation broth after 60 hours of incubation at 35 ºC. The colour of a produced bioflocculant was milky-white, and in a powdered form. The purified bioflocculant obtained had the highest flocculating activity of 80.2% at a dosage size of 0.4 mg/mL against kaolin suspension. The purified bioflocculant was cation-dependent with Al3+ (72%) as the most favourable cation. The purified bioflocculant was able to retain about 70% flocculating activity when exposed to 121 ºC temperature for 30 minutes that confirmed the thermostability of the bioflocculant. After the Fourier-transform infrared (FT-IR) analysis of the purified bioflocculant, it was revealed that hydroxyl, carboxyl, amine, thiocynates, alkynes, furan functional groups are present in the bioflocculant and are responsible for its best flocculation ability. The chemical composition of the purified bioflocculant showed total sugar (69%), protein (11%), and uronic acid (16%) with carbohydrates as main component and responsible for its thermal stability characteristics. A cumulus-like structure of the bioflocculant was revealed using a scanning electron microscope (SEM) and the weight fractions from the elemental analysis of the purified bioflocculant were C, N, O, Na, Mg, Al, P, S, Cl, K, Ca, which accounts for 16.92: 1.03: 43:76: 0.18: 0.40: 0.80: 14.44: 1.48: 0.31: 0.34: 20.35 (%wt), respectively. The XRD analysis of the purified bioflocculant showed that

the bioflocculant has a bigger particle with diffraction peaks at 10º and 40º indicating the crystallinity of the purified bioflocculant. The produced bioflocculant is highly effective at salt 5 g/L concentrations with flocculating activity of 81%. Increasing the salt concentration did not have a negative impact **on** flocculating activity. The produced bioflocculant showed highest removal efficiencies compared to the conventional chemical flocculants (Fe3+ and alum) tested in the study. The purified bioflocculant exhibited a remarkable removal efficiency in both domestic and industrial (coal mine) wastewater for COD, BOD, phosphorus, sulphate, nitrate, and total nitrogen with removal efficiency of 49% and 43% (COD), 79% and 64% (BOD), 46% and 48% (phosphorus), 79% and 73% (sulphate), 61% and 71% (nitrate), and 50% (total nitrogen). The bioflocculant also revealed a strong dye removal ability with the removal efficiency of 81% (Congo red), 81% (nigrosine), 73% (methylene blue) and 74% (safranin). In conclusion, this bioflocculant from P. kudriavzevii seems to have a potential in the removal of different impurities from various wastewater**,** especially the domestic and industrial wastewater.

Key words: Kombucha tea Scoby, flocculating activity, Pichia kudriavzevii, Kaolin clay, wastewater, removal efficiency, chemical flocculants.

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Department: Human Movement Science

Level: Honours

Research Title: The relationship between perceived and actual motor competence in children diagnosed with stutter between the ages of 2-13 years: Systematic Review

Abstract: Chantell Gouws[1]*, Nicoline van Dam[1], Snyman Thessner[1]
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Actual and perceived motor competence are important associates of various health related behaviours. As such, numerous studies have examined the relationship between both constructs in children. The aim of this review was to systematically examine, analyze and summarize the scientific evidence on the relationship between perceived and actual motor competence in children. This article reviews 46 refereed journal articles published between 2000 and 2020. All of the articles attempt to establish the relationship between perceived and actual motor competence in children. The strength of the association between actual motor competence and perceived motor competence in children is low to moderate, with current data demonstrating that the strength of association does not differ by age, sex, developmental status or alignment between measurement instruments. However, this review highlights the lack of clarity on the relationship between actual motor competence and perceived motor competence/physical self-perception. Future research should address issues surrounding the design of studies and measurement of actual motor competence and perceived motor competence/physical self-perception as well as explore other potential confounding variables (i.e., product- versus process-oriented assessments, race, and culture) that might affect the relationship between these two constructs.

Key words: perceived motor competence, actual motor competence, children, stuttering

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Department: Chemistry

Level: Masters

Research Title: Synthesis of transition metal doped chalcopyrite (CuFeS2) and chalcostibite (CuSbS2). nanoparticles by solution thermolysis of single source precursors

Abstract: Sifundo Mqadi[1], Malik Dilshad Khan[1], and Neerish Revaprasadu[1]

1Department of Chemistry, University of Zululand, Private Bag X 1001, KwaDlangezwa, SA.

Ternary metal sulfide materials have been extensively employed for various applications due to their promising properties contributed by the elegant combination of elements and their synergistic effect. It has also been established that elemental doping improves the physicochemical properties of these materials, contributing remarkably to their overall performance in diverse applications. In this study, we investigated the effect of doping transition metals (Ni, Co and Bi) in pristine ternary chalcopyrite (CuFeS2) and chalcostibite (CuSbS2). The parent ternary systems and their corresponding transition metal doped materials were facilely synthesized via heat-up (solution pyrolysis) of the respective transition metal diethyldithiocarbamate precursors at 250 o C. The structural, morphological, and compositional analyses of the prepared nanoparticles were elucidated by using powder X-ray diffraction (XRD), Scanning electron microscopy (SEM), transmission electron microscopy (TEM) and energy-dispersive X-ray spectroscopy (EDX) techniques. p-XRD results confirmed the formation of both pure chalcopyrite (CuFeS2) and chalcostibite (CuSbS2) phases which were maintained after incorporating different dopant concentrations. SEM results indicated the formation of pseudo-spherical chalcopyrite nanoparticles whereas plate-like morphologies were observed in chalcostibite nanoparticles. Similar morphologies of the two systems were also obtained in TEM images. Compositional analysis by EDX showed that the experimental stoichiometric composition corroborated well with the theoretical composition.

Key words: Sulfides, chalcopyrite, chalcostibite, heat-up, doping.

Title: An action research towards improving the food plate of the university students

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Department: Consumer Sciences

Level:

Research Title: An action research towards improving the food plate of the university students

Subtheme: Food Security

Abstract: Nokokoba Y, Ntanjana E, Nzimande A, Mtloung S, Palmer K, Ngwane N and Kolanisi U
Department of Consumer Sciences, Faculty of Science, Agriculture and Engineering

Reports about the South African food plate are concerning**;** the food plate is more about filling hunger sensations and satiety as opposed to satisfying dietary daily requirements needs for an active and healthy life. A similar trend has been reported in a pilot study conducted in 2020 amongst Consumer Sciences students where it was found that the food plate was more of 'food quantity' rather than 'food quality'. The university students are the 'forgotten population group' when addressing food and nutrition security. Underestimation of consuming poor quality diets could negatively influence their academic progression and healthiness in the future. To explore the development of a recipe book as an intervention to transform tendencies of preparing a 'poor food plate' to a 'good food plate' to promote an active and healthy life. Action research approach was applied, to create knowledge based on enquiries to produce practical context knowledge that is useful to people in their everyday life. A recipe book as an intervention to guide students towards making better informed food selection and a weekly eating plan to aid towards informed decisions was developed. Complementary, selected dishes from the recipe book were evaluated for consumer acceptability using a sample of 60 untrained consumer panellists. A recipe book reviewed by a dietician, presented an integration of indigenous and modern healthy foods. The recipes were cost-effective, ensuring that the ingredients were familiar, accessible (economically and physically) and easy to utilise. The consumer acceptability of selected dishes is underway.

Key words: active life, accessibility, diet habits, food (in)security, nutrition (in)security

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Department: Geography

Level:

Research Title: Upper Troposphere-Lower Stratosphere Ozone Trends over Marambio, Antarctic Peninsula using Ozonesonde Data

Abstract:
The ozone hole is a severe depletion of ozone in a reign of the ozone layer, particularly over Antarctica and over the Arctic. The depletion is caused by the destruction of ozone by CFCs. Ozone is very vital in the atmosphere and it should be kept monitored. Thus, the Ozonesonde measurement programme at Marambio (Antarctica) was established in the late 1980s, soon after the discovery of the Ozone hole. This study presents the extracting and processing of Marambio Ozonesonde data using satellite, evaluation of climatology and analysis of the long-term trends of ozone in the Upper Troposphere-Lower Stratosphere (UTLS) over Marambio, Antarctica over the period from 1988 to 2021. The seasonal maps of the total column of ozone indicate a hole over Antarctica during the spring season especially at the latitude range between 90° and 60° South. The resulting time series analysis indicates that in the upper troposphere and lower stratosphere region, lower ozone values are found especially in the September and October months. There is an indication of an upward trend in terms of ozone variability in the Southern Hemisphere over Marambio. Over the years, it was found that the ozone hole has recently recovered especially when averaging the time series for the months of September and October.

Keywords: Total Ozone Column, Ozonesode, Marambio, Stratosphere, Ozone

Title:

First Name:

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Email:

Phone No:

Department:

Level:

Research Title: Data-driven time series forecasting of COVID new cases in South Africa using Hybrid deep learning recurrent neural network

Abstract: Felix Silwimba[1], Nkanyiso Mbatha[2] and Maba Matadi[1]
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In early 2020, the World Health Organisation declared the unprecedented 2019 novel coronavirus as a global pandemic. This coronavirus disease (COVID-19) is a highly infectious disease caused by the SARS-CoV-2 virus that was first detected in Wuhan, Hubei province in China in December 2019 and spread **to** many other countries of the world within few weeks. In this study, hybrid data-driven forecasting models, based on long short-term memory networks (LSTM) recurrent neural networks (RNNs) and Temporal Convolutional Networks (TCN) are developed and tested on publicly available new cases of COVID-19 data. Robust data-driven hybrid time series-forecasting models that are based on signal decomposition techniques such as Ensemble Empirical Mode Decomposition (EEMD), and Empirical Wavelet Transforms (EWT) are developed using python. The performance test of these models is done in terms of various forecasting performance evaluation criteria such as the root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE) and correlation coefficient (R). In order to compare the modelled data to the ground truth, the COVID-19 data is divided into 70% training time series and 30% testing time series.

Key words: COVID-19, LSTM, forecasting, models, neural networks, disease

Title:

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Last Name:

Email:

Phone No:

Department: Consumer Sciences

Level:

Research Title: Acceptability of Cowpea-based Instant Soup Among Youth in Rural KwaZulu-Natal.

Abstract: TP Kheswa[1], U Kolanisi[1], M Siwela[2], L Sisoka[1]
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International projections state that by year 2050, hunger in the world will reach nine billion people, which implies a higher demand for food. A high proportion of South Africa's rural households still face the risk of food insecurity. Indigenous foods have been proposed as a solution, but the youth`s negative perceptions lead to declining utilization. Cowpea is an underutilized indigenous, locally available, nutrient dense legume with limited utilization in South Africa. The aim of the study was to determine quality characteristics of cowpea instant soup and sensory acceptability by rural youth. Dried flavourings, wheat and cowpea (Vigna Unguiculata) flours were used in soup preparation. Formulations were as follows: 100% wheat; 90% wheat/10% cowpea landrace 2 (CPL2); 80% wheat/10% CPL2; 90% wheat/10% cowpea landrace 1 (CPL1); 80% wheat/20% CPL1 variety. The soup made from cowpea flour was more acceptable than the control (wheat flour). Soup prepared with the CPL2 variant of cowpea was the most acceptable compared to the CPL1 variant. The 10% formulation was more acceptable than the 20% formulation for both landrace prototypes. The taste and viscosity of the CPL2 soup contributed to the higher acceptability compared to the CPL1 soup. The colour of CPL1 variant soup was the most acceptable attribute. Supplementation of wheat flour with maximum 10% cowpea could produce acceptable instant soup with a potential to enhance utilization and alleviate food insecurity challenges in rural communities. A positive experience of the instant cowpea soup product by the youth might result in positive perceptions and consumption behaviour.

Key words: youth, cowpea, instant soup, utilization, sensory evaluation

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Level: Honours

Research Title: A review of the essential visual skills required for soccer: Beyond 20-20 optometry

Abstract: Lourens Millard[1], Gerrit Jan Breukelman[1], Nonkululeko Mathe [1], Ina Shaw[1] & Brandon Stuwart Shaw[1]
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In ball sports such as soccer, the visual system is critical in guiding a player's search for crucial information that underpins skilful behaviour, which requires the incorporation of all of the relevant information in the environment in order to make successful decisions under pressure. However, vision in sport, and focusing on the specific visual skills required to be successful in a particular sport has largely been a practice ignored by experts and coaches as being an essential component of athletic performance. This is the first attempt to summarize and compile the necessary visual skills for soccer. This review's evidence suggests that, while current research still tends to focus on visual skills as a whole, there is a need to streamline this focus to the necessities of a particular sport. Furthermore, in identifying the visual skills essential for soccer, it allows for the effective training and testing of these skills, as well as for talent identification.

Key words: visual skills, sport vision, soccer vision, vision in sport

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Department: Biochemistry and Microbiology

Level:

Research Title: Isolation and characterization of manganese peroxidase producing ligninolytic bacteria from composting environmental samples

Abstract: Ngcobo BP, Mosa RA and Opoku AR
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Ligninolytic waste continues to cause land pollution and remains a great environmental threat due to lignin being recalcitrant to most degradation methods. If hydrolyzed, a great fraction can be transformed into products of high industrial interest. Microbial methods have been advocated over chemical methods which are expensive. However, fungi have been reported to have shortcomings. Hence, the imperativeness in the exploration of bacteria species for lignin degradation. This study investigated the degradation of lignin using manganese peroxidase (MnP)- producing bacteria isolated from composting environmental samples. Bacteria isolates, identified through the nutrient enrichment technique, were found to effectively degrade lignin and allow growth on kraft lignin, as well as have the ability to utilize guaiacol and veratryl alcohol and decolourize some dyes (Azure B, AZ; Remazol Brilliant Blue R, RBBR; Malachite green, MG; and Congo Red, CR). NADPH oxidation and 16S rDNA gene sequencing were used for characterization and confirmation of MnP-producing bacteria. Out of a total of 33 isolates, Pseudomonas aeruginosa (MF14446.1) and Enterobacter roggenkampii (CP033800.1), were found to be capable of producing measurable quantities of MnP which upon optimization had MnP activity of 7.4x10-3 U/L and 6.1 x 10-3 U/L, respectively. The MnP preparations were capable of detoxifying AZ, RBBR, CR, MG, as test bacteria (B. cereus, S. aureus, P. mirabilis and E. coli) grew better on the treated than the untreated dyes media. It is apparent that these organisms possess potency in not only combating lignin recalcitrancy, but also textile dye decolouration and detoxification.

Key words: Manganese peroxidase, Lignin degradation, Pseudomonas aeruginosa (MF14446.1), Enterobacter roggenkampii (CP033800.1)

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Department: Chemistry

Level:

Research Title: Catalytic oxyfunctionalisation of 1,2-dichlorobenzene using Mn loaded catalysts

Abstract: Nomthandazo Mkhizea and Rajasekhar VSR Pullabhotlaa
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The ozone-initiated oxidation of 1,2-dichlorobenzene catalysed by manganese supported on metal oxide (γ-Al2O3 and SiO2) at ambient temperature and pressure conditions is reported in this study. Wet impregnation method was used to synthesize various percentages of Mn loading viz. 2.5%, 5%, 7.5% and 10% on supports like γ-Al2O3 and SiO2. The as-synthesized catalysts were calcined for 6 hours at 300o C to remove impurities. The catalysts were then characterised by FT-IR, SEM, EDX, TEM and XRD techniques. Before the catalytic testing, oxidation reactions were performed in the absence of the catalysts. The ozonation reaction was also studied by using activated charcoal, bare γ-Al2O3 and SiO2 supports to investigate their catalytic activities in this reaction. All the reactions were conducted at an oxygen flow rate of 0.5 LPM and 40% current in an impinger glass reactor using 25 mL pure 1,2-dichlorobenzene and 1.25 g of the catalysts. The Mn/ γ-Al2O3 and Mn/SiO2 were found to be more active than γ-Al2O3, SiO2 support and activated charcoal. The 5% Mn/SiO2 catalyst was found to be the active catalysts during all the ozonation reactions. Therefore, it can then be concluded that the activity of the catalysts is attributed to manganese loaded in catalysts support (γ-Al2O3 and SiO2). The reaction products were characterized by Gas Chromatography - Mass Spectroscopy (GC-MS) and FT-IR for quantitative and qualitative identification of the products.

Key words: 1,2-Dichlorobenzene, Mn/γ-Al2O3 and Mn/SiO2 catalysts, Ozone and Mucochloric acid

[1] N. Mkhize, Prabal Pratap Singh, Deepak Kumar Das and V.S.R. Rajasekhar Pullabhotla, Catalysis Today (2021) In press. DOI: 10.1016/j.cattod.2020.06.025

Title:

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Department: Department of Biochemistry and Microbiology

Level:

Research Title: Combining more methods for acid mine drainage treatment in a fluidized bed-reactor andadsorption using organic matter.

Abstract: Mokoena G., Mthembu M.S. and Basson A.K.

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Passive treatment for acid mine drainage is getting recognition as it does not produce secondary waste which cannot be disposed. Acid mine drainage has metals which may be toxic in high concentration and this might shift the vegetation or make it extinct. In this study, fluidized bioreactor was used to culture monoculture of sulphate-reducing bacteria. The effluent was further treated using organic matter (sawdust) to adsorb the untreated pollutants. The analysis of sulphate and metals was done on spectroquant using Merks's kits. It was found that the bioreactor degradation of sulphate was from 3154mg/l to 402. In the sawdust reactor, the pollutants further dropped to 247mg/l which is within the South African standard. Effluent was additionally treated with nickel nano-particles where the final effluent was 53mg/l. The metals were undetected under 1mg/l. In the bioreactor the cells use enzyme degradation of sulphate to produce sulphide which precipitates metals as metal sulphide. On the other hand**,** the sawdust uses adsorption to bind and precipitate the sulphates and metals. Due to the cost of nanoparticles they were used last and it purified the effluent further releasing cleaner water that can be reused. With this finding it can be said that combining more techniques is more efficient.

Key words: Acid mine drainage, sulphate-reducing bacteria, effluent, sulphate, metals, bioreactor

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Department: Chemistry

Level:

Research Title: Catalytic oxidative degradation of m-cresol using ozone

Abstract: Bongiwe Phenyane and Rajasekhar VSR Pullabhotlaa
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The intensification of industrial activities over the years has caused an increase in the contamination of the environment with organic impurities. m-Cresol, a methylated derivative of phenol, is one of the organic impurities considered as a contaminant of great significance due to its toxicity and persistence in the environment. In light of the aforementioned, there has been a continued research interest to study different approaches for the removal of m-cresol in wastewaters. In this study the ozone initiated oxidation of m-cresol catalyzed by metal oxides (V_2O_5, γ-Al_2O_3 and SiO_2) at ambient temperature and pressure conditions was reported. The oxidation reaction was studied as a function of time, where sample aliquots were collected in every 3h time interval of a 24h reaction. The metal oxide catalysts utilized in this study were characterized using X-Ray diffraction (XRD), Fourier Transform-Infrared Spectroscopy (FT-IR), Scanning electron microscopy (SEM), Energy dispersive X-ray (EDX) spectroscopy and Transmission electron microscopy (TEM). Activated charcoal served as a reference catalyst to study and compare the activity to that of the metal oxides. Prior to catalytic testing, oxidation reactions were performed in the absence of the catalysts. All the reactions were conducted at 0.5 LPM of oxygen rate and 50% current in an impinger glass reactor using 25 mL of m-cresol and 1.25 g of the catalysts. The SiO_2 catalyst was found to be the most active catalyst in the oxidative degradation of m-cresol. The activity order of the catalysts was SiO_2 > Al_2O_3 > AC Charcoal > V_2O_5. The reaction products were characterised by Gas Chromatography coupled with Mass Spectroscopy (GC-MS) for quantitative and qualitative identification of the products.

Key words: m-Cresol, Ozonation, Catalysis, Conversion, Selectivity

Title: Miss and Miss

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Department: Human Movement Science

Level: Honours

Research Title: Causes and prevalence of Diabetes, Obesity and Physical Inactivity in black women aged 45-65 years in South Africa

Abstract:
Type 2 diabetes mellitus, obesity and physical inactivity are major sources of morbidity and mortality in South African black, middle-aged to early old aged women, spurred by increased urbanisation and unhealthy lifestyle factors. Local epidemiological data are required to inform health planning and policy. The purpose of this systematic review is to identify, collate and synthesise all studies reporting the prevalence and causes of diabetes, obesity and physical inactivity in South Africa. A secondary aim is to study the relationship between diabetes, obesity and physical inactivity. Multiple databases will be searched for diabetes, obesity and physical inactivity prevalence studies conducted in South Africa between 1997 and 2021. The systematic review does not require ethics clearance since published studies with non-identifiable data will be used. This review will provide best estimates to inform the Second National Burden of disease study which can guide health and policy planning.

Key words:

Title:

First Name:

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Email:

Phone No:

Department:

Level:

Research Title: The food and nutrition insecurity status of people living with disabilities in three Local Municipalities of Ugu District, South Africa

Abstract: Duduzile Khowa[1], Unathi Kolanisi [2], Cornelia du Preez[3], Nokuthula Tinta[3], Preez Nothando Qumbisa[2]
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People with disabilities (PWDs) are thought to be at a higher risk of food insecurity than abled-bodied people as a result of high marginalisation and vulnerability**.** However, there is little research done in order to solidify this assumption. The study herewith investigated the vulnerability status of PWDs living in the Ugu District to food and nutrition insecurity. A mixed research approach was adopted to acquire data. A stratified purposive quota sampling method was used to recruit one hundred participants in Ugu District Municipality. The participant administered questionnaires were composed of demographics for profiling PWDs, Food Insecurity Experience Scale (FIES), Coping Strategy Index (CSI), Household Expenditure on food, Dietary Diversity Scale (DDS) and the Self-Assessment measures. Complementary to this, a Body Mass Index (BMI), was done on fifty-one (51) participants. In addition, face to face interviews were done with caregivers and government officials who work closely with PWDs. Results indicated that PWDs at Ugu District are vulnerable to food and nutrition insecurity because of various factors such as disability, lack of education, lack of employment and households lacked assets that could be exchanged to monetary value and help improve their access to food. About 45% of PWDs were obese (≥30kg/m2 BMI for age) while 30% were found to be overweight (2529.9kg/m2 BMI for age). The study recommends that PWDs participate in economic activities that could release them from the poverty trap. Therefore, it is recommended that they develop their entrepreneurial skills and capacity-building which will diversify sources of income to enable them to have better access to nutritious food.

Key Words: People with disabilities (PWDs), food insecurity, nutrition insecurity, vulnerability

Title: Mr

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Phone No:

Department: Zoology

Level:

Research Title: The use of Macrobenthic Biotic Indices to assess the effect of fish-farming in Richards Bay Harbour.

Aurthors: [1,2]S. Nzama, [1]L. Vivier and [1]A. De Fortier

1. University of Zululand
2. 2SAIAB

Abstract:

Worldwide, aquaculture is increasingly being developed to address food security. However, large-scale aquaculture is plagued by potential environmental concerns, notably water quality and eutrophication of receiving waters. In South Africa, as part of a national effort to promote aquaculture, a trial fish farm using dusky kob (Argyrosomus japonicus) was established in Richards Bay Harbour (RBH) in 2015. This study aimed to use macrobenthic community indices to assess the effect of fish-farming in RBH. The study involved quarterly monitoring of water quality (physico-chemical parameters and nutrient concentrations) and the macrobenthic community at 6 sites along a gradient away from the fish-farm for 12 months during fish farm operation and for 8 months after operations ceased. Multi-variate community analysis (PRIMER) and macrobenthic community indices (AMBI, M-AMBI and BENTIX) were used to assess changes in macrobenthic community structure. Highest nutrient and total organic carbon levels at the fish farm site confirmed poor water quality and sediment eutrophication associated with fish-farming. Species diversity decreased towards the fish farm, while a change in community structure confirmed the effect of fish farming on the benthic community. Opportunistic taxa such as Pilargidae and Spionidae polychaetes dominated during fish farm operation, while more sensitive taxa re-colonised the area during the recovery period. The three biotic indices, notably M-AMBI, confirmed lower benthic habitat quality closer to the fish farm. The study concluded that biomonitoring programmes using biotic indices such as M-AMBI should routinely be employed in adaptive management strategies of sustainable aquaculture projects in estuaries.

Key words:

Title: Mr

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Department: Human Movement Science

Level: Masters

Research Title: The Influence of Objectively Measured Physical Activity and Sedentary Behaviour on Cognition and Academic Achievement in South African Primary School Children

Abstract:
The potential for physical activity and sedentary behaviour to improve cognitive function and academic achievement in children has received attention by researchers. This study will investigate the independent and combined associations between objectively and subjectively measured physical activity (PA) and sedentary behaviour (SB) on cognitive performance and academic achievement in South African primary school children. Four hundred (n = 400) participants between the ages of 9 – 12 years old will be recruited from a primary school to participate in this cross-sectional study. Participants will undertake a 7-day 24h accelerometry to objectively determine their MVPA and sedentary behaviour. BMI will be measured using the "International Society for the Advancement of Kinanthropometry". A questionnaire measuring sedentary behaviour (Adolescent Sedentary Activity Questionnaire (ASAQ)) will also be given to participants. Aerobic capacity will be measured using the 20-metre shuttle run multistage test (20-MST). Academic achievement will be measured as the marks average obtained from all complete subjects. The National Curriculum Statement (NCS) standardises the recording and reporting of learner achievement in each learning area by means of very specific specifications and requirements with regard to the number and types of assessment tasks, including end-of-the-year examinations (DoE, 2005). Cognitive Functioning CNS vital signs is comprised of familiar and well-established tests such as: verbal and visual memory, finger tapping, symbol digit coding, the Stroop Test, a test of shifting attention and the continuous performance test.

Key words:

Title: Mr

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Department: Human Movement Science

Level: MSc

Research Title: A systematic review of physical activity, lifestyle, well-being and selected indices of cardiovascular function in South African university athletes.

Abstract:
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The aim of this systematic review was to investigate physical activity, lifestyle, well-being and selected indices of cardiovascular function in South African university athletes with a special focus on university athletes from the year 2001 until 2020. A literature search including fifteen databases (Google Scholar, Science Direct, PubMed, EMBASE, ProQuest Dissertation, Connected Papers, Crossref, SAJSRSPER, AJOL, AJSS, Scopus, Sports Discus, Discovery, Research Gate & SABINET). Data collected between 2020 and 2021 were not included due to potential effects on the Covid-19's normal sports involvement and the lock-down rules. The literature was reviewed according to the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines, in order to identify appropriate studies for review. Studies found through the search were initially screened based on their titles and abstracts to identify studies on physical activity, lifestyle, well-being, cardiovascular function and South African university athletes. From the 1310 studies, 56 were found theoretically relevant and contain information that met our inclusion criteria and these were reviewed fully. There were more studies on urban university students and urban university athletes conducted. These results showed a gap on rural university studies.

Key words: physical activity, lifestyle, well-being, university students, university athletes, South Africa

Title: Mr

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Department: Human Movement Science

Level: MSc

Improving intrinsic motivation for physical activity (PA) among 6-14 years old children with asthma: A qualitative study

Abstract:

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Objective: To explore the views of healthcare professionals working with children with asthma on physical activity (PA), specific strategies used for physical activity promotion and associated challenges. Methods: In this explanatory study, in-depth qualitative interviews were conducted from government and private health professionals to explore their views surrounding physical activity promotion for children with asthma. Thirty-four participants (18 physiotherapists, 8 wellness officers, 5 clinical psychologists, and 3 dieticians) provided written informed consent and participated in this study. Results: Healthcare professionals highlighted significance of PA in asthma management, although they indicated that very few patients were motivated mainly by asthma or general health reasons. The professionals also highlighted the need for PA to be funny and enjoyable. It should be a routine of children's life, undertaken with significant others, beyond the walls of the hospital whenever possible. PA promotion approaches adopted focused solely on provision of individualised recommendations for individual patient's needs and goals and enhance intrinsic motivation for PA. Conclusion: This study offers important information for those developing interventions to promote PA among children with asthma. Importantly, future research should focus on developing participant-based individualised interventions that focus on enhancing intrinsic and support the integration of PA into everyday life based.

Keywords: asthma, physical activity promotion, healthcare

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Level: MSc

Impact of Land-Use and Land-Cover Change due to urban development: A case study of Durban, Kwazulu-Natal

Abstract:

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Land is a crucial resource where all human activities are undertaken. With each corner of the world, especially in South Africa, having their own way of utilising land, the resource isn't defined by a singular purpose. This study will be focusing on the land use and land cover changes to the city of Durban and its surrounding areas, comparing the years 1990 and 2020. One of the significant changes noted was the reduction in area occupied by natural vegetation and an increase in the bare surface. Urban development area has increased by 250% at an average rate of 16.50 ha/year between 1990 and 2020. Infrastructural and agricultural expansion, commercial forest, local environmental, human population growth, and local socio-cultural drivers were perceived by residents of land use and land cover changes. Increased soil erosion flooding risk, increased sedimentation into water resources like lakes and rivers, decrease in soil fertility, loss of biodiversity, decrease in annual average rainfall, and increase in the temperature were perceived by residents as negative local effects of land use and land cover changes. This study suggests practices of appropriate land use planning and management, participatory planning and management, proper environmental impact assessment and management of development projects and programmes are of principal importance to promote sustainable development in the Umgeni catchment.

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Level: MSc

Identification of potential groundwater recharge zones in Maputaland Coastal plain, South Africa

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Abstract:

Groundwater is unevenly distributed throughout the earth's surface. Remote sensing and GIS techniques are widely used to study the occurrence, movement and availability of groundwater through which a sustainable management plan can be achieved. This study aimed to delineate the groundwater potential zones of the Maputaland coastal plain of Kwazulu-Natal by comparing the Analytic hierarchy process (AHP) - Multi criteria decision-making (MCDM) technique and Boolean logical approach. The map of groundwater potential zones was prepared by assimilating 8 thematic layers, i.e., geology, geomorphology, lineament density, soils, slope, rainfall, and land use. Each thematic layer was assigned with subjective relative weights under AHP-MCDM technique and Boolean logic which were overlaid in a GIS platform to identify the groundwater potential zones. In the AHP approach weights were assigned to the thematic layers using the normalized eigen vector methodology to find the groundwater potential index, whereas in a Boolean approach, AND operator was applied in order to integrate thematic layers to delineate the groundwater potential zones. The delineated groundwater potential maps using AHP-MCDM technique indicates that about 6.0% (310.5 km^2) from the total area falls under very good; 67% (3467 km^2) good; 25% (1294 km^2) poor and 2% (103.5 km^2) under very poor, whereas in Boolean logic about 70 % of the area (i.e., 3623 km^2) falls under good and 30 % (1552 km^2) of the areas falls under poor groundwater potential zone. Further, the obtained results indicate that the geology, geomorphology, land use and slope played a vital role in groundwater recharge.

Keywords: Groundwater potential zones, remote sensing, AHP technique, Boolean logic, Maputaland, South Africa

Title:

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Assessment of nutrients and trace metals in groundwater of Luvuvhu catchment, South Africa

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Abstract:

Nutrients and trace metals in groundwater of the Luvuvhu catchment in South Africa were assessed. Luvuvhu catchment receives the highest monthly rainfall normally during the month of November to March every year. The highest rainfall of more than 184 mm is received during the month of February while winter months start from May to August. The present study aimed to determine the causes of the presence of the nutrients and trace metals in groundwater. A total of 84 groundwater samples and 9 soil samples were collected from agricultural land and settlement areas. The results indicated that the minimum value of phosphate was 0 mg/l, and the maximum was 9.74 mg/l. The concentration of sulphate in ranged from 1.5 mg/l to 14 mg/l, and the average was recorded at 4.59mg/l which did not meet the DWAF limit of 500 mg/l. Nitrate values in the study area ranged from 0.24 mg/l to 52.1 mg/l with an average of 50 mg/l exceeding DWAF limit of ≤11mg/l. Zinc in the study area ranges from a minimum concentration of 0 mg/l to maximum 0.52mg/l falling within the DWAF limit of ≤5mg/l The average value of Copper in the study area varied from 0 µg/l to 20 µg/l falling within the limit of both WHO and SANAS of 2000 µg/l. Maganese ranged from a minimum of 0 µg/l to a maximum of 0.67 µgl within the limit of ≤0.4 µg/l by DWAF and there is currently no limit set by the WHO. Trace metals such as arsenic, silver, chromium, lithium, boron, nickel cobalt etc. are found to be within the limits or standards set by both WHO and DWAF/SANAS. The study concludes that the concentration of nutrients and trace metals in the catchment does not pose a contamination threat to groundwater.

Keywords: Nutrients, Trace metals, anthropogenic, groundwater, Luvuvhu.

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Land use and land cover changes in Mhlathuze catchment of Kwazulu-Natal, South Africa

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Abstract:

Land cover refers to the naturally occurring attributes on the surface of the earth, while land use is the anthropogenic activity that is currently occurring thereon. Modification of land is often necessary to make way mainly for anthropogenic advantages and expanding needs. These include economic development, commercial progress and residential establishment. Land use, land cover assessments provide information and awareness that will benefit town-planners and policy makers before irreversible changes are made to land. The uMhlathuze Municipality is located between latitudes of 28° 37´´ and 28° 57´ south and between longitudes of 31° 41´ and 32° 09´ east and covers about 123 359 ha. It comprises of Richards Bay, Empangeni, eSikhaleni, Ngwelezane, eNseleni, Felixton, Vulindlela among other areas. Geologically, it is predominantly underlined with sedimentary, granite, mudstone. The aim of this study was firstly to map the different land use, land cover that exists in uMhlathuze municipality over 30 years, covering 1990 and 2020, secondly to quantify the areas of LULC and lastly to determine the extent of LULC changes. This was obtained through remotely sensed data in the form of Landsat images. The satellite images were then subjected to classification, and change detection through GIS tools, using LULC maps from the Department of Environmental Affairs as a reference to identify land classes. Accuracy assessments were also performed against ground truth using Google earth engine, where there was available data. Rainfall data was also used to identify the changes in land cover influenced by possible changes in rainfall. Population data was obtained to observe, if possible, trends in land cover were related to increase in population and thus urbanization. The results showed 9 predominant classes which all underwent changes in from 1990 to 2020. The naturally occurring areas were altered by anthropogenic influences: forest, woodlands, shrubs and wetlands were converted into sugarcane plantations, residential areas and mines. Population growth was found to play a role in the increase of residential areas. The rainfall trend generally should have variations over the 30 years. The study also concludes that the land cover was altered mainly by human activities.