



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

DECEMBER
2020



GIVE US FEEDBACK

CONTACT

Newsletter for Faculty of Science

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DISCOVER A WORLD OF OPPORTUNITIES



Message from the Dean

The 2020 edition of "Contact" is published at the end of a momentous year, which challenged how we live and work. You may be wondering how the Science Faculty and the University of Cape Town coped with the challenges posed by the coronavirus pandemic. Well, we concluded the academic year successfully! This success is a result of the dedication and commitment of our academic and support staff, who rose to the challenge of teaching and working remotely. Our students, too, quickly adapted to online learning. As with all years, our academic calendar ended with the graduation ceremonies on 14 and 15 December. But, it was a very

different graduation celebration as it was held virtually. Our students and their parents missed the opportunity to be on campus during the graduation, but we were all trying to save lives! I am heartened by our scientists who worked with governments to develop appropriate responses to the coronavirus pandemic while also contributing to research on the development of the vaccine. Our health and safety officers worked tirelessly to prepare the return of some staff and students to campus and to the laboratories.

Throughout the year our scientists, including postgraduate students, continued with their research, with some earning accolades among their peers nationally and internationally. Dr Sarah Fawcett and Professor Salome Maswime joined the elite group of young scientists at the Young Scientists Programme of the World Economic Forum. The African Academy of Sciences and the Royal Society awarded research grants to Dr Lauren Arendse from the Drug Discovery and Development Centre (H3D); Dr Rondrotiana Barimalala and Dr Ross Blamey, both from the Department of Oceanography; and Dr Felix Sizwe Dube from the Department of Molecular & Cell Biology, who joined a global group of 30 promising researchers. Two young researchers, Dr Itumeleng Monageng from the Department of Astronomy and Dr Susan Cunningham

from the Department of Biological Sciences received the College of Fellows Young Researcher Award. PhD student Doaa Ali from the Department of Chemistry is the winner of the 2020 Sub-Saharan Africa Young Talents Awards L'Oréal-UNESCO For Women in Science's prize.

Professor Ed Rybicki and his team in the Biopharming Research Unit (BRU) received an award from the Department of Science and Innovation, the South African Medical Research Council, and the Technology Innovation Agency to develop diagnostic reagents. Professor William Bond was the finalist for the 22nd National Science and Technology Forum annual awards. Professor Kelly Chibale was selected as one of the top 20 inspirational medicine makers in the field of small molecules by the United States-based The Medicine Maker's prestigious 2020 Power List. The World Wide Fund for Nature (WWF) awarded Professor Timm Hoffman from the Department of Biological Sciences its prestigious Living Planet Award for 2020. Professors Amanda Weltman and Jeff Murugan from the Department of Mathematics and Applied Mathematics were both awarded Simons Associateships at the International Center for Theoretical Physics. Emeritus Professor Michael Meadows was elected President of the International Geographical Union.

I hope that you enjoy this 2020 edition of Contact and reading about some of the highlights of this year in the Science Faculty. Please stay in contact with us. Wishing you everything of the best for 2021.

Maano Ramutsindela



STAFF ACHIEVEMENTS AND AWARDS



Professor William Bond named in Highly Cited Researchers list for 2020

Emeritus Professor William Bond, from the Department of Biological Sciences was named as one of three UCT scientists, included in the Highly Cited Researchers (HCR) list for 2020.

Compiled by Clarivate Analytics, the HCR list recognises scientists and social scientists who demonstrate significant and broad influence through the publication of multiple papers frequently cited by their peers over the course of a decade. Researchers included on the list have published papers that rank in the top 1% of total citations in the world in one or more

Essential Sciences Indicator fields for the period of survey between 2009 and 2019.

As many as 6 389 researchers from some 60 different countries/regions were included on the list. Among these, 3 896 received a high frequency of citations in a specific field, while 2 493 displayed exceptional performance across various disciplines – this being the category that Bond featured in. Professor Sue Harrison, UCT's deputy vice-chancellor for research and internationalisation said:

"It's always deeply gratifying to be recognised for your work in this manner, but it is even more significant that our researchers are being cited as key contributors to knowledge that will drive meaningful projects forward throughout the world."

When asked what it feels like to be featured on the HCR list once again this year, Bond said: "Well, not quite as exhilarating as winning the Rugby

World Cup but it has its similarities. You're out in the big wide world and, although we may seem on the fringes of science here in South Africa, those citations mean you know you're being heard and influencing scientific knowledge elsewhere." Bond's research focuses on the processes that most strongly influence changes in vegetation. These include fire, climate extremes, habitat fragmentation and vertebrate herbivory.





Professor Timm Hoffman WINS PRESTIGIOUS LIVING PLANET AWARD FOR 2020

SA acknowledged an individual whose work exemplifies how conservation truly can benefit both people and nature. Hoffman, who hails from the Eastern Cape, has spent a lifetime working on dry land ecology, most recently as the director of the Plant Conservation Unit at the University of Cape Town.

Hoffman has co-authored over 130 scientific articles, contributed to more than 30 books, supervised numerous students, and added to the development of new knowledge and insights into both the Fynbos and Succulent Karoo biomes. He also led the national review of land degradation for South Africa and has contributed significantly towards the understanding of the impacts of land use and climate change. Using fixed-point photography, his work has highlighted massive changes occurring in South Africa's ecosystems over an extended period. Beyond his ecological research, Hoffman also works to understand the complex ways in which rural social, cultural and economic livelihoods interact. In the village of Paulshoek in Namaqualand, in the Northern Cape, Hoffman has contributed positively to the community by creating a long-term contract job, other occasional employment and training for community members, as well as funding for development projects.

The World Wide Fund for Nature (WWF) announced leading arid zone ecologist **Professor Timm Hoffman**, from the Department of Biological Sciences, as the winner of its prestigious Living Planet Award for 2020. The award was given to him for his contribution to both conservation and helping the people who are dependent on the land to make a living in some of the driest parts of South Africa. The Living Planet Award is an annual award made to exceptional South Africans who, through their contribution to the conservation, inspire people to live in harmony with nature.

WWF South Africa CEO Dr Morné du Plessis said: "Timm is not only one of South Africa's foremost arid zone ecologists but is also one of the humblest and most compassionate people you will ever meet." Du Plessis said through the award WWF-

BRITISH ECOLOGICAL SOCIETY AWARD for SA climate change researcher

The British Ecological Society's (BES) Marsh Award for Climate Change Research has been awarded to UCT **Professor Wendy Foden**, a world-leading researcher in climate change vulnerability assessments of threatened species. Professor Foden, an honorary research associate at UCT's FitzPatrick Institute of African Ornithology, has been recognised for the global reach of her work with the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, as well as for her interest in translating science for practical conservation use, and in fostering conservation leadership.

Foden is currently based at the South African National Parks' Cape Research Centre where she leads a team carrying out applied research in and around the region's national parks. She is also an associate professor at Stellenbosch University and has chaired the Climate Change Specialist Group

of the IUCN Species Survival Commission since 2014. Foden said that a non-linear career path, which has left her with one foot in research and the other in applied conservation, has enabled her to spot gaps and opportunities for transdisciplinary collaboration: "Most of my research has been highly collaborative, so the award recognises the work of a community of very dedicated researchers. I'm simply fortunate to be in a position to gather key people together to create really useful products while we have a good laugh. I'm glad that such 'soft skills' are increasingly recognised in science."

Foden said that she was surprised by the award, but extremely proud to represent Africa's woman scientists. "I hope that the award inspires other women scientists, particularly from developing countries, to step up to conservation and climate change challenges."



UCT COLLEGE OF FELLOWS: YOUNG RESEARCHER AWARDS

The College of Fellows Young Researcher Award is offered annually in recognition of outstanding scholarly work by young academics who have made significant independent contributions to research in their field. The Science Faculty is proud to have two of only 7 young researchers at UCT who received the award this year.



◀ **Dr Itumeleng Monageng**, Department of Astronomy, holds a joint lectureship position between the Department of Astronomy at UCT and at the South African Astronomical Observatory. Dr Monageng is a stellar astrophysicist studying X-ray binary stars using data from telescopes operating at different wavelengths to understand the physical processes taking place in these systems, he has co-authored 17 publications.



◀ **Dr Susan Cunningham**, has just been promoted to Senior Lecturer in the FitzPatrick Institute of African Ornithology in the Department of Biological Sciences. The major focus of Susie's research is understanding the mechanistic links between temperature and fitness (using proxies such as breeding success and body mass maintenance) in birds under climate change. She is now the co-PI of the Hot Birds Research Project, together with Prof Andrew McKechnie at the University of Pretoria.

Every year, the World Economic Forum (WEF) selects an elite group of researchers under the age of 40 to participate in their Young Scientists programme.

This year, UCT is represented by two brilliant women scientists. **Dr Sarah Fawcett**, a senior lecturer in the Department of Oceanography is one of them, along with Professor Salome Maswime, head of Global Surgery at UCT. They will join young scientists from across the globe on a three-year journey of growth and impact. The Young Scientists have been selected on the basis of their contribution to advancing the frontiers of science in the areas of health, sustainability, inclusiveness and equity.

Fawcett has spent four years in her position as senior

lecturer in the Department of Oceanography at UCT establishing a strong and diverse research group and raising funds to build a new marine biogeochemistry lab at UCT, which is in its final stages of completion. Fawcett's research seeks to understand the connections between the components of Earth's climate system, as well as the impacts of human activities on marine environments. "My ultimate goal is to catalyse sustainable transformation in a white- and male-dominated field and support the development of womxn scientific leaders and role-models." Fawcett emphasises that the goal of this new laboratory is to facilitate high-quality, high-impact research and train the next generation of African scientists.

Fawcett's commitment to the development of African scientists is what drives her work. She is especially passionate about improving the retention, success and visibility of womxn in science, particularly black womxn.

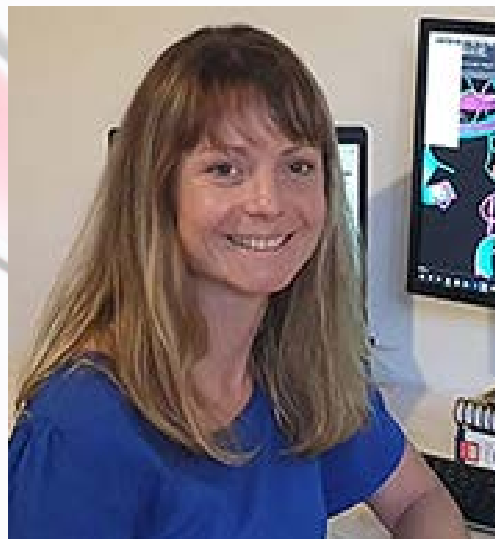
World Economic Forum YOUNG SCIENTIST AWARD FOR FAWCETT



FLAIR FELLOWSHIPS FOR RESEARCHERS FROM SCIENCE



Dr Rondrotiana Barimalala



Dr Lauren Arendse



Dr Ross Blamey



Dr Felix Sizwe Dube

Four young researchers from UCT have been selected to form part of the 2020 cohort of Future Leaders – African Independent Research (FLAIR) fellows. These fellowships are awarded to talented African early-career researchers whose work is focused on solving the needs of the continent.

The initiative is a partnership between the African Academy of Sciences (AAS) and The Royal Society, supported by the Global Challenges Research Fund. This year, the 30 promising young researchers will receive up to GBP300 000 each to conduct research over two years. The 2020 cohort was selected from a competitive pool of more than 700 applicants. Among the 30 successful candidates, four are from the Science Faculty at UCT.

The recipients are **Dr Lauren Arendse** from the Drug Discovery and Development Centre (H3D); **Dr Rondrotiana Barimalala** and **Dr Ross Blamey**, both from the Department of Oceanography; and **Dr Felix Sizwe Dube** from the Department of Molecular & Cell Biology.

Dr Lauren Arendse is leading a drug discovery programme that aims to explore novel treatments for malaria by building on the knowledge gained from using human kinase inhibitors to treat cancer. The *Plasmodium* parasite, which causes malaria, relies on enzymes known as kinases to reproduce and spread via the mosquito. Arendse and her colleagues are looking for new ways to disrupt multiple stages of the parasite's lifecycle by inhibiting novel kinase targets. By producing *Plasmodium* kinases in a laboratory, studying their structure and function and testing the ability of compounds to selectively inhibit them, Arendse and her team will gain insight into the role of these enzymes in the parasite, enabling the design of new antimalarials.

Historically, tropical cyclones that form on the south-

eastern coast of Africa have been considered 'too weak' for inclusion in hazard planning. But with the catastrophic damage caused by cyclones Idai and Kenneth in 2019, it has become clear that these weather events are intensifying. To understand what's behind this change, **Dr Rondrotiana Barimalala** is investigating the role that ocean eddies, upper ocean temperature and salinity play in the occurrence of tropical cyclones in this region. "For FLAIR, I will particularly focus on the role of the oceanic processes on tropical cyclone intensification in the Mozambique Channel," she explains.

Along with collaborators at UCT and in the United Kingdom, **Dr Ross Blamey** is currently investigating the role large thunderstorms play in the climate along the tropical edge of southern Africa. "Compared to other regions of the world, little is known about these storms in southern Africa, yet they are an important component of our climate system," he says. Through the FLAIR fellowship, he aims to address this gap in African climate science using a combination of newly available observations and state-of-the art climate model output. A better understanding of the present and projected future climate of this region will help address some of the complex socio-economic and environmental issues it faces in relation to water and food security.

A recent but rapidly expanding component of **Dr Felix Sizwe Dube's** research is around the evolution of the microbiome at different body sites in African children," he says. "[I'm looking at] the relationship between the microbiome and child health, with a specific focus on respiratory and skin infections, as well as antimicrobial resistance." As part of his FLAIR research, Dube will lead the microbiological aspects of a clinical trial that seeks to understand the effects of a proposed long-term treatment (the antibiotic azithromycin) on the microbiome in the lungs and airways of children with HIV and chronic lung disease in sub-Saharan Africa.

WORLD LEADER IN PHARMACEUTICAL INDUSTRY



Professor Kelly Chibale, founder and director of Africa's first integrated drug discovery and development centre, H3D, was chosen as one of the world's top 60 inspirational leaders in the pharmaceutical industry. The United States-based The Medicine Maker's prestigious 2020 Power List celebrates the most inspirational professionals working in the global pharmaceutical industry, driving the industry forward and saving lives. Chibale was selected as one of the top 20 inspirational medicine makers in the field of small molecules. "I am greatly encouraged that what we have been doing in Africa in the field of drug discovery is being acknowledged and recognised on the global stage," said Chibale, whose research focuses on delivering safe and affordable treatment

options for tuberculosis and malaria, while also creating jobs. H3D is well known for its ground-breaking research into a potential single dose treatment against malaria.

Chibale, who is the holder of the Neville Isdell Chair in African-centric Drug Discovery and Development and the South Africa Research Chair in Drug Discovery, said the COVID-19 pandemic had shown how vital it is to invest in drug discovery and development in Africa and across the world. "It is time to train a generation of African scientists to conduct drug discovery and build the critical infrastructure and expertise that can be sustained into the future so that Africa can respond adequately to future pandemics like COVID-19, Chibale said.



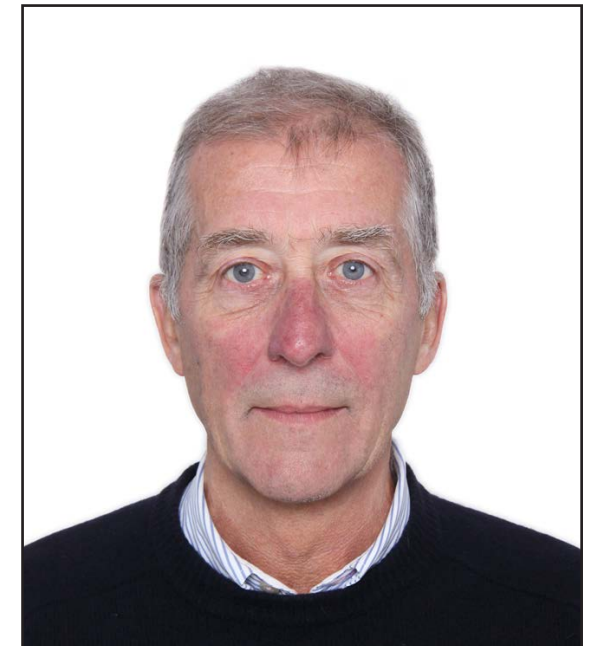
JANELIDZE AWARDED SA Mathematical Society 2020 Research Distinction Award

Professor George Janelidze from the Department of Mathematics & Applied Mathematics was awarded the South African Mathematical Society 2020 Award for Research Distinction.

Meadows elected PRESIDENT OF INTERNATIONAL GEOGRAPHICAL UNION

Emeritus Professor Michael Meadows, a Senior Research Scholar in the Department of Environmental & Geographical Science, was elected as President of the International Geographical Union (IGU) at its recent General Assembly, held online. Meadows, who was previously Vice-President (2008-10) and Secretary-General and Treasurer (2010-2018) of the organization is elected to the position for a four-year period. The IGU was founded in 1922 and will commemorate its centennial at an Extraordinary General Assembly to be held in Paris in August 2022. Meadows is proud to be only the second person from an African country to be elected as IGU President in almost 100 years and says that he is especially excited by the prospect of presiding over the centennial celebrations.

The purposes of the IGU are essentially to promote the study of geographical problems. The organization, which is a founding member of the International Science Council, gives



effect to this through more than 40 research commissions, as well as through its regular series of International Geographical Congresses, regional conferences and thematic meetings. In initiating and promoting geographical research, teaching and outreach internationally, the IGU has a crucial role to play in promoting the UN Sustainable Development Goals. As Meadows says: "Geography is, in many ways, the science of sustainability".

STUDENT AWARDS AND ACHIEVEMENTS

2020 SUB-SAHARAN AFRICA YOUNG TALENTS AWARDS L'ORÉAL-UNESCO FOR WOMEN IN SCIENCE'S

prize awarded to
Chemistry PhD student



Doaa Ali, a Ph.D. student from the laboratory of medicinal chemistry in UCT's Department of Chemistry was selected as a winner of the 2020 Sub-Saharan Africa Young Talents Awards L'Oréal-UNESCO *For Women in Science's* prize. Doaa, who hails from Sudan, is working on the development of new cancer treatments using a ground-breaking synthetic methodology based on garlic-like compounds (organotrissulfides), which are able to fight cancer cells. She hopes to become a professor of medicinal chemistry and thus help increase the proportion of women scientists in senior research positions in Africa. Doaa comments, "Winning this award has helped me recognise how other female scientists who

were awarded the L'Oréal-UNESCO prize broke boundaries and made important discoveries in the whole continent. To know that my research has been valued is a thrilling experience, and I hope that it will be a motivation for other women in Science.

Winning this award made me reflect on my own journey and how this achievement might encourage other young African women to pursue a career in Science, particularly those coming from a developing country such as mine in Sudan. This award has given me the confidence to dream about what might be possible in Africa, my beloved continent".



PHD SCHOLARSHIP AT UNIVERSITY OF CAMBRIDGE

for Jess Lund

FitzPatrick Institute MSc student and previous UCT undergraduate/Hons student, **Jess Lund** obtained a prestigious scholarship to do her PhD at the University of Cambridge. For her PhD she will be investigating the mechanisms and ecological consequences of host specificity in honeyguides, specifically looking at how phenotypic plasticity can facilitate host-

specific adaptations in the absence of genetic specialization. Jess comments, "The lockdown has set my MSc back a few months, so I will be starting my PhD later than anticipated, but being part of Claire Spottiswoode's wonderful research group (spanning UCT and Cambridge) has helped me remain sane during the pandemic".

INAUGURAL LECTURE IN FACULTY



Professor Hussein Suleman's Inaugural Lecture: THE NEED TO REALIGN COMPUTER SCIENCE WITH SOCIETAL NEEDS

Computer science involves numerous fast-evolving fields, such as algorithm and software design, making it difficult for computer scientists to keep up with developments. But computer science is faced with another more pressing reality: it is overwhelmingly motivated by profit and does not focus nearly enough on human and values-driven innovation. This is particularly concerning in low-resource environments like South Africa where computer science is often necessary for the pursuit of human development. But how should computer scientists respond? And what will they produce if it is not for profit?

For **Professor Hussein Suleman**, head of the Department of Computer Science and now a full professor in UCT's School of Information Technology the response should be a return to the roots of the discipline and realigning computer science with societal needs. By removing the profit motive, he argued,

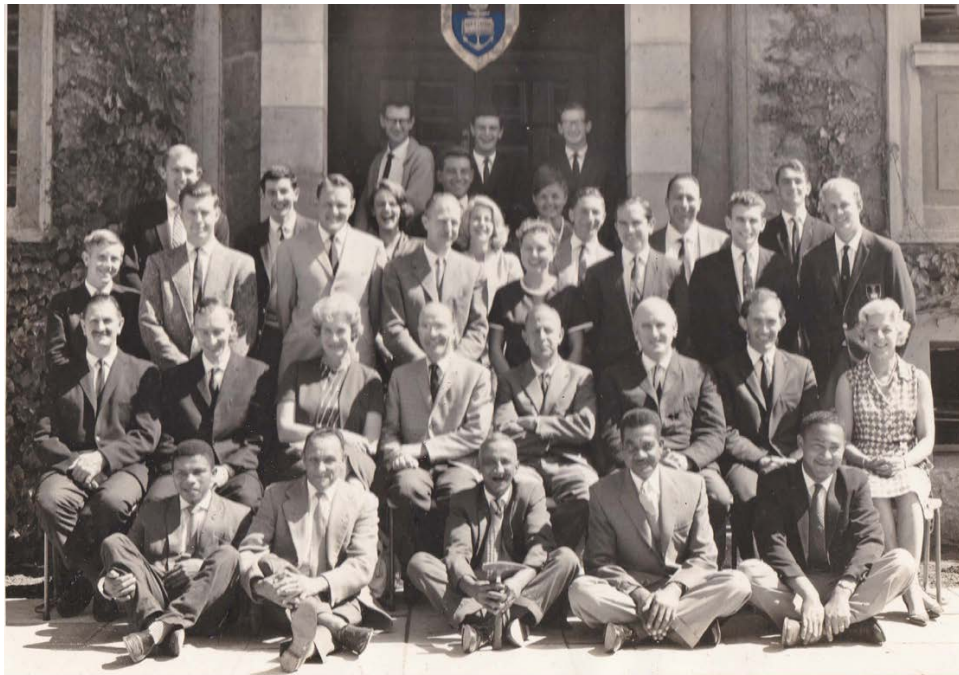
computer scientists can provide increased value for society. "It's all about money. There's no ethics, no context, no human-centric values here. It's all about producing massive profits."

Professor Suleman shared these views, which are grounded in his extensive research, during the Vice-Chancellor's Inaugural Lecture on Wednesday, 30 September, which celebrated his appointment to full professorship. In his lecture, titled "Computer Science at times of crisis: reflecting on societal drivers for software and algorithm design", Suleman tackled the challenges facing the field, presented possible solutions and interventions, and advocated for a return to roots. Concluding his lecture, Suleman reiterated the need to realign and to return to the genesis of the discipline, which can be traced back to the Second World War when a team led by Alan Turing harnessed early computer science to save human lives and end the conflict.

"We need to go back to our roots and understand that tackling crises is where we came from. And the way we're going to deal with the current crisis and future crises is by thinking about this in the way that we develop systems."

For him, what is required are more critical computer scientists who will develop the discipline in a "deeply contextual manner". This includes thinking about the environment in which systems are being developed, acknowledging that one-size-fits-all solutions are not the answer, not to over-engineer solutions, prioritising data rescue as much as data preservation, and minimising computation. "And if we do this right, this is something that can benefit ... everybody."

NEWS FROM ALUMNI



FACULTY OF GEOLOGY - 1965
 Back Row: W. Johnson, B. Kiley, B. Watters.
 Fourth Row: B. Hambleton-Jones, C. Hartnady, Miss N. Fullard, L. Lurie, Miss P. Weber,
 Miss S. Garish, R. Saadien-Raad, E. Schweitzer, J. Rogers.
 Third Row: V. Van Brun, D. Bowie, Miss E. Westall, R. Miller, A. Duncan,
 Seated: Mr. Rapley, E. Middlemost, Dr. M. Mathias, Prof. H. Martin, Prof. B. ...
 Dr. A. Fuller, A. Newton

Lennie Lurie, who graduated with a BSc 1969 and is now living in Israel, used the time on his hands thanks to Covid-19 to track down six of his geology mates who completed the first degree studies in 1965. Two of them became UCT geology lecturers/ researchers (Chris Hartnady and John Rogers) while the third, Professor Brian Watters, taught at the University of Regina in Canada. For Lennie, making contact with my former geo-mates, going back some 55 years was an emotional occasion. Lennie had this unusual anecdote to tell about life in the Geology Department in 1964.

THE BATTLE OF THE NECKTIES: Uncovering Strange Events in the Department of Geology in 1964

It goes without saying that all doctors, lawyers and those with professional qualifications have dealings with clients, usually in smart offices. Accordingly, their dress is at least semi-formal and relatively conservative. On the other hand, the geologist is a rare professional breed. His dealings are with the most inanimate things of nature which have been around for eons and his workplace is usually in the open field. Understandably, his dress in nature's garden is fairly functional, depending primarily on the weather and the environment.

As students of geology on the UCT campus, our dress was probably no different to those students in the faculties of law, architecture and sociology – probably no more or less sloppy or conventional than students in other faculties. I therefore clearly remember the shock and amazement which my fellow students and I experienced when we heard the statement made by Professor Eric Simpson that all the male students in our 2nd Year Geology Class of 1964 would from the following day be required to wear neck ties! The Prof gave no explanation for this ludicrous decision and it was obvious to all that there was nothing further to discuss with him. This ridiculous dress bombshell dominated our conversations. What had we done to deserve this punishment? Well: 'Necessity if the mother of invention' - the following day – and for the rest of the period until this absurd dress code rule was repealed by the "King" himself – every male student in our class sported the most bizarre, outlandish and awesome

neck tie that bore no relation to the type or colour of the shirt being worn. Every shape, pattern and colour tie was worn with immense pride. The lecture theatre took on the form of a circus ring with the clowns proudly parading with a dazzling range of exotic neck and bow ties!

An undeclared competition was under way: which student could find and wear the most unusual necktie for the Prof's next lesson? It was apparent that the Prof had bitten off more than he could chew. His intention to raise the standard of the students' dress code (for reasons known only to himself!) had totally backfired! It therefore came as no surprise to us when we were informed by a brief note on the Faculty notice board that "due to the hot summer weather, it has been decided that for the present, there was no need for the male students to continue wearing neckties during lectures". The geology students were magnanimous in their victory. The Prof's appearance for the next lecture encountered no hoots of derision or smug grins of success. Although the lecture was 'business as usual', we all felt an element of triumph. Subconsciously we touched our throats and relished the sensation of the missing noose!

Lennie is trying to track down all of the classmates of 1965 – please email him if you recognize yourself in this photo:

lennie@netvision.net.il

ALUMNI IN THE NEWS

TOP CORAL RESEARCHER FOR 2020

Dr Anne Cohen, who graduated with a PhD from UCT, supervised by Professor George Branch and Nick van der Merwe has been named one of ECO Magazine's top 15 coral researchers for 2020. Emeritus Professor George Branch comments, "The coral reef fraternity is a huge one, so nomination for this award, is a real feather in her cap".

Dr Cohen is now a tenured scientist at the Woods Hole Oceanographic Institution and faculty in the MIT-WHOI Joint Graduate Program in Oceanography, in Australia. Author of more than 100 scientific papers and reports on climate change and climate impacts on coral reef ecosystems, Dr Cohen served as Expert Witness on coral reefs to the US House of Representatives, served on the Science Steering Committee for the Intergovernmental Panel on Climate Change (IPCC), the Center for Ocean Solutions Committee on Corals and Climate Change and NOAA's Science Advisory Board Working Group for Ecosystem Sciences and Management. Her work is featured on Discovery Channel, WGBH NOVA, Public Radio International, WCAI Living Lab, BBC World Service and National Geographic Magazine. A 3-D "Science on a Sphere" film dedicated to Dr Cohen's Super Reefs initiative has been shown in 145 countries around the world and translated into several languages.



MARINE SCIENTIST RECEIVES PRESTIGIOUS CAREER AWARD

UCT Science Faculty Alum Professor **Lynnath Beckley**, Professor of Marine Science at Murdoch University, this year received the prestigious Australian Marine Sciences Association (AMSA) Jubilee Award for her career contribution to marine research in Australia. She received her PhD from UCT in 1985 for her study on the nursery areas of coastal fishes.

An early interest in fishes and the sea were the reasons Professor Beckley decided to pursue a career in marine science. It also helped that she ticked some of the qualities needed to achieve success – an inquisitive mind, tenacity and eagerness to make discoveries. Little did she know that her initial MSc research in intertidal ecology of St Croix Island off the South-East coast of Africa would lead to a successful career in Australia. After an international post-doctoral fellowship working with Professor Ian Potter at Murdoch University in Western Australia, Lynnath returned to UCT and led an expedition to sub-Antarctic Marion Island and pursued her interest in fish larvae.

This was followed by working as Principal Scientist at the Oceanographic Research Institute in Durban where she worked on a range of diverse fields including biological oceanography of the Agulhas Current (the western boundary current of the southwest Indian Ocean), general fish biology, recreational and subsistence fisheries and completed several fisheries and conservation projects along the east coast of Africa.

In 2002, she returned to Murdoch University to lead the Marine Science programme, lecture in coastal and marine management and focussed her research on marine resource use and biological oceanography of the Leeuwin Current. She admits that she's had an eventful marine science research career where her work has taken her across the globe. "I've worked along much of the African coast, at a sub-Antarctic island, all over Western Australia including the South-West, Ningaloo and the Kimberley, written books and research papers and even raced around the world as a navigator on a high-tech yacht," she said.

RESEARCH IN THE FACULTY

Global South research: HUMPBACK WHALES AND CLIMATE CHANGE



Humpback whale populations were decimated by whaling during the 20th century. Since the 1970s, when widespread protections outlawed humpback whaling, their numbers have started to recover. Now, however, they face a new threat: warming oceans brought about by climate change. Thanks to the recently launched Whales and Climate Program, **Professor Marcello Vichi** and **Dr Subhra Prakash Dey** from the University of Cape Town (UCT) will join scientists from seven research institutions in the Global South on a six-year project to better understand the effects of climate change on humpback whale populations and migration patterns.

For the last several years scientists and whale watching enthusiasts have

noticed a puzzling new phenomenon occurring off the West Coast of South Africa: humpback whales have been gathering in their hundreds, in what have become known as super groups. Professor Vichi, a marine scientist who specialises in understanding climate effects on marine ecosystems, explains that it is these kinds of questions that the Whales and Climate Program will seek to answer. He comments that the "The concurrent use of ocean models with whale observation networks can help us to understand how a changing climate is affecting humpback whales, including phenomena such as the recent large aggregations of humpbacks, which we have observed off the Cape West Coast."

The programme will include 25 researchers from five countries and a number of Antarctic voyages. Research teams from Brazil, Chile, Ecuador and Panama will investigate detailed movement of the South American west coast humpback whale population while South African-based researchers will analyse the combination of historic and more recent long-term datasets with future scenarios in multiple regions in the southern hemisphere. Dr Olaf Meynecke, a whale researcher from Griffith University, says the aim of a multi-year project such as this is to help establish a fundamental understanding of how changing ocean conditions are influencing the recovery of humpback whale populations. "Climate change is drastically altering ecosystems and our oceans are experiencing fast changes, affecting all marine life. The project will develop adaptation scenarios for advancing whale conservation policies and programmes."

WHEN THE RESEARCH IS BLOWING IN THE WIND

by Associate Professor Frank Eckardt



Most of the world's dry lands produce dust, which may travel over hundreds or even thousands of kilometres, affecting air quality, fertilizing the oceans on the way and reaching far flung icecaps. At source, the transport of dust also constitutes a loss of valuable nutrients. Study areas utilised by **Associate Professor Frank Eckardt** are determined by long term observations from space-borne data. For the past 15 years they have been trying to locate the dustiest place in Southern Africa, to visit these and to understand the surface conditions and processes that lead to persistent and frequent dust storms seen in the satellite records.



Their results show that the difference in dust emission potential is quite variable and in fact quite patchy even within a single field. They also found that some farmers were practising soil conservation, by retaining maize stubble and limiting surface disturbance. But such measures are not equally adopted and are also crop dependant. They also learned that the dustiest year in the image archives was one of the driest on record and that much of the agricultural areas in Free State were left bare in 2016. Given future drought years and cycles, it is pertinent to identify farming practices that could lead to widespread soil conservation practices during drought years but also consider longer term land use changes, should drought become the new normal. For example, the establishment and protecting of soil crusts might provide a short-term intervention, while switching back to grass cover could be more sustainable in the long-term. Project partners from the South African Agricultural Research Council and UCT PhD candidate Nolutindiso Ndara, currently examine grassland cover as a more appropriate landcover which protects soils but also stores more carbon. Their partners from the University of Pretoria have been looking at soils and dust microorganisms to determine if specific dust sources carry a genetic fingerprint and to ascertain the biological impact of dust fallout at its destination.

They work primarily with weather satellites that produce images, every 15 minutes, both day and night and in their study they examined satellite images covering South Africa over a 10-year period. After exploring more than 300 000 images, they found that much of the big dust events in South Africa occur in a few places in the Free State. These observations resulted in us surveying farms around Bultfontein, in the pursuit of the responsible soil types, while also collecting wind data, dust samples and details of the farming practices. They used a portable wind tunnel in conjunction with Swiss project partners from the University of Basel, who were able to establish dust emissions thresholds in response to variable soil conditions, such as soil crusts, silt and moisture content.



PARASITIC FINCHES mimic their hosts to deceive foster parents

Research published this year in the journal *Evolution* shows that the nestlings of brood-parasitic finches mimic the appearance, sound and movements of their host's chicks. Working in the savannas of Zambia, **Dr Gabriel Jamie** a research associate at the FitzPatrick Institute of African Ornithology at UCT, and a team of international collaborators collected images, sounds and videos over four years to demonstrate this striking and highly specialised form of mimicry. The study focussed on a remarkable group of finches that occurs across much of Africa called the indigobirds and whydahs (genus *Vidua*). This is a group of 19 species, which, like many cuckoos, forego their parental duties and instead lay their eggs in the nests of other birds ("hosts"). The hosts then incubate the foreign eggs and feed the young. These hosts are unusual in having brightly coloured and distinctively patterned nestlings.

Furthermore, the nestlings of each host species have their own unique appearance, begging calls and begging movements.

"*Vidua* finches are extremely specialised parasites with each species mostly exploiting a single host species. While previous work had suggested such visual mimicry may exist, this had never been quantitatively tested from a bird's visual perspective. Birds process colour and pattern differently to how humans do, so it is important to use models that approximate their visual systems", says Dr Jamie. "The current paper therefore answers a long-standing question as to whether these parasitic finches really do mimic their respective host's nestlings." The mimicry is not only amazing in its own right but may also have important implications for how new species of parasitic finches evolve. Previous work



has shown that speciation in *Vidua* finches is intimately connected to host switching, owing to a remarkable quirk of their natural history: young *Vidua* finches imprint on their host species, such that males grow up to imitate the song of their host and females grow up to be attracted to males who sing like the host she was raised by. Females also prefer to lay their eggs in the nest of the same host species as she was born in. Therefore, if a female accidentally lays her egg in the nest of a new host species, she has the potential to initiate a new lineage of *Vidua* that now specialises on the new host and is separated from *Vidua* lineages specialising on traditional hosts. Recent work has suggested that this process may not be sufficient to prevent the collapse of potential new *Vidua* species through hybridisation. Instead, the mimetic adaptations to different hosts identified in this study may also be critical in the formation of new species.

"This specialised mimicry is a vivid reflection of the role of learning in genetic evolution" says co-author of the paper from the FitzPatrick Institute at the University of Cape Town, **Professor Claire Spottiswoode**. The role of behavioural flexibility in influencing the course of genetic evolution is increasingly recognised among biologists. *Vidua* nestlings imprint on their hosts, altering their mating and host preferences based on early life experiences. These preferences strongly influence the host environment which their offspring grow up in, and therefore the evolutionary selection pressures they experience from foster parents. When maintained over multiple generations, these selection pressures are what generate the astounding host-specific mimetic adaptations that this paper reveals.

MARINE MICROFIBRES: less plastic than predicted

Microfibres are fine strands of thread used to make clothing, carpeting and household items like mops. They are found in the air we breathe, the water we drink, and throughout the world's oceans. Natural, rather than synthetic, microfibres, though, make up the majority of those found in the ocean's surface waters – despite the fact that currently two-thirds of all human-produced fibres are synthetic. Over the course of two years and five expeditions, **UCT's Professor Peter Ryan** and his team gathered 916 seawater samples from oceans around the world. "Some of these were collected as part of the Antarctic Circumnavigation Expedition, which took place from 2016 to 2017. Others were collected by researchers at sites in the Mediterranean, and Indian and Atlantic oceans," explains Ryan, director of the FitzPatrick Institute of African Ornithology based at UCT.

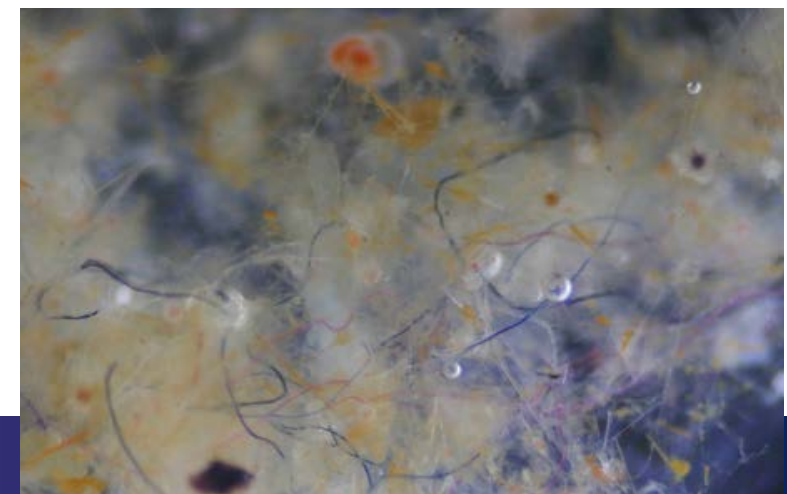
In most cases, the researchers collected a sample of 10 litres of sea water using a metal bucket lowered from the ship's bow during navigation. They then

filtered the water in a laboratory and counted and analysed all the fibres. "In general, each 10-litre sample of sea water contained 10-20 fibres, with a maximum of up to 500 fibres counted in a single sample." Only 8% of the fibres in these samples were microplastics. The rest, more than 90%, were plant or animal-based materials, like cotton, wool and other celluloses, such as linen and flax. The painstaking work of identifying thousands of fibres was conducted over the course of a year by Dr Giuseppe Suaria, an ocean scientist based at the Italian Institute of Marine Science and the lead author of the research published today in *Science Advances*. During 2018, the world produced 107 million tonnes of fibre – or the weight of more than 1 million Eiffel Towers. Of this, 62% was synthetic, with the majority produced from polyester plastics. "Our results showed that while it is true that textile fibres are ubiquitous in our oceans, there is a striking shortage of synthetic fibres," says Ryan. What accounts for this mismatch? "It may be that natural fibres are not degrading in the marine

environment due to dyes, coatings or chemical additives. Or, it could be that synthetic fabrics shed and release less fibres into the environment (for example, when being laundered) compared to natural fabrics."

The impacts of microfibre ingestion on marine organisms are poorly understood – irrespective of whether they are natural or synthetic in origin. Some lab studies have indicated adverse impacts, but not at the low concentrations currently found in the environment. Plastic pollution is definitely a serious issue. For larger animals, such as the seabirds Ryan studies, microfibres probably pass through the digestive tract quite rapidly, and thus have less of an impact than do larger plastic fragments, which might be retained for months by some birds. "We must also reconsider the impact of natural fibres – as well as synthetic ones – by looking into ways for fabrics to shed less overall, rather than swapping out synthetic for natural fabrics," says Ryan.

Vonica Perold (right), a doctoral researcher at the UCT FitzPatrick Institute of African Ornithology, and Manuel Tague (left), from the Mozambique Ministry of Sea, Inland Waters and Fisheries, sample seawater onboard the South African ship SA Agulhas II. Photo Peter G. Ryan. And Fibers entangled with plankton and other organic matter in sea water. Photo Patti Virtue (UTAS)





THE “FIREWALKERS” OF KAROO: dinosaurs and other animals left tracks in a “land of fire”

of an Early Jurassic mass extinction, according to a recent study published in the open-access journal PLOS ONE by **Associate Professor Emese M. Bordy**, a sedimentologist in the Department of Geological Sciences at UCT.

The Karoo Basin of southern Africa is well-known for its massive deposits of igneous rocks left behind by extensive basaltic lava flows during the Early Jurassic. At this time, intense volcanic activity is thought to have had dramatic impacts on the local environment and global atmosphere, coincident with a worldwide mass extinction recorded in the fossil record. The fossils of the Karoo Basin thus have a lot to tell about how ecosystems

responded to these environmental stresses. In this study, the researchers describe and identify footprints preserved in a sandstone layer deposited between lava flows, dated to 183 million years ago. In total, they report five trackways containing a total of 25 footprints, representing three types of animals: 1) potentially small synapsids, a group of animals that includes mammals and their forerunners; 2) large, bipedal, likely carnivorous dinosaurs; and 3) small, quadrupedal, likely herbivorous dinosaurs represented by a new ichnospecies (trace fossils like footprints receive their own taxonomic designations, known as ichnospecies).

These fossils represent some of the very last animals known to have inhabited the main Karoo Basin before it was overwhelmed by lava. Since the sandstone

preserving these footprints was deposited between lava flows, this indicates that a variety of animals survived in the area even after volcanic activity had begun and the region was transformed into a “land of fire.” The authors suggest that further research to uncover more fossils and refine the dating of local rock layers has the potential to provide invaluable data on how local ecosystems responded to intense environmental stress at the onset of a global mass extinction. Bordy adds: “The fossil footprints were discovered within a thick pile of ancient basaltic lava flows that are ~183 million years old. The fossil tracks tell a story from our deep past on how continental ecosystems could co-exist with truly giant volcanic events that can only be studied from the geological record, because they do not have modern equivalents, although they can occur in the future of the Earth.”

Several groups of reptiles persisted in Jurassic Africa even as volcanism ruined their habitat.

In southern Africa, dinosaurs and synapsids, a group of animals that includes mammals and their closest fossil relatives, survived in a “land of fire” at the start



South Africa is a water-stressed country. Increasing demand for water, together with uncertain supply due to climate change and catchment degradation, makes the delivery of municipal water a challenge. It is expected that, by 2030, the demand for water will be 18%–25% greater than the sustainable supply. There is thus an urgent need to understand more about the sources of tap water, their potential variability and how or when they are recharged. Research by MSc student **Ruan de Wet**, together with **Associate Professor Adam West** and **Professor Chris Harris**, set out to discover the likely source of tap water across South Africa. They used the Post Office to assist them in getting a National-level dataset of tapwater in a rapid and cost-effective manner. By running the study in different seasons, they could pick up which places had stable (groundwater) versus variable (surface water)

tap water sources. Previously, the only national level ground-water map was done at great expense by directly sampling boreholes across the country over 18 months from 2006-2007. This method is a major breakthrough for sampling this precious resource at high temporal and spatial frequency.

The researchers followed a citizen-science sampling approach to make the sampling cost-effective and rapid. They sent out envelopes addressed to 340 post office branch managers throughout the country at the end of the winter and summer season. In each envelope was an information pack, instructions and a request for their assistance in providing tap water along with two vials and a postage-paid return envelope to be sent back to our research lab. Within a short space of time, two-thirds of the post office branches had provided samples

with their tap water. This allowed the researchers to create a cost-effective and nearly synchronous map of tap water across the whole country. They then used the chemical signatures hidden in tap water (the so called “isotopic ratios” of oxygen and hydrogen) to show that there are two different “tap water worlds” - a surface world (that is linked to surface water resources like dams and reservoirs) and an underground world (that is linked to deep, possibly ancient, groundwater resources below the surface).

This research helps to understand our dependence on surface versus deep water resources and demonstrates a cheap and effective way to sample groundwater that should allow regular monitoring of this crucial resource into the future.



CLOUD COMPUTING to help save Cape's unique fynbos

In the mountains, valleys and plains of the Cape, there are about six thousand species of plants that are not found anywhere else in the world. But as the climate changes, and invasive species and human development elbow them out of their natural niches, they are rapidly disappearing.

The fynbos region is one of the world's six floral kingdoms and it is under threat from human habitation, climate change and invasive species. It has been 70 years since *Erica turgida*, with its

willowy thin branches and small cup-like pink flowers, was last seen in the wild, even though it was once common around Kenilworth in Cape Town. And this little plant is one of many. Almost 40 plants in the Western Cape have gone extinct since 1900. This is about 500 times higher than the background extinction rate, which is the natural rate at which plants become extinct.

A team of researchers from the South African Environmental Observation Network (SAEON) have developed a method of catching problems in the fynbos before they irreparably damage an area. With the seasonal fires that sweep through the Cape, its fynbos vegetation is always in a state of recovery. This makes it difficult to tell whether the plants and biome are healthy. Researchers from the SAEON have won a grant that will allow them to monitor the region's fynbos in real-time. In forests, it is relatively easy to tell whether there are changes and whether the trees are healthy; they are either green or they are not, says **Jasper Slingsby**, a SAEON biodiversity scientist and

part of the project. However, with fynbos "we are working with an open system. There are fires, it is not always green, and the seasonal variability is huge," he says. "To say, 'This is normal and this isn't' is very difficult."

At the same time, the Cape Floristic Region is under increasing threat. The region is one of the world's six floral kingdoms, with many unique plants. However, the drought, invasive species, and urban development are putting increasing pressure on this fragile ecosystem. However, the SAEON team's model predicts what the fynbos should look like at any given time, and using Google Earth Engine, they can evaluate whether what is on the ground is within the natural range, says Slingsby. The two-year grant, awarded by Google Earth Engine (GEE) and the international Group on Earth Observation, will allow the team to use the GEE platform to develop their system. "[GEE is] a cloud computing platform that processes major remote-sensing data sets from satellites," he says. "It allows you to run insane analyses; the scale of it is mind-boggling."

But the real innovation is in the model that powers their analyses. In a recently published paper, the researchers — which include Slingsby, SAEON data scientist and grant lead Glenn Moncrieff, and Adam Wilson from the University of Buffalo in the United States — laid out the nitty-gritty of how to compare satellite data of the Cape's fynbos with the predictions of what it should look like. "Tools to aid the management of open ecosystems are desperately required as they dominate much of the globe and harbour substantial biodiversity and carbon," they write.

Slingsby and colleagues' monitoring tool will allow them to have a bird's-eye view of the fynbos biome. "For example, the Cederberg is a large area and you don't know the impacts of the drought or the spread of alien invasive species. This [monitoring system] gives us an idea of what's going on out there, especially in hard-to-reach areas," Slingsby says.

FIRSTS FOR THE FACULTY

Publication of world's first African RESEARCH PAPER ON SOLAR GEOENGINEERING

In January, global Solar Radiation Management (SRM) research reached an important milestone: the publication of the world's first African research paper on solar geoengineering. The paper's lead author was Mozambican climatologist **Dr Izidine Pinto**, working with colleagues at UCT and the American National Centre for Atmospheric Research (NCAR). It was also the first publication to come from the DECIMALS Fund, the developing country research fund set up by SRMGI in 2018. It's a considerable achievement for Izidine, not least because he failed physics and chemistry in high school. Growing up in Quelimane, Mozambique, he came through the poorly funded public education system, where there were more than 60 pupils in his science classes. He found physics fascinating and kept persevering, however, taking opportunities as they came to him. He pursued a postgraduate degree in

meteorology at Eduardo Mondlane University in Maputo, before earning a bursary to study for a master's degree in Atmospheric Science at UCT. The masters was followed by a PhD, then a postdoctoral position in the Climate Systems Analysis Group (CSAG) and now he is also a lead author on Working Group I of the 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

Izidine first learned about SRM following the DECIMALS call for proposal in 2018. He has been working to model its impacts as part of the South African project led by Principal Investigator Dr Romaric Odoulami and co-PI Dr Chris Lennard. Their recent paper, published in the Journal of Geophysical Research, explores how SRM might affect extremes of temperatures and rainfall around Africa.

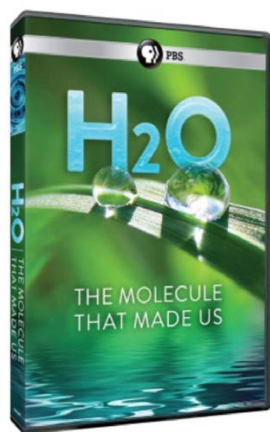
UCT-BUILT APP TO SUPPORT babies in need of breast milk

UCT computer science students have developed and are now upgrading an app for Cape Town-based human milk bank Milk Matters. What began with senior lecturer, **Dr Melissa Densmore** in the UCT Centre in Information and Communications Technologies for Development (ICT4D), donating her excess breast milk to Milk Matters, for babies in need, has resulted in a lasting relationship that has seen UCT students conducting research on and for the milk bank, as well as the development and upgrade of an app. **Milk Matters** is a non-profit human milk bank based in Cape Town. Mothers who can express excess breast milk freeze their milk and donate it to the organisation. The milk is given to premature babies, who are particularly vulnerable to fatal complications if they are not fed breast milk, making the donations vital for saving lives and acting as a bridge to breastfeeding. Since the inception of Milk Matters in 2003, over 2 500 mothers have donated breast milk, and thousands of babies at 28 different hospitals across the Western Cape have benefited from this lifeline.

In 2016 **Chelsea-Joy Wardle** and **Mitchell Green** were the first of Dr Densmore's students to focus on Milk Matters for their honours research projects. This included designing an app that helped facilitate donations and communication. Wardle built on this and continued the research for her master's degree, which she completed in 2019. Under Densmore's supervision, Wardle took an inclusive approach, known as co-design, to develop the app. This approach sees the user community involved and consulted at every stage of the development process. The result was an app that provides donor mothers

with a tool to track their donations and an estimate of how many babies their milk will feed. It also provides the donor mothers with useful breastfeeding information, details about Milk Matters depots and a simple tool to self-assess their ability to meet certain essential requirements of donating breast milk. They can also contact Milk Matters through the app for further information.

Now three honours students are building on this research under Densmore's supervision. **Gerhard Serton**, **Dino Bossi** and **Gustavo Amicis M de Souza Mendes** are aiming to make the app more widely available, improve communication between Milk Matters and donor mothers and make it easy and cost effective for the non-profit to share interesting and current information. Conducting their research and interviews during a pandemic presented a few challenges, which included depending on technology that wasn't always reliable, connection issues, problems with microphones and finding interview times that suited everyone. Upgrades to the app include making it available to both Android and iOS users, providing donor mothers with educational material, updating users on Milk Matters news and events, tracking and visualising donations and listing the locations of depots for registered users. Top of mind for the honours students is "minimal cost and maximum reward". This includes using technology that only requires writing one set of code for both operating systems and ensuring that supporting infrastructure remains "free tier". Bossi explained that by ensuring minimal cost and maximum reward, they hope to lay the groundwork for other non-profits that want to expand technologically but are concerned about cost. "It's actually possible with quite a small team in a small space of time with very limited funding," he said. In addition to developing and updating the app, as well as enriching the field of human-computer interaction with research about milk banking in South Africa, Densmore and her students are also contributing towards community building. "It takes a community to make it possible for a milk bank like ours to operate and feed babies."



Jill Farrant features in documentary: H2O - THE MOLECULE THAT MADE US

Professor Jill Farrant recently featured in a 3 part documentary, H2O: The Molecule That Made Us - a 3-hour series from WGBH Boston, which premiered on three consecutive Wednesdays in April/May. The film dramatically reveals how water underpins every aspect of our existence, how in the emptiness of outer space, Earth is alive because of water and looks at how humanity's relationship with this simple molecule is everything. Prof Farrant appears as a thread throughout the documentary with a special focus in the last episode which concentrates on the crises associated with

drought. In this she includes a feature on the effects of the drought in SA. There was also an additional documentary on her work, which appears on the website. View it here: <https://www.pbs.org/wgbh/molecule-that-made-us/home/features/resurrection-plants/>

In the words of Prof Farrant, "It is encouraging to see that academics from UCT are being recognized for their work that might be a solution to world crises".



Dr Lynne Shannon attends FIRST OF ITS KIND WORLD BIODIVERSITY FORUM

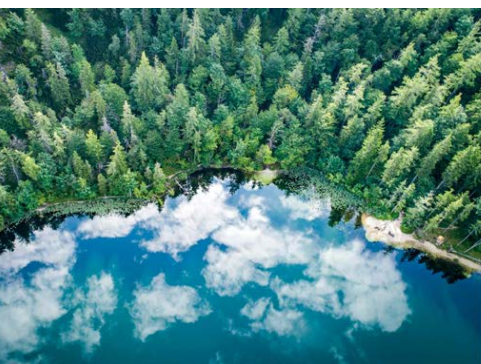
Dr Lynne Shannon (SARChI Chair in Marine Ecology and Fisheries Group in the Department of Biological Sciences) was invited to attend the only strictly marine-focused component of the World Biodiversity Forum 2020 held in Davos, Switzerland, earlier this year. The World Biodiversity Forum is the first of its kind and brought together a range of leading researchers, early career researchers, decision-makers, practitioners and representatives from various sectors to debate the sort of biodiversity future we do and/or do not want. The primary aim was to 'redefine and set the agenda for biodiversity as a focal point over the next 10 years.'

The component of the Forum Lynne attended dealt with 'Connecting the human dimension and global marine ecosystem services towards a better wealth and health of the Planet'. Lynne delivered a presentation entitled 'Getting the balance right – thoughts from a South African fisheries perspective', which was co-authored with Dr Lauren Waller (SANCCOB) and used a South African case study to emphasize the multi-faceted trade-offs requiring careful consideration in the purse seine fishery for small pelagic fish, such as sardine and anchovy. A joint paper entitled 'Marine Biodiversity: linking transformative changes and the oceans' human dimensions' was prepared for People and Nature as joint output from this session.

Lynne found the conference fascinating and particularly enjoyed the keynotes that encompassed the diverse spectrum of authorities, mainly in the terrestrial environment and representing many unique fields

including ecology, politics, biodiversity, anthropology, philosophy, environmental ethics, economics and geography. Noteworthy were two South African speakers, Professor Emma Archer, a world-recognized geographer from the University of Pretoria (and a former UCT student), and Dr Benis Egoh, a conservation biologist now tenured in California but who trained at UCT and the University of Stellenbosch.

Lynne was part of the team that was responsible for proposing the World Biodiversity Conference Resolution, adopted as output from this conference. The weekend after the conference was concluded, Lynne was invited to participate in a high-level, focussed workshop on 'Synthesizing the best available scientific evidence to inform the development of the post2020 Global Biodiversity Framework'. A report was subsequently submitted to the Convention on Biodiversity (CBD) and a high-level scholarly article is in preparation as well.



WORLD BIODIVERSITY FORUM

Davos, Switzerland
23-28 February 2020



NEW SPECIES OF PLANT discovered in Tokai Park

A new species of sedge, the Hidden Veldrush (*Schoenus inconspicuus*) which is listed as critically endangered, has been discovered in Tokai Park. The plant is currently known from fewer than 10 plants on the planet and has only been collected six times at two localities. The discovered Hidden Veldrush is described in a recent publication by UCT Biological Sciences’ researchers **Dr Tammy Elliott** and **Professor Muthama Muasya** and **Doug Euston-Brown** who first officially noticed the occurrence of the plant in November 2019. It closely resembles a grass with which

it often grows – *Tenaxia stricta*, the Cape Wire Grass – and telling them apart requires a very careful look at the leaf sheath (which grass aficionados would know as the flange on the leaf blade where it curls around the stem, and sedges have a closed sheath). Unlike its close relatives, which like wetlands or rocky mountains, the Hidden Veldrush prefers deep, dry sands.

As with other threatened species, the Hidden Veldrush’s future is complicated. It appears that this species especially

needs fire: but we don’t even know if it coppices to survive fire, or – as appears likely – is killed by fire and has to establish from seeds: an unusual trait among Veldrushes. Its rarity may suggest that this is a species that likes open spaces such as grazed areas and might not compete well with coppicing species such as the Cape Wire Grass. However, Veldrushes are often eaten and don’t fare well in heavily grazed areas. But studies on its regeneration ecology will need to wait for the next fire, and [in the] meantime we have to plan for its future,” shared the research team.

THE WATER HUB: treating contaminated runoff from an informal settlement

By Dr Kevin Winter, Environmental & Geographical Science & Lead Researcher: Future Water Institute, UCT

Contaminated runoff from informal settlements in South Africa poses an immediate public health risk to residents living in high density compact urban spaces, but the impact is also evident in the receiving waters further downstream. Surface water runoff from informal settlements comprises a mix of grey- and blackwater and is often accompanied by solid waste. Getting water and sanitation into an informal settlement is seen as a ‘basic’ service, but getting water out of an informal settlement and ensuring that it is safely treated is woefully neglected in municipal service plans. In 2017 the Western Cape government established the Water Hub as a research and innovation site for the purpose of demonstrating new technologies and techniques in water treatment. The decision to establish this test bed site was prompted by a regional drought, the worst on record that resulted in Cape Town’s ‘Day Zero’. The site is situated in the beautiful Franschoek valley, north east of Cape Town, surrounded by majestic mountains and vineyards. Less than 1 kilometre upstream of the site is an informal settlement characterised by pervasive urban poverty, unemployment and vulnerability to

health risks. In contrast, the formal historical town of Franschoek is a mere 2.5km away and is well-known as a tourist attraction, hospitality industry and award-winning culinary restaurants. The setting is a microcosm of South African cities and towns.

Context is important. It positions the Water Hub, as research and development centre, to engage in socio-economic and environmental issues and to contribute to the transformation conventional thought and practice. The site is located on an old abandoned wastewater treatment plant. The project began by repurposing existing infrastructure and changing the drying beds into large biofiltration cells for polishing and cleaning up to 100 000 litres of water each week. Each cell is filled with different media such as stone aggregates and carbon sources. Water quality and flow are measured by using real-time sensors and loggers and transmitting this data via the internet. After two years of data collection the results have led the researchers to tentatively conclude that nature-based solutions are capable of cleaning contaminated runoff from informal

settlements without the need to add chemicals. Nitrogen and phosphorous concentrations are reduced by up to 90%, and almost all *Escherichia coli* bacteria is removed. Treated water is used for irrigating vegetables and the crop is regularly tested to comply with health and safety standards.

The circular economy

The project aims to incorporate a Circular Economy approach that will help to close the loop on a small portion of the material and energy flows that come from the formal town of Franschoek, for example, organic waste that is destined for landfill. The challenge will be addressed by integrating the Food-Energy-Water-Waste nexus and to focus attention on resource recovery, reuse and production of market goods to support cooperative

business enterprises. This development of this theme is in a partnership with the European Belmont SUGI WASTEFEW project in which the Water Hub is one of four international “Urban Living Labs” (ULLs) with a common aim of reducing and understanding the waste economy in the United Kingdom, Netherlands, South Africa and Brazil.





WANTED: HONEYGUIDE SIGHTINGS

by Jessica van der Wal

The Honeyguide Research Project at UCT's FitzPatrick Institute has recently launched *Honeyguiding.me*: a citizen science initiative to improve the understanding of the cooperative partnership between honeyguide birds and humans in Africa. The project invites bird enthusiasts to share where they've seen a Greater Honeyguide and whether they were guided or not, to allow mapping where the bird occurs and how much guiding still occurs on the continent. These records will help our understanding of how this unique interspecies relationship is maintained across time and space. Visit: Honeyguiding.me to share a sighting or for more info.

The Greater Honeyguide (*Indicator Indicator*) is known for its habit of guiding people to bees' nests in parts of Africa. Bird and human cooperate to gain access to bees' nests, from which humans gain honey, and honeyguides get wax. The birds know the whereabouts of the bees' nests but cannot access the wax alone, whereas humans have the tools to open the

nests. This relationship between birds and humans in which both parties benefit is called a mutualistic relationship, and is an extremely rare example of animal-human cooperation that has evolved through natural selection.

The honeyguide-human mutualism is thought to have once been common in sub-Saharan Africa, but is now much reduced and is known to exist regularly in only a few remote areas where people still rely on a supply of wild honey. However, honeyguides still attempt to guide humans at least occasionally in other places in sub-Saharan Africa. When a Greater Honeyguide wants to guide you, it will alert you to its presence with a distinctive, nasal chattering call –“tjrrr tjrrr tjrrr tjrrr”. Through inviting bird watchers to share their honeyguide sightings, the Honeyguiding.me citizen science project will be able to map the extent of the guiding behaviour across Africa, and track it over time. The site is available in English, French and Portuguese.

EPIGENETIC AUTISM STUDY breaks new ground

After three years of lab work, and a year of banging on school doors to recruiting a cohort and then writing up a paper while home-schooling young children through Covid-19 lockdown, **Dr Colleen O' Ryan** finally published her ground-breaking new study on epigenetic autism. When Dr O'Ryan embarked on an ambitious project to research the genes associated with autism spectrum disorder (ASD) in a cohort of South African children, she hardly expected the study to lead her right back to UCT's Chemical Pathology laboratory where her academic career started thirty years ago. “I often tell my students that nothing you learn is ever lost,” said O'Ryan, who established and currently heads up the Genetic Autism Cape Town Research group within UCT's Department of Molecular and Cell Biology.

It would be hard to find better testament to this

statement than O'Ryan's own full-circle journey to the recent publication of “*DNA methylation associated with mitochondrial dysfunction in a South African Autism Spectrum Disorder cohort*”, a ground-breaking paper appearing in the Autism Research journal. O'Ryan explained that what makes their paper unique is the fact that it's the first paper from a South African research group examining a South African group of children using a whole genomic approach, as well as one that used an epigenetic (methylation) approach. “So, what we're basically showing is that in a South African cohort of children, DNA methylation is different between children with and without autism, and that this methylation is associated with mitochondrial dysfunction in ASD.” Their findings also open up a range of new study possibilities for up-and-coming researchers to embark on.



CITIZEN SCIENCE URBAN CARACAL PROJECT

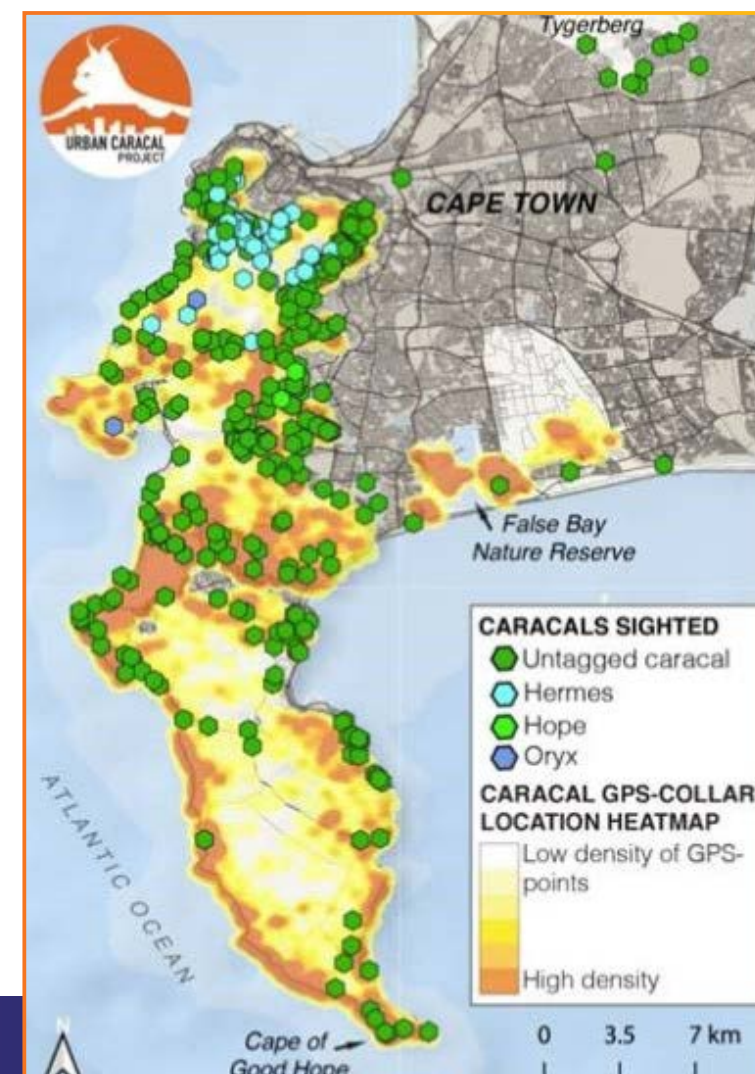
iCWild's Urban Caracal Project has been making great strides this year but most notably for them is the incredible ongoing public engagement with the project. More than 500 people have submitted their sightings reports. They recently summarized data based on public sightings of caracal around Cape Town and mapped it together with their GPS collar data—see figure on right and read more at <https://www.facebook.com/urbancaracal>. Their Facebook page (which has approximately 11 000 followers!) has stunning photos of caracal, advice about what to do if you sight a caracal and information about them.

Caracals have been spotted on Chapman's Peak, Clifton, Kommetjie, the Pipe Track, Lion's Head, Bantry Bay and along Kloof Road and seem to have carved out a niche for themselves in Cape Town. Dr Laurel Serieys, principal investigator says, "Caracals are extremely flexible, behaviorally". Serieys and the team at iCWild captured and collared 26 of the cats with tracking devices to learn about them, what they eat and the environment they inhabit. Their research shows that these caracals have a diverse diet - consisting of more than 70 prey species: medium-sized birds, rats and frogs. The GPS coordinates from their collars show that they spend time on the coastline hunting seabirds and penguins. They also prey on domestic cats, chickens and ducks and Serieys describes them as a conflict species, who, in agricultural areas are persecuted by farmers.

Genetic surveys indicate that these cats have high levels of inbreeding—suggesting a closed off population. There are about 320 square kilometers available to them in the peninsula and typical male territory in other areas is about 75 square kilometers. It is estimated that there are about 50 cats in the area which suggests heavy competition in a small territory and Serieys says her team has detected caracals killing and eating other caracals. Their data showed that the cats prefer to spend time right at the edge of the urban areas, where they

are likely to encounter increased foraging opportunities; indicating that these urban cats may have become habituated to exploiting food sources near humans.

Habitat loss is the greatest threat to biodiversity globally and when habitat is transformed by fragmented human development, species such as these show they adapt to environmental change and make the most of it by hunting prey like guinea fowl, vlei rats and Egyptian Geese which are abundant at the urban edge.



COVID-19 AND SCIENCE

HARNESSING PLANT POWER TO CURB COVID-19

Here's a different reason for tobacco to be in the news: Cape Bio Pharms, a biotech company with its origins in the Biopharming Research Unit (BRU) at UCT, has joined the global effort to create a fast and affordable antibody test for COVID-19, using a distant relative of the tobacco plant.

The team of scientists who works at the lab is using *Nicotiana benthamiana*, a relative of the tobacco plant, as a bioreactor to produce COVID-19 antibodies. They are working towards developing a serology test, which detects antibodies in a patient's blood and can be used to see if they have been exposed or previously infected. "This is unlike most diagnostic COVID-19 tests, which look for genetic material [from the virus]

to see if someone is currently infectious," says Cape Bio Pharms Co-Founder Tamlyn Shaw.

Dr Inga Hitzeroth, a biochemist based at UCT's BRU, explains that they have been using *Nicotiana benthamiana*, for over 20 years because of the plant's strength, ability to grow quickly and weakened immune system. She and her colleagues – as well as others around the world who work with *N. benthamiana*, – essentially harness the plants immune system as a factory to produce antibodies that can later be extracted and used in vaccines. They do this by 'infecting' the plants with a foreign substance that induces them to produce antibodies to fight the 'infection'. "When the plants are about six weeks old, we infiltrate them with antigens – substances that provoke an immune response. The plants then start producing proteins to fight this 'infection'," she explains.

Professor Ed Rybicki, virologist and director of the BRU, explains that what makes plant-produced antibodies particularly useful is the speed with which they can be harnessed: from seed to extraction can take weeks. By comparison, when using mammals like rabbits or sheep in the same way, the process can take months to half a year, he says. Rybicki also notes that each batch of plant-based reagents is derived from the same genetic construct, standardising the results –

another advantage that doesn't apply to animal-made antibodies.

Harvesting antibodies from plants

In the case of COVID-19, the team at Cape Bio Pharms first sourced the gene sequences for the virus SARS-CoV-2 under the banner of the global partnership Plants Against Corona, which consists of commercial research labs and academic partners around the globe. The team then developed antigen constructs that they used to infiltrate the plants and turn into highly effective bioreactors whose immune systems churn out antibodies against the virus. These antigen constructs are an essential component of global efforts to create both diagnostic tests and a vaccine for COVID-19. The antigens created by Cape Bio Pharms have been shared with the Plants Against Corona network to be used by researchers around the world. "We have already sent samples of our antigens to local test-kit manufacturers who are validating our proteins externally. These proteins have passed our own internal validations and tests, and one of the test-kit manufacturers has confirmed our protein has been clearly recognised by antibodies against the virus," says Shaw.

Local solution to a global need

According to Shaw, the ability for South African scientists to have access safe, reliable and reproducible reagents in South Africa also strengthens their position in global biotech innovation. "At the moment, our scientists rely on the imports of these products, which costs a lot of time and money. The easier it is for them to secure a sustainable supply of stable and reproducible

proteins, the more medical innovations we'll be seeing coming from our shores." While time is of the essence in the current COVID-19 crisis, the team also take a long-term view of the role of plant-powered antibodies in biotech research. **Dr Ann Meyers**, another BRU researcher, explains that the techniques being harnessed against COVID-19 also have applications far beyond this virus and the generation of medically useful compounds. "At the BRU, we work on creating antigens and vaccines for a wide range of diseases that affect both humans and animals. These include everything from HIV-1 and HPV to other diseases like the Rift Valley virus and bluetongue virus, which infects sheep. By creating affordable diagnostic tests, we can help local researchers to better understand the incidence of these diseases in Africa. The BRU is also an essential incubator for highly-trained researchers who understand this work and who go on to create important research networks across the continent."



The team at Cape Bio Pharms (left to right): Francisco Pera, head of upstream research & development; Tamlyn Shaw, co-founder and chief scientific officer; Belinda Shaw, co-founder and CEO; Scott de Beer, head of downstream research & development. Photo supplied.



SOLUTIONS TO MASK WEARING CHALLENGES

Creative collaboration between Centre in ICT4D and d-school inspires students to respond to Covid-19 pandemic with innovative solutions to mask wearing challenges

A collaboration between the UCT Centre for ICT4D in the Faculty of Science and the d-school, resulted in a creative and critical project approach to addressing the current COVID-19 crisis and coming up with creative solutions for mask-wearing challenges. Not only was this a particularly relevant project, but it was an example of just how successfully emergency remote teaching and learning can take place. This inter-disciplinary collaboration involved ten Honours, Masters and PhD students in Computer Science and Information Systems who were thrown together in the deep end of on-line learning. The project took on a life of its own and morphed into something different from what the

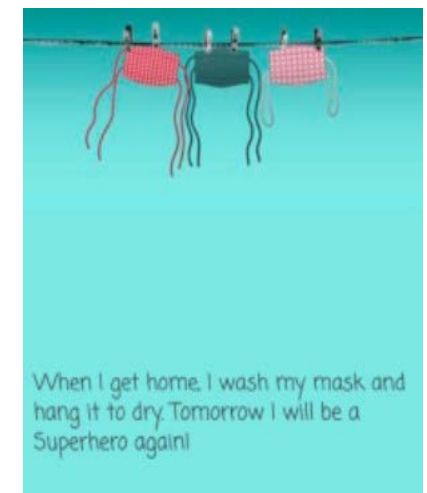
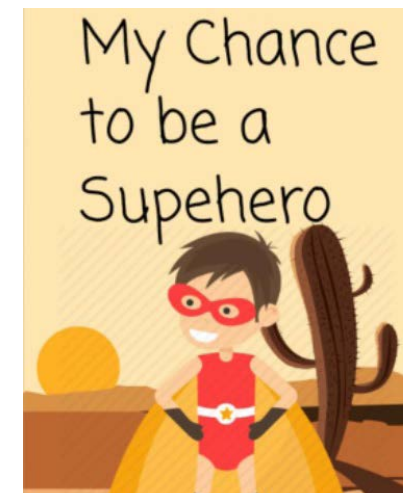
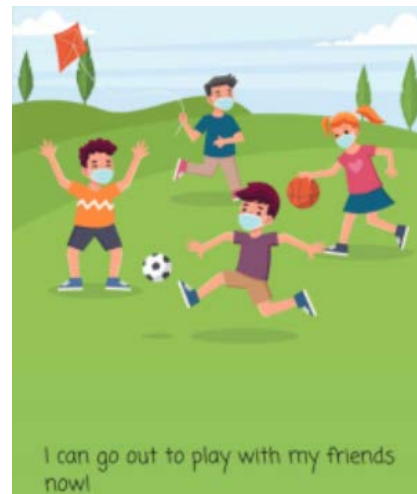
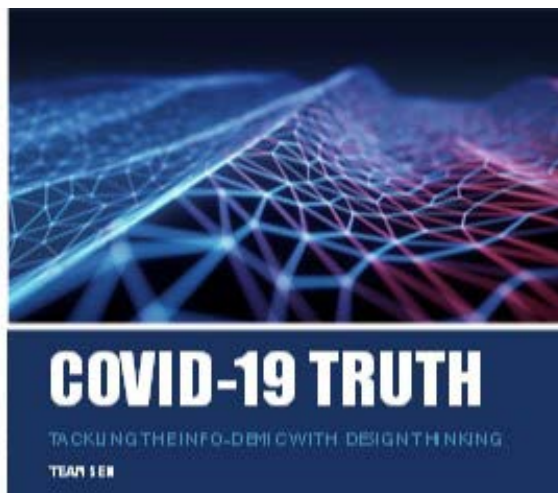
co-ordinators **Melissa Densmore** and **Hafeni Mthoko**, who co-teach the Introduction to ICTs for Development course, had initially intended it to be. This year, for the fieldwork component the course conveners decided to use a hands-on real-life project on masks for COVID-19, for which they also included a Design Thinking component led by Nailah Conrad from the School of Design Thinking.

Initially it was thought that the project would be about mask production and dissemination – where to get hold of masks, etc. However, after having scoped the problem, the students realised that the far greater issue was information about correct usage and wearing of masks. The student's research revealed that many people did not understand how to wear a mask properly and were not understanding Covid-19. While many people were wearing masks, they were wearing the same mask day in and day out, they were not wearing it properly and were not washing it. After the first round of interviews, the data showed that the interviewees were more concerned about what types of mask was safe to wear and were confused about the mixed opinions on using medical masks, cloth masks, 2 or 3-layer masks, etc. In interviews with teachers, the students learned how teachers and parents were struggling to get children to wear their masks in the correct manner. As noted by Rebecca Njuguna, "our team concluded that the biggest problem we observed across the diverse pool of interviewees was the need for reliable information about masks, not necessarily a need for the masks themselves". This necessitated reframing the challenge and

addressing the problems highlighted by their interviews. Despite the challenges of having to work remotely, the one group came up with an innovative children's storybook about mask wearing (which is in English, isiXhosa, Tshivenda, and Afrikaans – with Swahili and isiZulu translations in process) and a follow up quiz for Heroes to assess knowledge of mask wearing. The other group developed a concept for a unified platform for government communications about Covid-19.

Outcomes

This project revealed a team of students who are passionate about developing their communities and coming up with strategies to address the issues those communities face, by utilising Information and Communication technology strategies. One of the outcomes of the course is that it generated a high degree of social awareness and produced a decolonised curriculum, while producing something that could potentially have significant impact. Furthermore, the presenters were encouraged about the inter disciplinary nature of the project and hope that this will encourage future interdisciplinarity and publicise the course, which is open to all majors. Wallace Chigona, Director of the Centre in ICT4D, commented, "What stood out was the inter-disciplinary nature of the project which brought together students from different faculties and study levels, where they worked on practical issues in a hands-on manner which involved real people and real issues. This was not just a theoretical project but was about students engaging with communities".



Prospects for SARS-CoV-2 diagnostics, THERAPEUTICS AND VACCINES IN AFRICA

Professor Ed Rybicki and Prof Anna-Lise Williamson's postdoc Dr Mani Margolin was lead author on a very prestigious Nature Reviews Microbiology review on SARS-CoV-2 / COVID-19:

The limited capacity for testing and contact tracing, poor health-care systems, lack of pharmaceutical manufacturing capacity and underdeveloped infrastructure in Africa pose several challenges that constrain the response of the region to the coronavirus disease-2019 (COVID-19) pandemic. This is worsened by the high burden of infectious diseases, which may worsen disease outcome and compete for the available resources. A further challenge is the dire

economic consequences of prolonged lockdowns in countries with weak economies.

CONCLUSIONS: The ongoing COVID-19 pandemic presents an unprecedented global humanitarian and medical challenge. Although this has prompted unparalleled progress in the development of vaccines and therapeutics in many countries, it has also highlighted the vulnerability of resource-limited countries in Africa. Not only do these countries have limited testing capacity but the infrastructure to manufacture tests, vaccines and therapeutic drugs is largely absent, and few clinical trials are underway on the continent to combat SARS-CoV-2. Clearly, there is an urgent need for capacity development and the available resources should focus on solutions that are specific to the needs of the continent. For example, there is an urgent need to inexpensively

manufacture viral antigens for serological testing: this will determine the seroprevalence of the virus where PCR-based testing is not available for mild infections. Therapeutics development should focus on repurposing existing drugs, or using convalescent plasma that can rapidly be used to treat infection and could be prioritized for individuals who are at high risk. Appropriate manufacturing partnerships need to be established to produce vaccines that could be tested and licensed on the continent, to limit reliance on global initiatives that may be overwhelmed by the global demand for a vaccine. In fact, this may present an opportunity for governments to finally invest in much-needed cGMP-compliant vaccine manufacturing facilities. Although the situation is unquestionably dire, Africa has an important role in the global fight against COVID-19, and the resilience and resourcefulness of the people are not to be underestimated.

MINISTER'S FUNDING AWARD to South African Covid-19 testing ability to BRU

The Department of Science and Innovation (DSI), the South African Medical Research Council (SAMRC) and the Technology Innovation Agency (TIA) made seven funding awards to local companies, organisations and researchers in order to ramp up the country's ability to produce locally developed reagents and test kits for COVID-19. The awards are valued at approximately R18 million and the funding recipients will commence their responsibility immediately, with six months to begin production.

The Biopharming Research Unit (BRU), at UCT, under the leadership of **Professor Ed Rybicki**, received one of these awards for the development of diagnostic reagents. The BRU will develop and produce highly stable synthetic DNA and RNA molecules, containing all the commonly used target sequences used for SARS-CoV-2 nucleic acid detection, as well as internal control sequences to check for the integrity of the nucleic acids.

The combination of this and projects from CSIR and CapeBio Technologies will address South Africa's immediate needs for locally produced RT-PCR reagents for gold standard test kits. The planned used of biopharming technologies, which involves the production of pharmaceutical proteins in plants that have been genetically modified for this purpose to produce these reagents will be an added advantage.

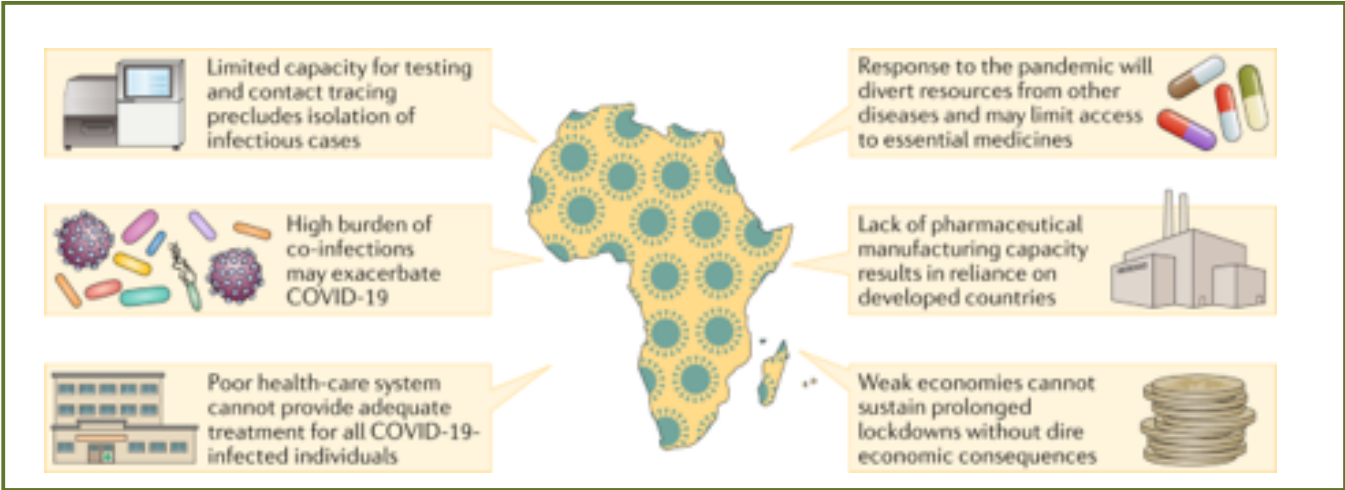


Fig. 1: Challenges for African countries in their response to the COVID-19 pandemic.

CORONAVIRUS AT UCT – twice in one career

by Professor Justin O’Riain



In December 2002, a virulent enteric coronavirus struck UCT’s captive naked mole-population that was housed in the John Day building on Upper Campus. The virus ravaged what was then the world’s largest captive population of arguably the world’s most fascinating mammal. The founder of (Prof Jenny Jarvis), and heir to (Prof Justin O’Riain), this biological treasure trove watched helplessly as the virus spread like wildfire, wiping out decades of work in research and husbandry in a few months. We did salvage some data from this disaster says O’Riain, with a research paper showing that being old, male and inbred significantly increased the probability of mortality. Some 18 years later and coronavirus was back on campus but this time as the COVID-19 human pandemic, with gender and age again once again amongst the predictors of increased vulnerability.

Lockdowns have resulted in what scientists are referring to as the “Anthropause” in which human impacts on the world have been temporarily curtailed. Initially lockdowns were thought to have provided

many wild animals with a welcome reprieve from the hustle and bustle of human activities. Collisions with vehicles on land, in the sea and in the air account for an extraordinary number of animal deaths annually and reduced traffic across all mediums is certain to have had an immediate positive impact on wildlife. Additionally, reduced presence of people in streets and open spaces in urban areas was reported to coincide with more animals being detected deeper in urban areas than normal. In Japan deer were roaming the empty streets of major cities and monkeys in parts of India were pushing deeper into urban areas in search of food that is normally easily obtainable from street vendors that have had to stay at home. Of course, these observations come with bias in observer effort with more people at home for prolonged periods being more likely to notice normally elusive animals in their neighbourhood. In time those researchers who had sampling devices like camera traps in place before and during the lockdowns will perhaps reveal just how much animals adjusted their activities in the Anthropause.



Of direct concern to wildlife biologists was that COVID-19 has proven transmissible to other wildlife, with early reports of a tiger and lion testing positive at the Bronx Zoo in New York and displaying surprisingly similar symptoms to humans (coughing and listlessness). The risk of cross transmission to the great apes put them on tourist lockdown and concerns are rising over the financial viability of their ongoing protection in the absence of tourism revenue. More locally there is concern for primates that frequent urban areas including vervet monkeys in KZN and baboons in the Western Cape. Monkeys have been shown to have receptors for COVID19 and to experience illnesses such as pneumonia once infected. Conservation authorities are on alert for possible signs of cross-transmission to either primate.

While the full extent of these negative impacts will only emerge in time, the pandemic has undoubtedly driven a global reflection on our relationship with wildlife and how we trade animals and their parts for consumption. Markets with live animals are the melting pots for people and wildlife where pathogens can mix, mutate and evolve the ability to infect both humans and animals. The unregulated harvesting, transporting and sale of wildlife in live markets has always posed enormous welfare and conservation concerns. Now that it has been



confirmed in the minds of most that it carries a serious human health risk, the brakes are finally being applied to runaway illegal trade train.

Arguably the biggest potential negative impact of the current pandemic is the drying up of revenue for protected areas across much of Africa. Reduced protection and increasing poverty of communities neighbouring protected areas makes bushmeat harvesting for both subsistence and for sale a real threat that is predicted to escalate. The pangolin might have been removed from the medicinal cabinet of many Asian countries, but it and many other wildlife remain on the menu as a critical source of protein for communities who may be experiencing heightened levels of food insecurity linked to COVID-19.



A LEADING COVID-19 MODELLER ANSWERS SOME QUESTIONS ABOUT INFECTIOUS DISEASES

Associate Professor Sheetal Silal, at UCT

A senior lecturer at the University of Cape Town, **Associate Professor Sheetal Silal** from the Department of Statistical Sciences at UCT, has been leading efforts to model COVID-19 in South Africa. Associate Professor Silal has spent her career developing and using mathematical models to understand the spread of infectious diseases and how public health policies can most effectively control them. It is therefore not surprising that when the South African government decided to enlist expert support to inform the country's response to the COVID-19 pandemic, Associate Professor Silal was one of the first experts they turned to. Since March this year, she and colleagues in the South African COVID-19 Modelling Consortium have been using all the tools at their disposal to investigate how the disease might progress in the country and how each of these many scenarios would affect the population's health.

How does one build an infectious disease model?

A multi-disciplinary approach is the foundation for determining what goes into a model. The first step is always to consult widely - clinicians, intensivists, economists, biologists, epidemiologists, public health specialists et cetera. By consulting experts from different fields, we can build a more complete picture of how the disease behaves and is being treated. To me this is a real benefit of mathematical modelling – we see ourselves as the synthesizers of information. They use data on the virus and the disease it causes – infectivity, recovery time, mortality rate and so on; the behaviour of people – how strictly do (or can) they observe physical distancing and lockdown measures; the capacity of the healthcare

system – how many intensive care units (ICUs) are there, how many nurses and so on. We combine these data to show how the virus could spread, what effect that would have on health infrastructure, and the potential impact of intervention strategies.

With a new disease like COVID-19 is it challenging to get enough data?

The key has been to design our models so that they can quickly be updated to accommodate new information as it becomes available. Some details were well known before the pandemic, the number of ICU beds for example, but with a completely new disease and unprecedented lockdown policies there were a huge number of unknowns, which was a challenge. While we've learned a lot in the past months, remain ready to adjust model parameters as more data emerges.

There were many countries already suffering badly from COVID-19 before the disease began to spread widely in South Africa. To what extent can other countries' data help to inform your models?

Looking at COVID-19 we know that severity of illness and transmission are affected by age. Many African countries have far younger populations than European countries. Therefore, the spread of infection, its severity and fatality rate should not necessarily be transplanted from European data into an African context without first taking age into account. Another

example is testing. Countries are employing different testing strategies for different reasons. In a country with enough resources to perform mass testing, they can get a reliable measure of the virus' presence and how that varies geographically. Countries with limited resources may prioritize testing only for the elderly, the severely ill, or contacts of positive cases. Because of these differences in approach, it's very difficult to say, "European countries have followed a certain increasing case trajectory, so we should expect the same to happen in our country." because the numbers all mean different things. So, while it is useful to study what is going on in other countries, one cannot transplant trends of an epidemic from one country to another without interrogating how the contexts differ.

Looking to the future, how is the experience of responding to COVID-19 changing the field of infectious disease modelling?

Something that emerged quickly was the formation of many new international collaborations and networks. These are welcomed and I hope they continue even after we have overcome the pandemic as they help us to distribute information and techniques. Should another outbreak occur they will also help us respond more effectively in the future. Being in the public eye has also brought a lot of reflection over our



responsibility to engage with the public and I hope the efforts that have started in this area also continue.

In terms of the work of disease modelling itself, this field has been developing for over 100 years and despite COVID-19 being a shock to almost every system, it hasn't changed the science behind our work. There will certainly be new insights generated but these will be evolutions of the field rather than revolutions.

A positive consequence of the pandemic is renewed interest in and a rise in popularity of mathematical disease modelling. In my travels throughout the African continent, I have found that we have very talented mathematicians and students of mathematics. In the last few months, I have received numerous requests for postgraduate study in the field. This talent needs to be harnessed and channelled through funding and research projects to support our continent's governments to control the diseases that continue to devastate our people and to respond locally and effectively to future outbreaks.

EVENTS IN THE FACULTY

MEETING ROOM IN COMPUTER SCIENCE RENAMED after visionary professor

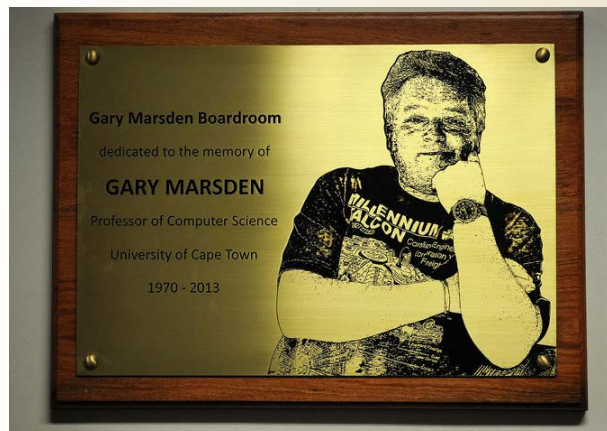
A meeting room in the Department of Computer Science was recently named in honour of **Prof Gary Marsden**. Colleagues, family and former students of the much-loved and visionary Professor Gary Marsden gathered to name a meeting room in his honour at the Centre in Information and Communications Technologies for Development (ICT4D) in the University of Cape Town's (UCT) Department of Computer Science.

Marsden passed away suddenly from a heart attack in December 2013 at age 43, but it was clear at the naming ceremony that he has left a lasting impression on people in the department, the faculty, UCT and the international research community. Speakers, including Vice-Chancellor Professor Mamokgethi Phakeng, told of the ripple effect of Marsden's passion for teaching and research, and spoke movingly about the influence he had had on them, both personally and professionally, during his 13 years at UCT.

Marsden was the founding director of the Centre in ICT4D, an accredited research group within the university, with a focus on

computing solutions to human and socio-economic development problems. In a proposal to name the boardroom after Marsden, head of the computer science department, Associate Professor Hussein Suleman, said Marsden's research was recognised internationally, evidenced by numerous publications and concomitant citations, and a multitude of leading international researchers who visited UCT as a consequence. Marsden's book *Mobile Interaction Design* is considered a seminal work on the design of mobile applications, especially for and in poor communities.

Marsden earned a Distinguished Teacher Award and was remembered by his students for his exceptional and inspiring lectures often punctuated with laughter. "Gary's humour opened the way to point out the inequalities, incongruities and urgent need for change. I remember the laughter of the enthralled audience of undergraduates or the bemused donors from the tech industry as they laughed as they gave him lots of money," said Associate Professor Marion Walton, convener of Digital Media and Informatics at UCT's Centre for Film and Media Studies.



Gary Marsden's parents, Letta and Roy Marsden (back), his daughter, Holly (front, left), wife, Gil, and son, Jake.



Global Women's Breakfast 2020: EMPOWERING WOMEN IN CHEMISTRY

Drs Cesarina Edmonds-Smith and **Roxanne Mohunlal**, from UCT's Department of Chemistry, organised the IUPAC Global Women's Breakfast 2020: Empowering Women in Chemistry, which was hosted at Rhodes Memorial Restaurant. More than 50 women from UCT, Stellenbosch University, UWC and CPUT, as well as representatives from Lassec gathered in conjunction with woman at 242 breakfasts being held in countries across the world. The Global Women's Breakfast was designed to assist women chemists to expand their network of contacts, both locally and internationally. Women at different stages of their individual careers were encouraged to inform each other about their career progress, and together explore

opportunities, in professional development and in research or teaching horizons.

The postgraduate students, academics, scientific officers and sales representatives enjoyed a morning of networking and forming new bonds. The morning comprised of an introduction and brief history highlighting the importance of this initiative by **Dr Cesarina Edmonds-Smith**, followed by a relaxed breakfast where delegates chatted about what life is like as women in science and exchanged stories about their personal journeys which was empowering and inspiring to all who attended.

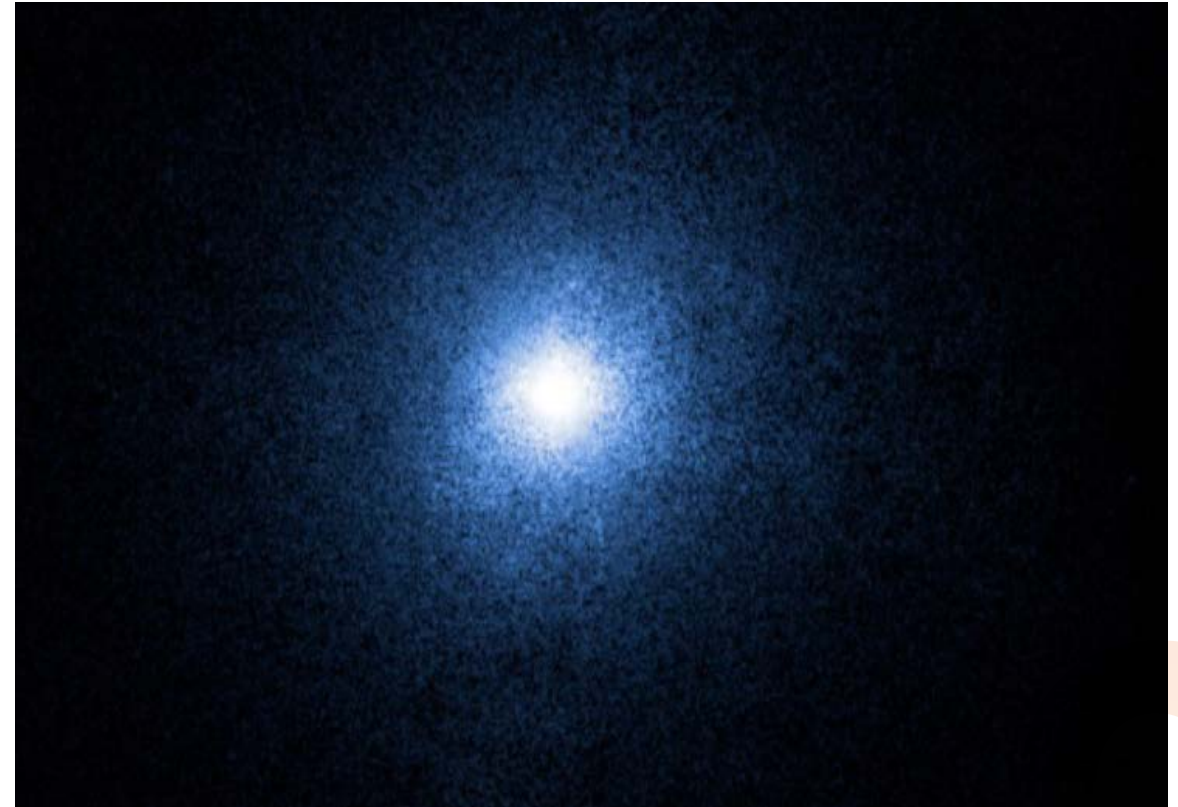
RECORD ATTENDANCE AT VIRTUAL STRINGS CONFERENCE

in High Energy Theoretical Physics

Professor Jeff Murugan's group, The Laboratory for Quantum Gravity & Strings hosted the premier international conference in high energy theoretical physics, Strings 2020. This year had a record 2300 participants from all over the world. "Basically, we had to reinvent this conference that [has] been around for 30 years," said Murugan, who leads UCT's String Theory Group in the Department of Mathematics and Applied Mathematics. But there's always that silver lining. The offshoot is that many more researchers participated from many more groups previously excluded by funds, gender, stage-of-life (young parents, for example) and juniority. By opening the conference on a virtual platform and making it free, participant numbers soared from 400 to 2 300.

This has important repercussions for a small field, said Murugan. South Africa's string community includes the UCT group, one at the University of the Witwatersrand and individual researchers at other universities. String theory is complex. Murugan calls it an edifice at the front lines of high-energy theoretical physics and mathematical physics. The [Live Science website](#) describes it as "an attempt to unite the two pillars of 20th century physics – quantum mechanics and [Albert Einstein's theory of relativity](#) – with an overarching framework that can explain all of physical reality". "Strings provided an elegant mathematical way of describing the strong force, one of the four fundamental forces in the universe, which holds together atomic nuclei." Murugan added: "Today, we realise that string theory is really a far more diverse set of tools to understand a vast spectrum of things – from quantum chaos to cosmology."

A big topic at this year's conference was the idea of black hole information paradox. The National Aeronautics and Space Administration's (NASA) succinct description of a black hole describes it as "a place in space where gravity pulls so much that even light cannot get out. The gravity is so strong because matter has been squeezed into a tiny space. This can happen when a star is dying. Because no light can get out, people can't see black holes". Much progress has been made in understanding the information paradox of black holes. "We've learned that there are correlations in the temperature of the black hole that allow us to reconstruct what falls into a black hole. A big theme of this year's meeting was the resolution of [Stephen] Hawking's information loss paradox," Murugan said. "But string theory has proven to be an important tool in solving many other problems. A lot of the technology that we use in string theory is portable to other areas of physics. An example from my own research is our co-discovery a few years ago of a beautiful set of relations, called dualities, between different quantum field theories that lend themselves to a deep understanding of the



properties of a remarkable new class of materials called topological quantum matter." He added, "This is what we expect will replace silicon as the basis for future technology. So trying to understand the properties of these materials is vital. And the mathematical techniques from string theory are the same techniques that will go towards understanding the stability, electrical properties and possible uses of these new materials."

The opportunity presented by THE CALL FOR DECOLONIZATION



Dr Margaret Blackie, from the Department of Chemistry and Polymer Science at Stellenbosch University, presented the Department of Chemistry Transformation Committee seminar with a talk entitled, "The opportunity presented by the call for decolonization"

In her talk, Dr Blackie highlighted three major factors impacting tertiary education in South Africa now, namely (a) Decolonisation (b) the 4th Industrial Revolution and (c) The Covid-19 Pandemic. She expressed the need to form a broader view of what we are doing and what the value is of an undergraduate degree in Science—challenging our presumptions.

Explaining that what started her off thinking about this topic was when the UCT student made the "Science Must Fall" video with a claim to throw out Newton, Dr Blackie recognised that although it wouldn't be helpful to throw out Newton, it was important to consider that maybe the student had something important to say.

The alienation that students were experiencing needed to be acknowledged because this clearly does impact their engagement and this raised the issue of how to facilitate conversations between students and scientists. Dr Blackie clarified that decolonisation takes a different shape in STEM because the nature of the project of education is different. In STEM subjects the focus is on the conceptual understanding (what you know), as contrasted with Humanities where the focus is on the development of the worldview and the orientation to society and knowledge). In Science the relationship to knowledge is strong and the relationship to society is weaker and scientists can be blind to the way that the other fields of education

operate. The implications of this are that even though Science is favouring the relationship to knowledge, there is a relationship to society that is operational. She pointed out that regardless of the educational project we are involved in, there are three things that we need to take into account, namely: Power; Being & Knowledge. All three of these are operational whether we recognise them or not. In science, we are 'Knower Blind' - Scientific knowledge is objective and socially neutral, however we can be blind to the person as a scientist, who we cannot presume is objective and socially neutral. Dr Blackie emphasised how we tend to conflate neutrality of scientific knowledge with presumed neutrality of scientists and that this is a dangerous step to make. She made the point that the second conflation we make is that science education is not the same as science—education can never be socially neutral—the education project is always socially embedded.

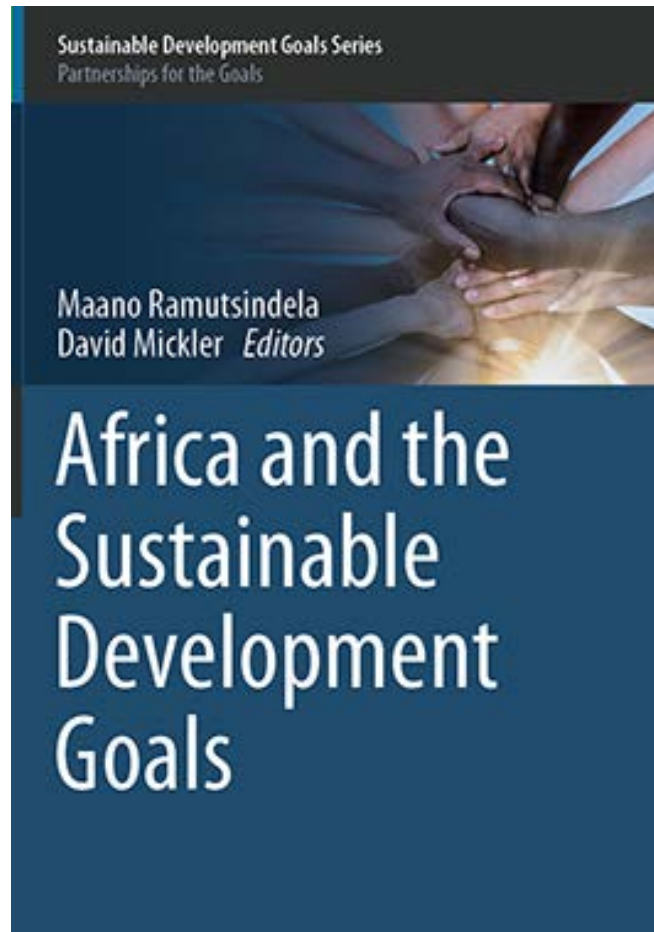
What then is the value of an undergraduate Science degree? We will still need to teach the periodic table for example, but the question we need to ask is:

**How are power and being operational in our sphere?
Education is not about an individual passing an exam rather it is about induction into the community—thus we have an obligation to help those**

who feel that they don't fit in. This shift into a space where power and being play a role potentially provides a platform for a better sense of engagement. It leads to me as an academic questioning myself: What do I think I am doing? And where do I need to be more careful?

Dr Blackie highlighted how examples are socially infused and how we need to question whether examples from our own experience become hurdles to understanding. This requires recognition that my life experience as a lecturer is not necessarily normative, but is my experience/ voice. She invited the audience to think about the most obvious starting points for themselves and encouraged them to think about how this could mould/ shape their teaching and how decolonisation might work in their classrooms; while being aware that we are 'knower blind' in science education. Dr Blackie ended her talk with the deep question of 'What is the purpose of our degree?' and what is the broader purpose of the degree beyond sound conceptual understanding.

NEW BOOK IN THE FACULTY



Groundbreaking new book: **AFRICA AND THE SUSTAINABLE DEVELOPMENT GOALS**

According to **Professor Maano Ramutsindela**, Dean of Science and co-editor of *Africa and the Sustainable Development Goals*, the book brings together over 80 researchers from a variety of disciplines on five continents to demonstrate an approach to an equitable global partnership in the production of knowledge relevant for Sustainable Development Goals (SDGs) in Africa. *Africa and the Sustainable Development Goals* (Springer, 2020) Ramutsindela, who co-edited the book with Dr David Mickler of the University of Western Australia, explains that the book is unique both in the range of its research perspectives and because it does not take the Sustainable Development Goals (SDGs) as given, it instead critically traces their development and the conditions under which they are implemented in Africa.

“Africa has witnessed many development plans that were imposed from outside that hardly improved the conditions of ordinary people. The SDGs are an aspirational blueprint for development because while they do not want to leave anyone behind, they do not as yet usher in a strong people-centred approach to development. This book places the SDGs in the context of an unequal, global economy and Africa’s own developmental pathways as articulated

in the AU (African Union) Agenda 2063,” explains Ramutsindela.

The book mirrors the breadth and scope of the complexity of SDGs in Africa with several chapters that analyse aspects of mining and their implications for governance and human development in different parts of the continent, and chapters on health systems, work conditions, agriculture and media.

“The book recognises both the scope of the SDGs as well as the diversity of the African continent and its peoples and resists all-encompassing claims and solutions,” Mickler says.

“Instead, through its process of bottom-up research collaboration, it highlights how a diverse group of scholars interprets the intersection of certain SDGs and local conditions in particular parts of Africa, while also accounting for national and regional development frameworks and priorities.”

TRAVELS ACROSS THE GLOBE



ANTARCTIC ICE-SHELF PUZZLE

by Katherine Hutchinson

Ice shelves, massive floating bodies of ice, are well-known for their buffering effect on land-based ice sheets as they slow their flow towards the sea. This buffering effect plays an important role in moderating global sea level rise. The Antarctic Peninsula has been experiencing high levels of change during the last 30 years due to atmospheric and ocean warming. Larsen A Ice Shelf collapsed in 1995 and Larsen B broke up in 2002. The demise of its neighbours has raised questions regarding the future stability of Larsen C, Antarctica's 4th largest ice shelf. The enhanced melting of ice shelves is concerning as this leads to the thinning and acceleration of their tributary glaciers which means more fresh water is injected into the surrounding ocean. The consequence of this is a rise in sea level and a change in ocean properties. Both having potentially disastrous repercussions on human populations and natural systems.

During the last 30 years Larsen C has exhibited considerable variability in ice thickness and extent. Yet the role of the ocean in driving these changes remains unclear. To understand what processes were underway I embarked on the [Weddell Sea Expedition](#) to

one of the most remote areas of our planet, the Antarctic Weddell Sea. My team and I focused our oceanographic measurements in the area of exposed ocean lying between Larsen C and the recently calved massive iceberg A-68. We wanted to measure the properties of the ocean adjacent to Larsen C Ice Shelf to find out what processes are at play. The aim was to improve our understanding of how the ocean could impact the stability of the ice shelf. This region is crucial in setting the properties of Antarctic Bottom Water.

Antarctic Bottom Water constitutes the deep limb of the global ocean conveyor belt which controls global climate. We were able to identify that a foreign water mass was flushing onto the continental shelf adjacent to Larsen C, bringing heat to the area. Our data revealed a high level of mixing between this warm water and the local very cold waters. This could have implications for the melting of the ice shelf and a change in properties the parent waters of Antarctic Bottom Water.

Breaking new ground

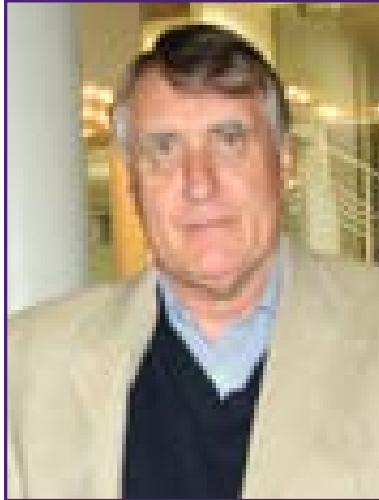
The measurements we took in the Weddell Sea adjacent to Larsen C Ice Shelf represent the highest spatial

resolution sampling in this area to date. They provided us with a clear view of the underwater conditions in an area where we have very little data. The mighty SA *Agulhas II*, a powerful ice-class ship, enabled us to gather high resolution data during the the Weddell Sea Expedition. The results revealed that the heat brought into the area is redistributed via effective mixing with local shelf waters. This showed that there is potential for transformation of the source waters of Antarctic Bottom Water. We also identified the possibility for a flow of the continental shelf waters into the ice shelf cavity underneath Larsen C, raising questions about future ice shelf melting and thinning.

Where to from here?

The measurements we took in the Weddell Sea are extraordinarily valuable and provide great insight into a remote and data-sparse part of our ocean. But scientists need to go beyond observations. We need to make use of innovative tools such as numerical climate models to further understand ocean-ice shelf interactions and the feedback effects on the global ocean.

IN MEMORIAM



We are deeply saddened by the death of **Emeritus Professor Ken MacGregor**, who passed away from COVID-19 on 17 June 2020. Ken joined the University of Cape Town (UCT) in 1974 and was head of the Department of Computer Science for more than 30 of his 38 years of service to our university. He built up the department from its inception to the world-class department it is today.

Passionate and committed to computing, to his staff and to his students, he was one of UCT's best-known professors, whose sense of humour, larger than life personality and Scottish accent were as legendary as his sense of fairness and his integrity. His knowledge of UCT and its people,

his strategic thinking and innovative nature were at the heart of the department's success over the years. Under his guidance the department grew in size and stature – its degrees became internationally accredited; an industrial advisory board was established; and his students left their mark on research and industry, both locally and abroad.

His contribution to the South African computer science academic community was recognised by the South African Institute of Computer Scientists and Information Technologists (SAICSIT) with a special Pioneer Award in 2011. Ken was one of the founding members of SAICSIT and also a long-time member of the International Federation of Information Processing's WG2.4 on Systems Implementation Technology, where his refreshing presentations and discussions were re-membered by all. Ken published numerous conference and journal papers, predominantly in the field of distributed computing. His computer science interests and expertise extended well beyond this, and his considerable contribution to postgraduate supervision spans an impressive range of subjects and students, such as Mark Shuttleworth and many other noteworthy achievers. Ken was instrumental in forging successful careers for hundreds of students, and he remained in touch with many long after their graduation.

Ken was innovative not only as an educator and researcher; he was also a pioneer in the computer industry and always keen to work with emerging IT companies. After retirement he continued to run his own computer company and collaborate in local and international research. A prominent figure in the Cape Town Computer Society, he was known for many years as Mr Unix and as an evangelical supporter of free and open-source software. Thanks to his outgoing, friendly, highly entertaining and often irreverent sense of fun, he was extremely well known not only within but also far beyond university circles.

Ken was a keen golfer in his later years and a keen soccer player in his earlier days – he earned his colours playing football for UCT. He loved the outdoors and travel. He continued to pursue these interests after retiring from UCT and had recently returned from trips to St Petersburg, the Galapagos Islands and Paris. Ken was a loving and devoted father and grandfather to his daughter, Linda, and her children, and a loving and devoted partner to Joan Rapp, Emeritus Director of UCT Libraries. A kind, supportive and vibrant man, father, partner, colleague and professor, he leaves a huge gap in the lives of so many whose careers and friendships he blessed, and he will be sorely missed.



The Department of Mathematics and Applied Mathematics at UCT has been greatly saddened by the death of **Professor Hans-Peter Künzi** while on sabbatical in Switzerland. Although we knew he was ill, this has come as a shock to us all. Hans-Peter was the leader of the Topology Research Group here at UCT, but his support also extended to cooperation with colleagues working in Category Theory, Algebra and Analysis.

Hans-Peter first came to UCT in the 1980's as a postdoctoral student with Guillaume Brümmer. He returned to UCT and to the Department when, after appointments in various capacities in Europe and the USA, he was appointed as Full Professor in the year 2000. In 2011 he became a UCT Fellow.

He was highly respected internationally for his research, as evidenced by his NRF A-rating, and he was a leader in his primary area of research, aspects of asymmetric topology. In July 2004 he was the main organizer of the 19th Summer Conference on Topology and its Applications, one of the large annual conferences in his field, which was held at the University of Cape Town. He has a large number of publications – over 200 – and many co-authors. He also published in the areas of order and in combinatorics. He was on a number of Editorial Boards, including Quaestiones Mathematicae, the Journal of the South African Mathematical Society, and had a large number of research students.

Hans-Peter's willingness to take on the position of HoD for the period August 2012 – December 2016 was a clear indication of his commitment to the well-being of us all in the Department.

We will all miss him. He was very supportive of our individual efforts and initiatives, even when they were not necessarily in his direct line of research.

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We value regular contact with our alumni, so please email us on **katherine.wilson@uct.ac.za**. We would like to hear about what you are doing with your Science degree in order for us to inspire a young generation of potential scientists and build career profiles of opportunities for Science graduates.

We would also like to cover interesting initiatives you are involved in, in future *Contact* newsletters.

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