NELSON MANDELA UNIVERSITY

Change the World

mandela.ac.za

Chemistry Department 2023-Mid 2024 Newsletter

From the Head of Department

Dr Adeniyi Ogunlaja (HOD Chemistry)

Department of Chemistry Newsletter!

It is with great pleasure that I welcome you to our annual newsletter, our department offers a wide range of programs designed to cater to the diverse interests and career goals of our students. From Diploma in Analytical Chemistry, Polymer Technology and Chemical Processing Technology to Advanced diploma in Analytical Chemistry and BSc undergraduate degree in Chemistry to graduate programs BSc Hons, Hons in Formulation Science, MSc and PhD in Chemistry, we are committed to providing a comprehensive education that equips our students with the knowledge and skills needed to succeed in their chosen paths. The past year has been filled with remarkable accomplishments. Our staff and student have been at the forefront of community science engagement and innovative research, with significant contributions in areas such as sustainable energy solutions, catalysis, medicinal chemistry, natural products, crystal engineering, sensors and environmental studies.

It is our vision to be a globally relevant African rooted Chemistry department that is responsive to socio-economic and environmental challenges in society through trans disciplinarity for a sustainable future. At the core of our strategic plan is a commitment to excellence in education, research, and engagement. In recent times, more partnerships with industries are been forged especially on collaborative research projects which may result in technology transfer opportunities. These collaborations enable us to bridge the gap between academia and industry, and fostering innovation. Additionally, we are enhancing engagement activities within the department mainly through school visits, open days programme, national science week and science shows. Thanks to a team of dedicated staff members within the department led by the Department's science engagement chair. These activities not only enrich the academic experience of learners but also create opportunities for mentorship, career development, and knowledge exchange.

As part of our ongoing efforts to enhance the quality of education offered by our department and in line with Faculty vision 2030, the Department currently undertaking a comprehensive recurriculation process aimed at aligning our programs with the latest advancements in the field of chemistry. This process involves revising course curricula, updating learning outcomes, and integrating emerging trends into our educational offerings. Through this process, we aim to ensure that our programs remain relevant, enhance student success and progression, and competitive in today's rapidly evolving landscape.

As we look ahead into the year, I am confident that together we can achieve great things. By fostering a culture of collaboration, innovation, and inclusivity, we will continue to elevate the profile of our department and make meaningful contributions to the field of chemistry.

Thank you for your ongoing support and dedication. I encourage you to stay connected with us through this newsletter as we share updates on events, achievements, and opportunities within our vibrant chemistry community.

Staff Exchange Nelson Mandela University – HSRT (Hochschule Reutlingen – Reutlingen University)

Written by: Dr Mandla Khumalo

In April (20th) one of the Chemistry Department's academic staff, Dr Mandla Khumalo was invited along with other 3 colleagues from different departments within the Nelson Mandela University to create research collaborations and present their presentations at Reutlingen University, Germany. The general overview of the presentations was holistic, covering synthesis and modification of polymer materials, textile, 3D printing and their characterization and theoretical investigation, up to processing and testing. A special feature of the institute's activities is the close cooperation of scientists and engineers, and a broad range of modern instruments and methods are available including pilot plants allowing material and technology development under industry-relevant conditions.

"In that manner I could meet many of the researchers. It is a lively group of people and all highly intellectual and straight to the point. We are looking forward with collaboration", says Dr Khumalo

The research focus was on materials problems and needs which can be approached by control of interface-related properties as well as interactions at interfaces and surfaces. A deep understanding of techniques and processes as well as of underlying physical aspects will provide the basis to develop long-term concepts for technological implementation and applications of new polymer materials.

25th National Rubber Conference - IOM3

Written by: Prof Percy Hlangothi

Prof. Percy Hlangothi, Director of Centre for Rubber, Science and Technology and Associate Professor in the Chemistry Department at Nelson Mandela University, has taken over as the National Executive Committee Chair of the IOM3 Southern Africa. After holding the position of Eastern Cape Chair for a few years, he is now the new National Executive Chairman of the IOM3 (Institute of Materials, Minerals and Mining) Southern Africa. Most of the Southern African branch's members are from the Rubber and Polymer Industries. This institute is an overseas branch of IOM3 (UK). The 25th National Rubber Conference's opening ceremony made this announcement.

Prof. Percy Hlangothi presented a paper titled *"Why the resistance in the absorption of waste tyre recycled materials"* at the 25th National Rubber Conference from May 17–20, 2023

Professor Percy Hlangothi and Ms Kerry Kirkman.

Professor Ernst Ferg has been graded for his third dan in karate.

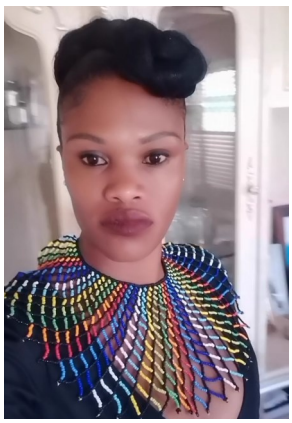
Prof Ernst Ferg

Professor Ernst Ferg started training karate with his twin daughters, Sarah and Faith, in 2012, at the age of 47. It took him five years of training towards his first dan (2017), then two years for his second dan and three years to his third dan. The general karate style is Goju Ryu and the club is affiliated to the Okinawa Goju-Ryu Karatedo Kyokai (OGKK). The style is affiliated to Karate South Africa (KSA) and students do participate in local and international competitions. The technical level of understanding the katas in their application becomes more complex as one progresses, he says. The grading was over two days and took place in George, because the head of the style for the Southern/Eastern Cape (Honbu), Sensei Jannie LeGrange (seventh dan), is located there. Congratulations to Prof Ferg on this achievement.

Dr Zikhona Tywabi-Ngeva wins the NMU Emerging Researcher award.

Dr Zikhona Tywabi-Ngeva, awarded as the winner of the Vice-Chancellor's Excellence Award of Nelson Mandela University for the year 2023, is a specialist in sustainable agriculture, waste management, and finding innovative solutions to environmental issues using cost effective and energy-efficient processes.

Ms Amanda Maqoko completes her Business Administration Management course!



Ms Maqoko successfully finished a certificate in Business Administration, which commenced in January 2023 and concluded in September 2023. Her next endeavor entails undertaking a management course. The reason behind pursuing this course was to acquire skills and knowledge that possess direct relevance across various facets of my life. Be it in the realms of planning, influencing, analyzing, networking, or organizing – this course has facilitated the enhancement of crucial competencies essential for advancing my career prospects and ultimately achieving success.

NEW STAFF MEMEBER

Administrative Assistant at Chemistry Department North Campus

Ms Christine Phillips, joined the Department from the Nelson Mandela University, Leadership Academy in April 2023, where she was the Admissions Officer for eleven years. Christine previously worked at Rhodes University for six years. She has a Diploma from Damelin College.

Chemistry Postdoctoral Fellow represents South Africa as a Young Observer at the 52nd IUPAC General Assembly

Written by: Dr Mapokolo Mpho Phiri

I had the privilege of being an IUPAC Young Observer at the 52nd IUPAC General Assembly in The Hague, Netherlands, from August 19th to 25th, 2023. This opportunity was made possible through funding from the Royal Society of Chemistry. The IUPAC Young Observer program aims to promote diversity in representation across different countries, age groups, ethnicities, and sexual orientations, thereby ensuring the continued inclusivity of the organization.

As a Young Observer, I attended IUPAC General Assembly meetings within the Polymer Division. This division of IUPAC is responsible for developing recommendations on nomenclature, symbols, units, terminology, and conversions specific to the field of polymers. During our participation, we engaged in speed dating/networking session with representatives from other IUPAC divisions.

"I was truly impressed by the unwavering commitment displayed by the IUPAC committee members in their efforts to standardize and provide recommendations within the fields of Chemistry and Polymer, all while doing so on a voluntary basis"

This session provided us with insights into the various divisions of IUPAC and their ongoing projects, highlighting the importance of inter-divisional collaborative efforts.

Additionally, I had the privilege of attending the World Chemistry Leadership Meeting (WCLM) with the theme "Catalyzing Innovation for Sustainable Development." At the WCLM, I not only encountered innovative research presentations but also witnessed different countries vying to host future IUPAC conferences. Moreover, I observed elections for the IUPAC Science Committee and gained a deeper understanding of the organizational processes within IUPAC. It was surprising to learn that these scientific conferences are meticulously planned, often nearly a decade in advance.

I also had the opportunity to present a poster titled 'Plant Extracts as Antimicrobial Agents in Bone Healing' at the 49th World Chemistry Congress, which occurred concurrently with IUPAC General Assembly. Most presentations at the congress revolved around topics such as machine learning, automated synthesis, and AI-driven research. One notable highlight was the concluding plenary session by Professor Chad Mirkin, his talk titled "Exploring the Matterverse with Nanomaterial Megalibraries". He emphasized how they had adapted AFM tips for use in nanolithography and further modifications to achieve narrow particle size distributions of nanoparticles. Another intriguing presentation focused on the application of metal-organic frameworks in the food industry.

Additionally, we were invited to attend the RSC Reception for networking opportunities and refreshments. It was an honor to meet Professor Gill Reid, the President of the Royal Society of Chemistry, who received the IUPAC2023 Distinguished Women in Chemistry or Chemical Engineering award during the same Congress.

In conclusion, I was truly impressed by the unwavering commitment displayed by the IUPAC committee members in their efforts to standardize and provide recommendations within the fields of Chemistry and Polymer, all while doing so on a voluntary basis. During the World Chemistry Congress, I observed a robust collaboration between academia and industry in most developed countries, accompanied by substantial industry investments in innovative solutions. Notably, some researchers received funding from companies such as UNILEVER. Furthermore, I learned that SHELL is not solely a fuel producer and supplier but also operates a dedicated research laboratory engaged in a variety of projects, including the development of foams for couches and mattresses.

Dr Mapokolo Mpho Phiri.

James Moir Medal winner

Duncan McFarlane received the James Moir medal in December for being the top honours student at Nelson Mandela University in 2022. Dr Neliswa Mama who represents NMU at the South African Chemical Institute (SACI) presented the award to him.
Mr McFarlane is currently completing his MSc in Chemistry with Professor Benita Barton as his supervisor.

25th National Rubber Conference

Chemistry Master of Science students, namely Ms Atupele Bunu and Ms Bhongo Ngxovu, collaborated to deliver a presentation at the 25th National Rubber Conference from 17-20 May 2023 on the topic of "Evaluation of various ground tyre rubber and rPP grades as potential alternative TPE blends in high performance applications". Subsequently, they were honored with the second position for their exceptional performance as conference speakers, while the esteemed first place was secured by Prof Chris Woolard, a Research Associate at Nelson Mandela University presently affiliated with Stellenbosch University.

Master's in chemistry student wins the 2023 IOM3 online Young Persons' Lecture Competition.

Lodewikus Vorster, a master's student in chemistry and researcher at eNtsa, has won the IOM3 Young Persons' Lecture Competition South Africa, which invites students and professionals up to 28 to deliver a short lecture on materials, minerals, mining, packaging, clay technology, wood science, or an engineering-related subject. The competition, organized by IOM3, is sponsored by The Worshipful Company of Armourers & Brasiers and Henry Royce Institute. The winner will represent their country in the Young Persons' World Lecture Competition in November 2023. The lecture, titled "Cyclic potentiodynamic polarization testing of TIG welded 316L stainless steel for characterization of pitting corrosion," was completed in collaboration with eNtsa.

Doctoral student Olwethu Poswayo wins the 2023 Global Challenges University Alliance (GCUA) 2030 award.

Doctoral student Olwethu Poswayo won the first prize of 3500 Euros for her research project titled "Optimizing biomass utilization for bio-oil production and hydro-processing to produce quality biofuel". Ms Poswayo also won an all-expenses paid trip to Sweden to present her research at the GCUA's meeting. The research focused on "combining algae and coal into coalgae composites, which can meet energy demand, protect the environment, and reduce greenhouse gases." The adjudicators gave praising comments to Ms Poswayo for effectively communicating the results and contributing to global sustainable development, specifically focusing on SDG 7 and SDG 13.

PhD graduate uses indigenous plant to recycle rubber tyres

End-of-life rubber tyres from motor vehicles are a huge waste problem in South Africa. The recycling challenge is to devulcanise (soften) the rubber in these tyres in an eco-friendly manner so that it can be recovered and re-used in new tyres and other products. This is according to Dr Jabulani Mnyango.

Dr Mnyango began his PhD in Chemistry while co-supervised by Dr Buyiswa Hlangothi (Acting Director of School of Biomolecular and Chemical Sciences), Professor Christopher Woolard (a chief researcher in renewable polymers and fuel and rubber chemistry at Stellenbosch University) and Professor Percy Hlangothi (Director of the Centre for Rubber Science and Technology at Nelson Mandela University). His research focused on "a South African indigenous plant, Tulbaghia violacea, as a readily available and non-toxic agent to devulcanise waste tyre rubber in an eco-friendly manner."

He says the plan is to possibly commercialise his process down the line but before this can be considered, it requires checking Tulbaghia violacea from other provinces to see if they work as well as the Tulbaghia they used from the Eastern Cape. Dr Mnyango now has his sights set on doing postdoctoral research overseas.

Dr. Buyiswa Hlangothi's Research Group Shines at the 16th Frank Warren Conference

The 16th Frank Warren Conference, held at the Protea Hotel Ranch Resort in Polokwane from December 3-7, 2023, was a significant event for the Chemistry Department, particularly for Dr. Buyiswa Hlangothi's research group. This prestigious conference brought together leading chemists and researchers to share their latest findings and innovations. Dr. Buyiswa Hlangothi, Dr. Nehemiah Latolla, Mr. Mooketsi Mpuputla, and Ms. Shahlaa Visagie represented our department with distinction. Dr. Hlangothi delivered a highly praised Plenary Lecture on "Plant Extracts as Sustainable Alternatives for Tyre Waste Management," showcasing innovative approaches to addressing environmental challenges using natural resources.

Dr. Nehemiah Latolla, a Postdoctoral Fellow, captivated the audience with his Oral Presentation on "New Pentacyclic Triterpenes from Strychnos Henningsii and their Antidiabetic Activity," highlighting novel research in natural product chemistry with potential therapeutic applications.

PhD candidate Mooketsi Mpuputla and MSc student Shahlaa Visagie also made significant contributions with their en gaging poster presentations, which drew considerable interest and sparked lively discussions among conference attendees.

Right to Left: Dr Buyiswa Hlangothi, Shahlaa Visagie, Mooketsi Mpuputla, and Dr Nehemiah Latolla

The participation and presentations by Dr. Hlangothi's research group not only demonstrated their individual excellence but also underscored the department's commitment to advancing scientific knowledge and addressing global challenges through innovative research.

Prof Barton and research group attended the South African Crystallographic Society symposium in Makhan-

Professor Benita Barton, Danica Trollip (PhD), Dani Recchia (MSc), Jarryd Vorgers (PhD), Brandon Barnardo (PhD) and Duncan McFarlane (MSc) collectively participated in the SACrS (The South African Crystallographic Society) Symposium, which took place on the 22nd and 23rd of January in the year 2024, held in the city of Grahamstown, also known as Makhanda. The event provided a profoundly enriching experience as they engaged in listening to various talks delivered during the symposium and had the opportunity to interact with distinguished individuals such as Prof Susan Bourne from the University of Cape Town (UCT). The knowledge and insights gained from the symposium left them with a sense of a deeper understanding of the topics that were discussed. Additionally, the interactions with Prof Susan Bourne and other attendees have expanded their professional network, providing us with valuable contacts where they may need to seek guidance from peers at other institutions.

JINR Russia Expertise Workshop

Dr Ogunlaja and Prof Tshentu were invited to participate at the XXIII JINR Expertise for Member States (JEMS) and Partner Countries Programme. The 23rd iteration of JEMS was specifically tailored for high-level South African administrators and managers of science, research, and engineering projects and was held at JINR, Dubna, Moscow region and Russia from 11–15 September 2023.

Prof Tshentu and Dr Ogunlaja research groups attended the 33rd Catalysis Society of South Africa (CATSA) Conference in Mossel Bay, Western Cape in November 2023.

Professor Zenixole Tshentu's group which includes Dr Tendai Dembaremba (Postdoc), Dr Peter Fapojuwo (Postdoc), Ms Olwethu Poswayo (PhD), and Ms Rinae (MSc), while Dr Adeniyi Ogunlaja group comprise of Ms Rendani Mudau (MSc) and Ms Sphumelele Majodina (PhD) collectively participated in the CATSA conference through oral and poster presentations. Catalysis is a rapidly evolving field with new catalyst discoveries and breakthroughs emerging regularly. This knowledge is invaluable for remaining competitive and relevant in our work. CATSA provided an excellent platform for recent advancement in catalysis and catalyst development, networking with industry experts, peers from other institution, and potential collaborators. By attending the conference, we can stay updated on current trends, methodologies, and challenges in the field of catalysis research.

ENGAGEMENTS

Science Club activity

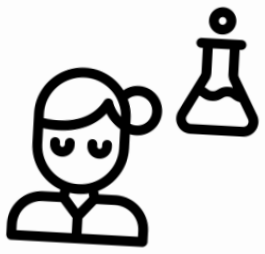
On 2 February 2023 the Pearson Science Club hosted a booth together with the Department to attract new members into the school's Science Club. The activities were successful with over 90 learners attending the first quarterly gathering that was held at Pearson High School and on 6 February along with the Alexander Road High Science Club. A combination of physics and chemistry experiments were performed by volunteers (under the guidance of Dr Rubidge and Dr Sasha-Lee Dorfling. The event was concluded by making ice cream with liquid nitrogen as a portable freezer.

Under the guidance of Dr Rubidge, a scholar poured liquid nitrogen onto a balloon to show the effect (drastic) volume reduction) of temperature on a contained pocket of air.

Andrew Rabie High School Career Expo

On the 19th of April 2023, the Chemistry department accompanying the Faculty of Science visited Andrew Rabie High school in Newton Park, for the Career Expo to ignite a passion for science among students.

As we interacted with the students, we were struck by their curiosity and passion for learning. Many of them had never considered a career in science before, but after engaging with them about programmes offered in the department, they were buzzing with excitement about the possibilities that the field of chemistry could offer them. It was an amazingly humbling experience to play a role in igniting the spark of interest in these young minds and potentially shaping the future of science in this country.



Prof Watts Conferences

Prof Paul Watts: Invited Talk

Conference title: Innovations in API Manufacture
Date of conference: 17-18 March 2022, Boston
Keynote Lecture: Local drug manufacturing in Africa following the COVID-19 pandemic

Conference title: Flow Chemistry Summit 2022
Date of conference: 17-18 March 2022, Boston
Keynote Lecture: Continuous flow synthesis of APIs

Conference title: CPAC Rome Workshop 2022
Date of conference: 21-23 March 2022, Rome
Invited Lecture: Process Optimization of Drugs Utilizing Continuous Flow Approaches

Conference title: CPAC Summer Institute 2022
Date of conference: 19-21 July 2022, Seattle
Invited Lecture: The Vision of Continuous Flow: Can Africa Facilitate local API Manufacturing

Conference title: TEDX Nelson Mandela University
Date of conference: 26 October 2022, Port Elizabeth
Invited Lecture: Go with the flow: Drugs for Africa

Conference title: Flow Chemistry Asia 2022
Date of conference: 6-7 October 2022, Tokyo
Keynote Lecture: Continuous flow drug manufacturing in Africa

Conference title: Atlantic Basin Conference on Chemistry
Authors: Paul Watts
Date of conference: 13-16 December 2022
Location of conference: Morocco
Invited Lecture: Continuous flow synthesis of APIs to facilitate local drug manufacture

Prof Watts Research Group Conferences

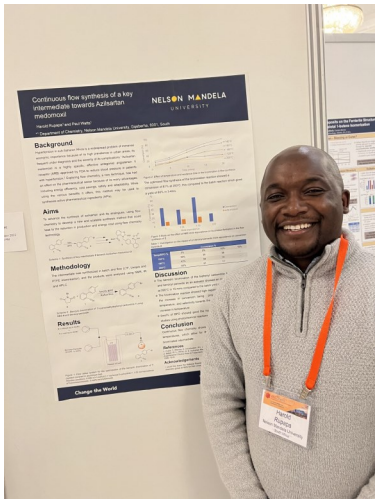
Group conferences

Conference title: 24th International AIDS Conference
Authors: Sinazo Nqeketo and Paul Watts
Date of conference: 24 July - 2 August 2022
Location of conference: Montreal, Canada
Poster title: Cost-effective continuous flow synthesis of HIV second and third generation integrase inhibitor drugs: a step towards local API manufacturing in Africa

Conference title: American Chemical Society Annual Conference
Authors: Muyiwa Arisekola, Faith Akwi and Paul Watts
Date of conference: 21-25 August 2022
Location of conference: Chicago
Oral presentation: Toward bortezomib synthesis in flow

Conference title: Atlantic Basin Conference on Chemistry
Authors: Harold Rupapa and Paul Watts
Date of conference: 13-16 December 2022
Location of conference: Morocco
Poster title: Synthesis of key intermediate towards Azilsartan medomoxil

Conference title: 9th IUPAC International Conference on Green Chemistry
Authors: Faith Akwi and Paul Watts
Date of conference: 5-9 September 2022
Location of conference: Athens, Greece
Oral: A roadmap towards the development of a scalable continuous flow process
for the synthesis of a Raf kinase inhibitor, BAY 43-9006



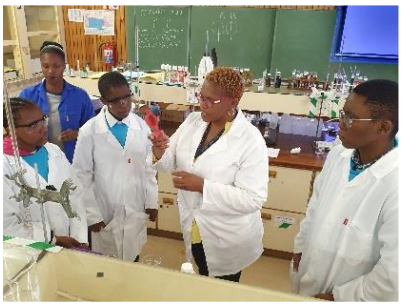
Inspiring Minds: iGEMS Explores the NMU Chemistry Department

On the 5th of April 2023, the Chemistry department had the great pleasure of hosting a group of eighteen brilliant Grade 12 students from the esteemed iGEMS *(Incubating Great Engineering Minds)* program. These students were taking part in a Science Bootcamp as part of their holiday activities. The primary objective of the Science Bootcamp, which was organized by Mrs. Pienaar from the Faculty of Education at NMU, was to bring the subject of Science "come to life" for the students through engaging hands-on learning experiences. Specifically, the focus was on the challenging topic of acids and bases, a subject that plays a significant role in the Grade 12 year-end Physical Sciences chemistry exam paper. While the students may have a good grasp of the theoretical knowledge related to acids and bases, they often struggle to comprehend the practical application and significance of the calculations they perform. The overarching goal of the session was to provide the learners with a valuable opportunity to explore a real Science laboratory setting and conduct an acid-base titration experiment themselves. This hands-on experience aimed to help them bridge the gap between what they learn in the classroom and how it is applied in real-life situations, fostering a deeper understanding and appreciation for the subject.

Moments from the iGEMS Science Bootcamp

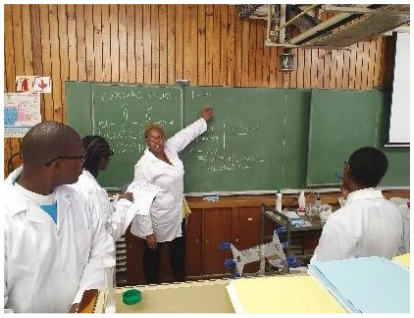
iGEMS students and Mrs Pienaar are excited to wear lab coats.

Mr Bosman demonstrates the function of a fume hood.



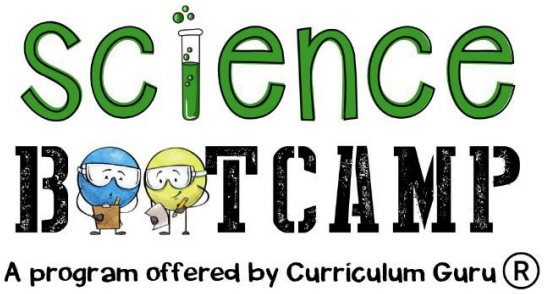
Ms Mtwa shows students how to use a pipette.

Mr Bosman demonstrated the colour changes of acid base indicators



Ms Mtwa performing titration calculations with students based on the data they gathered.

Students showing off as the colourless phenolphthalein changed to bright pink when the titration reached its endpoint.

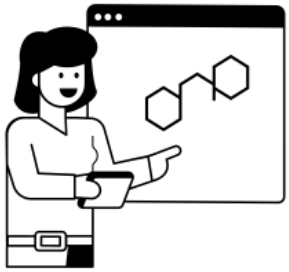


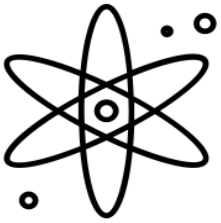
National Science Week 2023

National Science Week is an annual event that aims to promote awareness and appreciation of science. This initiative is led by the Department of Science and Innovation (DSI), brings together various stakeholders and role players who engage in science-based activities during the week. It is a celebration of vital importance to the field of science and technology in our daily lives. 19July–03 August the department hosted various chemistry laboratory tours for visiting schools around Gqeberha during NSW.

Lawson Brown High school Chem lab visits 1 August 2023

Alexandre Road & Collegiate Girls High School visiting the Polymer lab 3 August 2023.



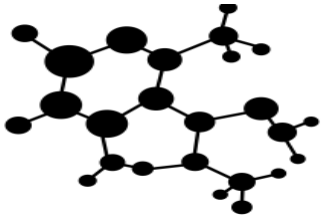


Department of Public Works and Infrastructure (DPWI) Career Expo

The Career Expo organized by the DPWI (Gqeberha Regional Office) took place on the 18th of August 2023 at Ntyatyambo Primary School in Crossroads at Peddie, targeting Grades 10 – 12 learners from Amathole West District Schools (Ngqushwa CMC). The high turnout at the event signifies strong student engagement. Prof Tshentu was specially invited to share insights on Careers in Science and Technology, as well as to demonstrate cool chemistry experiments like flame coloration by atoms, latex coagulation into a bouncing ball, and nitrocellulose combustion. Prof Tshentu made sure to spend quality time with small groups of learners, discussing

science careers and conducting experiments, while other students were moving around different stalls and stations. The Ngqushwa CMC is working hard to boost interest in Maths and Science among schools in the area, with a focus on helping them excel. While there has been some progress in matric pass rates, there's still a long way to go to improve Maths and Science education in this region.

Professor Tshentu demonstrating coagulation of latex into a rubber ball.



11th Nanoscience Young Researchers Symposium

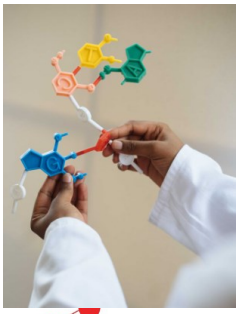
Shaping the Future of Nanotechnology

The prize winners with the Chemistry Departments MSc Nanoscience student Rolivhuwa Mulovhedzi winning 3rd best oral presentation.

Hosted in October by the Department of Chemistry at the Faculty of Science building at Nelson Mandela University, the symposium was organized as a bustling and dynamic platform dedicated to fostering collaboration among scientists, postgraduate students, academic researchers, and industry partners, providing them with the invaluable opportunity to share insights, discoveries, and innovative ideas pertaining to the vast realms of nanoscience and nanotechnology. The overarching goal of this symposium was to facilitate the expansion of scientific networks, thereby serving as a catalyst for the generation and incubation of groundbreaking scientific concepts that have the potential to significantly influence the trajectory of this rapidly evolving and transformative field.

The symposium, characterized by its spirit of inclusivity and cooperation, witnessed the active participation of individuals representing a diverse array of prestigious academic and research institutions, such as Nelson Mandela University, Tshwane University of Technology, University of Limpopo, University of Johannesburg, CSIR, Rhodes University, University of Western Cape, Durban University of Technology, UNISA, and Mintek. Through a series of over 17 PhD oral presentations and a showcase of more than 36 posters, the symposium effectively showcased the exceptional depth and breadth of research talent present within the region, underscoring the significance of collective knowledge exchange and collaboration in advancing the frontiers of nanoscience and nanotechnology.

Nanoscience Symposium attendees



SABINANO

INNOVATION IN NANOTECHNOLOGY, RESEARCH & DEVELOPMENT AND INDUSTRIAL APPLICATIONS

Collaborations with St. Paul's University and Nelson Mandela University's Chemistry Department

In October, a collaboration between Nelson Mandela University and St Paul's University in Limuru, Kenya was demonstrated as a prosperous and productive venture. The interactive collaboration involved the participation of specialists Louise Hamilton and Nicole Vorster from Nelson Mandela University, who were extended an invitation by St Paul's University to deliver enriching workshops at their Limuru campus aimed at undergraduate students from diverse fields such as Business, IT, Health Science, and Communication.

The workshop was a two-day workshop. Dr Nicole Vorster assumed a central role during the second day, leading an engaging workshop focusing on the craft of producing cosmetic creams and lotions. The day commenced with an in-depth theoretical session, dissecting the elements of creams, deliberating on various components, and demonstrating the development of a formulated product. The live demonstration by Nicole on creating a cream captured the attention of the audience, offering a unique and enlightening encounter. This practical approach served as a source of inspiration for both students and faculty members, highlighting the accessibility of cosmetic creation as a tangible skill.

The highlight of the day was when participants congregated in groups to assess a variety of pre-made creams. The workshop drew to a close with a concluding ceremony graced by the presence of the University's Vice-Chancellor, featuring addresses and the distribution of certificates.

The visit's success sparked enthusiasm and engagement among students and staff. Many showed interest in starting their own cosmetic businesses, inspired by the possibilities explored during the visit.

Dr Nicole Vorster issuing a programme graduate with her certificate

Dr Nicole Vorster demonstrating the preparation of a cosmetic cream

Dr Nicole Vorster talking about cosmetic formulations

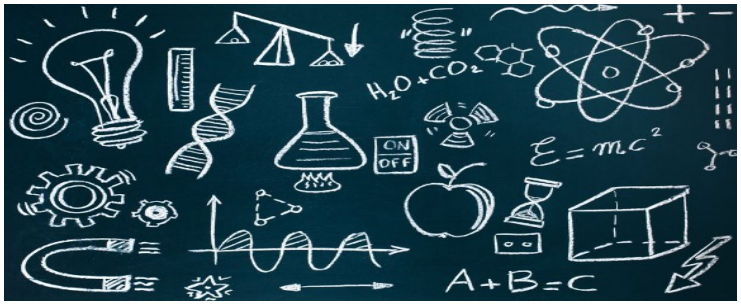
Dr Gletwyn Rubidge and Dr Nicole Vorster of the Chemistry Department gave talks and demonstrations at Pearson High

On 23 February 2024, the Chemistry department's lecturers paid a friendly visit to Pearson High school in Gqeberha Summerstrand. They delighted the grade 10, 11, and 12 scholars with exciting demonstrations. The topics covered during the visit were "Factors Affecting the Blue Bottle Experiment", "Elemental analysis using flames, arc, and sparks", "Esters", and "Formulation of Hand and Face Creams".

Dr Nicole Voster and Ms Anneka Greef with the learners of Pearson High School.

Dr Nicole Voster and Ms Anneka Greef demonstrating how to make creams.

Dr Nicole Voster talking about making creams.

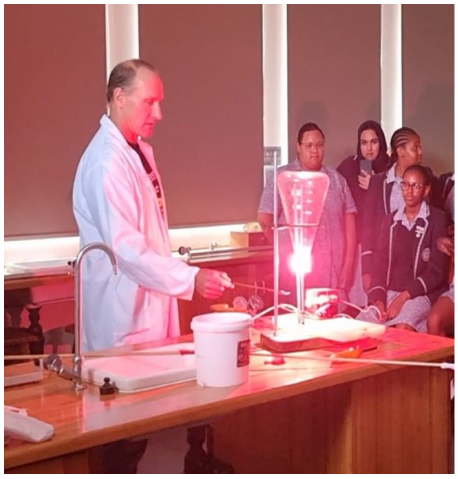


The Chemistry Department also contributed to the "150-year Collegiate Celebration".

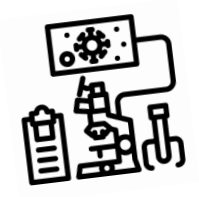
04 March 2024, staff took over all the morning science lessons for grades 10-12 and gave exciting talks and demonstration making the Science classes a lot of fun. Professor Ernst Ferg gave a talk about battery safety which was well received by the girls who have phones, and they became aware of possible battery failures. Dr Rubidge gave three classes covering topics of internal combustion engines, factors affecting reaction rates, elemental analysis and esters. Dr Nicole Vorster, representing Innoventon gave two lessons on formulations and two demonstrations of making hand and face creams.

Dr Rubidge guiding a scholar in ignition of a special ester (nitrocellulose).

Prof Ernst Ferg presenting an eye opening "Battery Safety" talk.



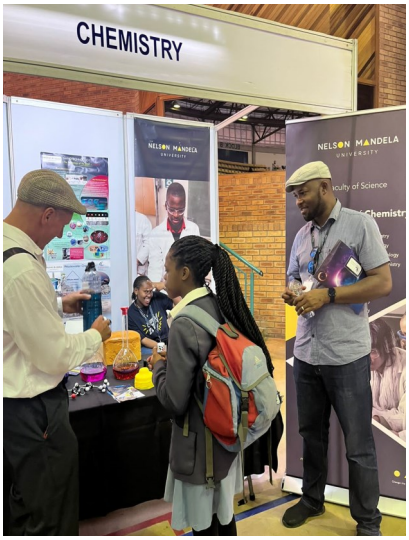
Dr Rubidge demosntrating atomic emission using an electric arc to excite strontium



2024 OPEN DAY

From the 10-11 May 2024, Nelson Mandela University successfully organized and conducted its traditional Open Day event at the Missionvale Campus located in Gqeberha. During this highly anticipated occasion, the Chemistry department of the university actively engaged in various enriching and edifying activities aimed at promoting the understanding and appreciation of the field of Chemistry among the attendees. The comprehensive and sophisticated programmes offered over the span of the two days provided a remarkably pleasant and intellectually stimulating experience for all participants, particularly the eager learners in attendance. Throughout the duration of the event, these enthusiastic learners had the pleasant opportunity to acquire a wealth of valuable knowledge and insights pertaining to the captivating realm of Chemistry, as well as gain a deeper understanding of the diverse array of academic programs and qualifications available through the esteemed Chemistry department of Nelson Mandela University. The department would like to thank all the academic staff Dr Rubidge, Dr Khumalo, Dr Ogunlaja, student assistants: Lungile Mtsweni, Keamogetswe Ramorei and Sethupathi Murugan; admin staff: Christine Phillips, Thando Gijana and Zizipho Mgoli.

Moments at the #NMUOpenDay2024



Graduations 2023

Congratulations to our 2023 and 2024 graduands!

The Chemistry Department at Nelson Mandela University has earned a reputation as a leader in academic excellence in both teaching and research. The scientific skills required to excel in chemistry has quite clearly been passed on to students. The department of Chemistry celebrates an astounding number of graduands (at Diploma, Advanced Diploma, BSc, Hons and postgraduate levels). This achievement is a testament to the department's commitment to excellence in teaching and research.

April 2023
Autumn Graduation

DIPLOMA IN ANALYTICAL CHEMISTRY

FIELD, Catelyn
GEZANI, Ayabonga Princess
JAM-JAM, Sibabalwe
MABANDLA, Nonkululeko Lukhanyile
MAXONGO, Bali
MDONDOLO, Masamkele Siseko
MNYAMANI, Siphamandla Sibongile
MOLi, Nomaxabiso
MPHAGA, Rolivhuwa
MVOTO, Siziphiwe Aphelele
NENWANGONI, Mueletshedzi
NOSE, Siphe
NWAYINWAYI, Yongama
QHALA, Sihle
QUM, Chuma
QWABE, Lukhanyo
TAPOLISI, Vuyolwethu
TSHISA, Masibulele
ZITUMANE, Zintle

CUM LAUDE

NZIMENI, Anele

DIPLOMA IN CHEMICAL PROCESS TECHNOLOGY

JOBE, Wanga
MASHAU, Letlhogonolo Christopher
MAZOSIWE, Phuthuma Walter
MNGOMEZULU, Amahle Mandisa
MSOMI, Lihle
MXENGE, Akanye
RADEBE, Lindiwe
SIKHOSANA, Edwin Obakeng
TANDWA, Zininzi
TUDU, Katlego Remembrance
ZULU, Mandisa
ZWANE, Samkele

CUM LAUDE

DIMBA, Siza Lindokuhle

DLAMINI, Malusi

MNCUBE, Thandeka Nothando

DIPLOMA IN POLYMER TECHNOLOGY

MANGE, Inga

MBANGO, Luyolo

MDAZUKA, Lukanyo

MKHONTO, Carnell Warren

MQOBOSHWANA, Avuyile

NKABI, Yandisa

SIBUYI, Nyeleti

SIYOTHULA, Minentle

SOGWANGQA, Yondi

SONYABASHE, Cebisa

ADVANCED DIPLOMA IN ANALYTICAL CHEMISTRY

BOMELA, Sisipho

DU PREEZ, Michael

MAKELENI, Abongile Lolwethu Akhona

MDYOBHENI, Billy Sibuso

MSUTU, Khulisiwe

McDONALD, Carolynn Jill

NCUBE, Bonginkosi

MSUTU, Khulisiwe

McDONALD, Carolynn Jill

NCUBE, Bonginkosi

RAMAKATSA, Kedibone Francina

VAN SENSIE, Ashne Christolene

YOBA, Sibulele Zabo

BACHELOR OF SCIENCE HONOURS IN CHEMISTRY

AGHERDIEN, Rafeeq

ASIEMA, Christian Amollo

KLAAS, Lulama

KOTZE, Tyla

MACKAY, Jason

MATINKETSA, Lebogang

MBUMBULWANA, Luzuko

MTAKATI, Lwandile

NGXOVU, Ntombebhongo

NTSINGILA, Inga Natacia

OLIVANT, Ryan James

PRINSLOO, Petrus Jacobus Christopher

RETYU, Buzani

SWARTBOOI, Simthandile

VISAGIE, Shahlaa

RAMAKATSA, Kedibone Francina

VAN SENSIE, Ashne Christolene

YOBA, Sibulele Zabo

BACHELOR OF SCIENCE HONOURS IN CHEMISTRY

AGHERDIEN, Rafeeq

ASIEMA, Christian Amollo

KLAAS, Lulama

KOTZE, Tyla

MACKAY, Jason

MATINKETSA, Lebogang

MBUMBULWANA, Luzuko

MTAKATI, Lwandile

NGXOVU, Ntombebhongo

NTSINGILA, Inga Natacia

OLIVANT, Ryan James

PRINSLOO, Petrus Jacobus Christopher

RETYU, Buzani

SWARTBOOI, Simthandile

VISAGIE, Shahlaa

VORGERS, Jarryd Allister

VORSTER, Lodewikus Francois

CUM LAUDE

BUNU, Atupele Anisa

MCFARLANE, Duncan William

MOREKU, Clementine

MYBURGH, Lisa

RECCHIA, Daniella Loridana

BACHELOR OF SCIENCE HONOURS IN FORMULATION SCIENCE

DANGAZELE, Aviwe

MTAYISI, Sineyethu Princess

NGCOKO, Zamokuhle Jimmy

NQAYI, Qhawekazi

SEKOME, Miracle

WITBOOI, Cecile

CUM LAUDE

DYANI, Sanelisiwe Anelisa
LETSOALO, Sefenya Lesego Simon
VAN DEN HEEVER, Chrize

MASTER OF SCIENCE (RESEARCH)

SEYISI, Thulethu

TROLLIP, Danica Brione - *Cum Laude*

WILLIAMS, Arushan

April 2024
Autumn Graduation

DIPLOMA IN ANALYTICAL CHEMISTRY

BALOYI, Rifuwo Fortune

GUDE, Sikhona

HLOMA, Alicia Zandile

JARA, Siphelele

KHABINGESI, Esona

KHOZA, Thembi Tinyiko

KITCHEN, Odwa

MALI, Chulumanco

MASOKA, Inga Sanelisiwe

MOLOKO, Koketso Charmaine

NAMA, Pilani

NGWENYA, Nokulunga

NJAJULA, Aphelele

NQUMA, Zukhanye

QOKOSE, Yamkela

SIKO, Sizukise

SIPINGO, Mbasa

SITHOLE, Aphelele

VINJWA, Moeketsi

WAITE, Kendre

DIPLOMA IN CHEMICAL PROCESS TECHNOLOGY

JUSSON, Giovanni

LEKGOATHI, Jessica

MDLULI, Andiswa

CUM LAUDE

MOSIKILI, Jerry

MOTLHAPING, Natasjha Kegomoditswe

DIPLOMA IN POLYMER TECHNOLOGY

BASSON, Hank Joseph

MAGQABI, Luvo

MATSHA, Neliswa

SIWISA, Lutho

ADVANCED DIPLOMA IN ANALYTICAL CHEMISTRY

LE ROUX, Cuwan Juandean

NTSHEYIYA, Baxolise

NZIMENI, Anele

BACHELOR OF SCIENCE HONOURS IN CHEMISTRY

FRIEND, Maryke

GROBBELAAR, Mari

JOSEPHS, Shane Charles

KOTA, Siphosethu

MAHLAKA, Ndiphiwe

NDEVU, Sinovuyo

RAMAKATSA, Kedibone Francina

TAFENI, Lindelani

CUM LAUDE

BOTHA, Karla

ELS, Liesl

TUCK, Reece Leighton

BACHELOR OF SCIENCE IN FORMULATION SCIENCE

MAZIBUKO, Nelisiwe Ignatia

MBATHA, Phiwokuhle Nothando

MASTER OF SCIENCE (RESEARCH)

CUM LAUDE

ADAM, Muhammed Ameen

CUTHBERTSON, Jarryd Pierre

KOTZE, Tyla

MOKGOHLOA, Mathule Collen

MYBURGH, Lisa

VORGERS, Jarryd Allister

2023 Autumn and Summer Graduation – PhD Graduates

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

VICTOR CHIKE AGBAKOBA

Previous qualifications:

2013	BSc Chemistry (Hons)	University of Abuja
2015	BSc (Hons) (Chemistry)	Nelson Mandela Metropolitan University
2018	MSc Chemistry (*Cum Laude*)	Nelson Mandela University

Thesis:
DEVELOPMENT OF BIO-BASED COMPOSITE FILAMENTS FROM POLY (LACTIC ACID) AND CELLULOSIC NANOMATERIALS DERIVED FROM FORESTRY WASTE RESIDUES FOR 3D PRINTING APPLICATIONS

In this work, 3D printable bio-based composites were successfully produced using polylactic acid (PLA) biopolymer and micro-/nano- cellulose derived from forestry waste biomass. This study contributes new knowledge in the production of FDM 3D printing application, mechanical recycling, and hydrolytic degradation of bio-based composites made from renewable resources. The findings from this research have yielded various outputs in the form of a patent (under preparation), journal papers in internationally accredited scientific journals and presentations in both local and international conferences. This study resulted in the development of technology demonstrators at "Technology Readiness Levels (TRLs) of 6 and 7". Other notable awards include an honourable mention as 1st runner-up at the "FIBRENAMICS" award ceremony of the 5th International conference on natural fibres (ICNF, Portugal, 2021).

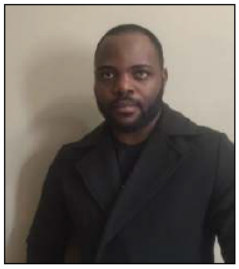
Supervisor: Dr MJ John
Co-supervisor: Prof SP Hlangothi

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

ALLEN TAUYA GORDON

Previous qualifications:

2014	Bachelor of Science in Maths and Chemistry	University of Venda
2016	Bachelor of Science Honours in Chemistry	University of Venda
2018	Master of Science in Chemistry	University of Venda



Thesis:
CU(II)-CATALYZEDVISIBLE-LIGHT-DRIVE HYDROCARBOXYLATION OF SCHIFF BASE DERIVATIVES WITH CO_2

Climate change takes place due to increases in carbon dioxide concentration, hence, great efforts have been made on transforming CO_2 into useful chemicals in the field of synthetic chemistry. The study investigated the use of a series of novel copper (II) complexes for the photocatalytic hydro carboxylation of Schiff Bases with CO_2 via direct insertion of CO_2. It demonstrated CO_2 fixation by hydro carboxylation of imine (C=N) bonds. Good to excellent yields of a broad range of α–substituted-amino acid derivatives were obtained under mild conditions such as room temperature, atmospheric pressure of CO_2 and blue LED light. Preliminary bioassays showed that the fixation of CO_2 into Schiff Bases influences its biological properties. The method for the synthesis of these unnatural amino acids is facilitating investigations onto protein/peptide modifications, which is viewed as excellent candidate for further study. Three articles have been published from this work in international peer-reviewed journals and one conference paper has been presented.

Supervisor: Dr A Ogunlaja

THE DEGREE OF THE DOCTOR OF PHILOSOPHY (CHEMISTRY)

SIBONGISENI GLORIA GAQA

Previous qualifications:

2008	BSc	University of Fort Hare
2011	BSc (Hons) (Chemistry)	University of Fort Hare
2013	MSc (Chemistry)	University of Fort Hare

Thesis:
SYNTHESIS OF THIAZOLIDINEDIONES (ROSIGLITAZONE & PIOGLITAZONE) USING FLOW CHEMISTRY SYSTEMS

Diabetes is a metabolic disease characterized by chronic hyperglycaemia due to impairment of insulin secretion or defective insulin action. In 2019, approximately 463 million adults were living with diabetes and it caused 4.2 million deaths worldwide. The number of patients in South Africa affected by diabetes is rapidly increasing. Thiazolidinediones are a class of established antidiabetic drugs, however these are not manufactured on the continent and need to be imported at substantial cost. This research established integrated continuous flow procedures to produce both rosiglitazone and pioglitazone in very high yield.

Supervisor: Prof P Watts

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

KANYISILE MHLANA

Previous qualifications:

2015	National Diploma Analytical Chemistry	Nelson Mandela Metropolitan University
2016	BSc (Hons) Formulation Sc (*Cum Laude*)	Nelson Mandela Metropolitan University
2017	MSc Chemistry	Nelson Mandela University

Thesis:
CONTINUOUS FLOW SYNTHESIS OF NEVIRAPINE USING MICROFLUIDIC SYSTEMS

This research developed an improved approach for synthesising the antiretroviral drug Nevirapine, utilizing microfluidic continuous flow systems. Nevirapine was the first non-nucleoside reverse transcriptase inhibitor approved by the Food and Drug Administration and is still used in South Africa as monotherapy for infants to prevent HIV transmission during breastfeeding. The microfluidic technology made the synthesis more cost effective by reducing the reaction times and improving the drug yield. The implementation of this technology will assist in improving essential drug accessibility in South Africa and many low-income countries.

Supervisor: Prof P Watts

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

JABULANI INNOCENT MNYANGO

Previous qualifications:

2014	BSc (Biochemistry, Chemistry and Microbiology	University of South Africa
2017	BSc (Hons) (Chemistry)	Nelson Mandela University
2019	MSc (Chemistry)	Nelson Mandela University

Thesis:
UTILIZATION OF CRUDE EXTRACTS OF TULBAGHIA PLANT SPECIES AS POTENTIAL DEVULCANIZATION AGENTS TO RECYCLE RUBBER IN A SUPERCRITICAL FLUID CO_2 REACTOR

This study focused on utilization of a South African indigenous plant, Tulbaghia species, as a readily available and non-toxic devulcanization agent to recycle waste tyre rubber in an eco-friendly and effective reaction medium. The research was necessary because devulcanization, a process that seeks to recover rubber from end-of-life tyres, is a widely preferred process of recycling end-of-life tyres but unfortunately it requires utilization of expensive and eco-unfriendly devulcanization agents. Findings from this study showed that the Tulbaghia crude extracts can significantly devulcanize rubber vulcanizates to produce high-quality rubber that can be re-used to produce both primary and secondary rubber products. The combination of the detailed analysis of the plant extracts and their effectivity for devulcanization made this study unique. Two journal articles were published in 2022 in the Journal for a Sustainable Circular Economy, and Journal of Cleaner Production.

Supervisor: Dr BG Hlangothi
Co-supervisor: Dr CD Woolard
Co-supervisor: Prof SP Hlangothi

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

SINAZO NQEKETO

Previous qualifications:

2017	BSc Chemical Science (*Summa Cum Laude*)	University of the Western Cape
2018	BSc (Hons) Chemical Science (*Cum Laude*)	University of the Western Cape

Thesis:
AN EFFICIENT APPROACH FOR THE SYNTHESIS OF DOLUTEGRAVIR AND ITS ANALOGUE EXPLOITING FLOW CHEMISTRY

This research explored the application of flow chemistry for the synthesis of a newly approved HIV drug, namely dolutegravir. This drug is a major breakthrough in HIV treatment as the dose may be substantially reduced from 600 mg to 50 mg per day, compared to current treatment regimes. The efficient seven-step continuous flow procedure afforded dolutegravir in reduced reaction times and improved yields compared to traditional batch procedures. Furthermore, the methodology was extended for the synthesis of a third-generation inhibitor analogue named cabotegravir. The vision is that continuous manufacture will enable the local cost-effective manufacture of AIDS drugs within South Africa.

Supervisor: Prof P Watts

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

STIAAN SCHOEMAN

Previous qualifications:

2017	BSc	Nelson Mandela Metropolitan University
2017	BSc (Hons)	Nelson Mandela University
2020	MSc	Nelson Mandela University

Thesis:
THE DESIGN AND SYNTHESIS OF NOVEL FLUORESCENT COUMARIN-BASED DERIVATIVES AS CHEMOSENSORS FOR THE APPLICATION OF TOXIC METAL ION DETECTION

This study focused on the design, synthesis, and application of novel coumarin-based fluorescent and colorimetric chemosensors for use in the detection of toxic metal ions in water. These novel chemosensors were modified with functional groups such as Schiff bases, enone and hydrazide linkers, which formed part of the binding sites where metal ions could interact during complexation. This interaction induces a chemical change that can be observed using fluorescence and UV-vis spectroscopies. Furthermore, the thionation of the coumarin backbone produced a chemosensor that could interact exclusively with mercury (II) in the presence of other metal ions. Lastly, real-world applications of these compounds were investigated using various water samples from the NMB area and showed promising results.

Supervisor: Dr N Mama

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

THEMBELA CELIA SONTI

Previous qualifications:

2002	BSc (Chemistry and Statistics)	Vista University
2004	BTech (Chemistry)	PE Technikon
2018	MTech (Chemistry)	Nelson Mandela University

Thesis:
USE OF FLOW REACTORS FOR AN IMPROVED SYNTHESIS OF TENOFOVIR DERIVATIVES

Tenofovir diisoproxil fumarate (TDF) is a prescription drug used to treat and prevent HIV infections. In this research, a highly efficient integrated synthesis of TDF using continuous flow reactors was developed affording tenofovir in 65 % overall conversion from readily available starting materials. The TDF prodrug was subsequently synthesised in 100 % conversion. We are currently investigating ways to commercialise this technology, with the vision to reduce the cost of drugs to enable more people to have access to these live saving medicines.

Supervisor: Prof P Watts
Co-supervisor: Dr BG Hlangothi

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

WILLIAM ZIVANAYI

Previous qualifications:

1990	Certificate in Education (Chemistry)	University of Zimbabwe
1996	BEd (Hons) (Chemistry)	University of Zimbabwe
2006	MSc Ed	University of Zimbabwe

Thesis:
EVALUATION OF THE TOXICITY OF SECONDARY METABOLITES IN SOLANUM INCANUM L. TO ADVANCE COMMUNITY KNOWLEDGE

This study evaluated the knowledge, opinions, and attitudes of the farming community in Gweru regarding the use of the indigenous plant (*S. incanum*) as a pesticide. The investigations included bioassay (efficacy and toxicity) and phytochemical (extraction, phytochemical analysis, isolation and structure elucidation) studies. In terms of phytochemical investigation, the study resulted in the isolation and characterization of nine compounds, one of which was a new compound, and two were reported for the first time from this plant. The study has overall contributed towards the community's understanding of the use of *S. incanum* in terms of its efficacy and associated toxicity issues. It has also contributed towards a better understanding of the chemistry of the plant by isolating and characterizing secondary metabolites using a combination of chromatographic and spectroscopic techniques. One journal article has been published from this work, and another is under journal review.

Supervisor: Dr BG Hlangothi
Co-supervisor: Dr NH Rasana

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

PHUTI CEDRIC TSIPA

Previous qualifications:

2014	BSc (Chemistry and Polymer Science)	University of Stellenbosch
2017	BSc (Hons) (Chemistry)	Nelson Mandela University
2018	MSc (Chemistry)	Nelson Mandela University

Thesis:
THE USE OF A NOVEL CHEMICAL SYSTEM TOWARDS IMPROVING WASTE TYRE PYROLYSIS AND THE QUALITY OF WASTE TYRE PYROLYSIS PRODUCTS

Waste tyre pyrolysis is one of the major break throughs in the waste tyre recycling sector world-wide. However, this process has limitations that cannot be avoided, and these include high energy, high Polyaromatic hydrocarbons (PAHs) and high sulphur content. This research investigated how a novel chemical pre-pyrolysis treatment of waste tyres affected the pyrolysis temperature, quality and quantity of the resultant products. Key findings include significantly reduced pyrolysis process temperature, which translates to lower energy costs; as well as improved quality of the resultant products by virtue of obtaining reduced content of typically harmful chemical compounds in both the oil and solid residue fractions. This work produced various outcomes in the form of publications in internationally accredited scientific journals and presentations in both local and international conferences.

Supervisor: Prof SP Hlangothi
Co-supervisor(s): Dr NM Mkhize
Dr SA Iwarere

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

BOTHWELL NYONI

Previous qualifications:

2007	BEng Chemical Engineering	University of Science and Technology, Zimbabwe
2012	MEng Chemical Engineering	North-West University, South Africa

Thesis:
PYROLYSIS OF ALGAL BIOMASS AND COAL IN A ROTARY KILN REACTOR: PYROLYSIS BEHAVIOUR, PRODUCT DISTRIBUTION AND KINETIC ANALYSIS

This research focused on converting low-grade coals, algal biomass, and their blends into liquid fuels and chemicals through thermochemical decomposition in a rotary kiln oven. Prioritising biomass substitution for coal helps mitigate environmental impacts. The investigation analysed decomposition kinetics, product yields and compositions using analytical instruments. Findings revealed that oils derived from coal and algae blends contain biofuel compounds like alcohols, fatty acids, esters, and poly-cyclic aromatic compounds. These results are vital as the world shifts towards low-carbon, and resource-conserving green economies. The findings from this study were presented in local and international conferences and published in reputable scientific journals.

Supervisor: Prof SP Hlangothi

2024 Autumn and Summer Graduation – PhD Graduates

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

SIMEON SHIWEDA HAMUKOSHI

Previous qualifications:

2015	Bachelor of Science (Hons) Chemistry and Geology	University of Namibia
2018	Bachelor of Science (Hons) Organic Chemistry	Nelson Mandela University
2020	Master of Science Organic Chemistry	Nelson Mandela University
2021	BSc (Hons) Water Utilization and Environmental Engineering	University of Pretoria

Thesis:
SYNTHESIS AND APPLICATION OF HYDROXYL FUNCTIONALIZED CHEMOSENSORS FOR SELECTIVE DETECTION OF IONS IN AQUEOUS SYSTEMS

In this study, ten (10) hydroxyl-containing compounds were successfully synthesized and used as chemosensors for the selective detection of ionic species. These novel compounds were modified with various functional groups which formed part of the binding sites where an analyte could interact during complexation. The oxime-based chemosensor exhibited remarkable selectivities for copper (II) and cyanate ions with distinct fluorescence enhancement. On the other hand, coumarin-based and quinoline-based chemosensors displayed unique absorption properties in the presence of iron (II) and mercury (II) ions respectively.
Furthermore, naphthalene-based chemosensors demonstrated distinctive absorption behaviors in the presence of certain cationic species. Lastly, molecular modeling and pH studies were conducted to understand the binding mechanisms between these compounds and the preferred analytes. The results obtained from this work have been published in three International Journals with two more manuscripts currently in preparation.

Supervisor: Dr N Mama
Co-supervisor: Prof V Uahengo

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

MCQUILLAN MOYO

Previous qualifications

2013	BSc (Biochemistry, Chemistry and Microbiology	Nelson Mandela Metropolitan University
2014	BSc (Hons) Formulation Science (*Cum Laude*)	Nelson Mandela Metropolitan University
2016	MSc (Chemistry) (Research)	Nelson Mandela University

Thesis:
SYNTHESIS OF GATIFLOXACIN, AN IMPORTANT FLUOROQUINOLONE ANTIBIOTIC USING CONTINUOUS FLOW TECHNOLOGY

Approximately 90% of the active pharmaceutical ingredients (APIs) found in drugs, such as the widely needed antibiotics used in sub-Saharan Africa, are imported primarily from India, China, and Europe. To decrease reliance and enhance accessibility to critical medications in Africa, this study leveraged state-of-the-art technology surpassing conventional methods. The synthesis of gatifloxacin, originally conducted in a batch setup, underwent transformation through the application of continuous flow technology, offering an advanced and future-proofed process. The research established a more efficient multi-step continuous flow approach for synthesising gatifloxacin, surpassing the effectiveness of existing batch methods and providing an opportunity for local production on the continent.

Supervisor: Prof P Watts

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

FRANCIS MATOTA MATHE

Previous qualifications:

2015	BSc (Chemistry and Physics)	Nelson Mandela Metropolitan University
2016	BSc (Hons) Formulation Science (*Cum Laude*)	Nelson Mandela Metropolitan University
2017	MSc Chemistry	Nelson Mandela University

Thesis:
THE ON-DEMAND CONTINUOUS FLOW GENERATION, SEPARATION, AND UTILIZATION OF MONOSILANE GAS, A FEEDSTOCK FOR SOLAR-GRADE SILICON

The purpose of this study was to convert South African natural resources into added value materials. In this project, reactors were developed to efficiently convert raw silicon, via a series of continuous flow modules, into highly toxic and explosive monosilane gas. This was further converted into photovoltaic grade Si for use in solar cells. Currently South Africa (SA) exports the raw silicon to Germany for beneficiation. However, when SA needs the material, it subsequently costs 20 times the price to buy back. Hence this sophisticated approach will hopefully enable SA to gain access to lower cost solar cells; given the major energy crisis that is currently being experienced, this is a significant project and an industrial partner is already interested in commercialisation of technology which has been patented worldwide.

Supervisor: Prof P Watts

THE DEGREE OF DOCTOR OF PHILOSOPHY (CHEMISTRY)

ULRICH SENEKAL

Previous qualifications:

2017	BSc (Biological Sciences)	Nelson Mandela Metropolitan University
2017	BSc (Hons) Chemistry (*Cum Laude*)	Nelson Mandela University
2019	Master of Science (Chemistry) (*Cum Laude*)	Nelson Mandela University

Thesis:
INVESTIGATION OF FOUR ROOF-SHAPED HOST COMPOUNDS FOR THEIR SEPARATION POTENTIAL OF MIXTURES OF GUEST ISOMERS AND RELATED COMPOUNDS

This study explored the potential use of organic host compounds for separations of isomeric guest mixtures. Mixtures of isomers are extremely difficult to separate by conventional fractional distillations because each component boils at near-identical temperatures. Distillations are thus extremely costly in energy and economic terms. For a sustainable future, alternative separatory tools are required. This study successfully demonstrated that industrially relevant chemical mixtures may be separated by these host compounds using supramolecular chemistry strategies. This work therefore offers an alternative and greener separation strategy for these mixtures. As a result, eight articles were published in international high impact factor journals.

Supervisor: Prof B Barton

GET IN TOUCH WITH US

Chem.mandela.ac.za

@NMU_Department_of_Chemistry

NMU Chemistry Department

NMU Department of Chemistry

For any interesting articles related to Chemistry that you would like featured in our next newsletter please contact:

zizipho.mgoli@mandela.ac.ac/secretaries-chemistry@mandela.ac.za

Chemistry Department
Building 13 (Office 0103&0104 South Campus & A102 North Campus), P.O. Box 77000, Gqeberha 6031, South Africa, **Tel**: 041 504 3061/2286, **Email**: adeniyi.ogunlaja@mandela.ac.za, **Email:** secretaries-chem@mandela.ac.za

Change the world.