LEGENDS OF SOUTH AFRICAN SCIENCE II

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Academy of Science of South Africa (ASSAf)
PO Box 72135, Lynnwood Ridge, Pretoria, South Africa, 0040
Tel: +27 12 349 6600 • Fax: +27 86 576 9520
E-mail: admin@assaf.org.za

The Academy of Science of South Africa (ASSAf) was inaugurated in May 1996. It was formed in response to the need for an Academy of Science consonant with the dawn of democracy in South Africa: activist in its mission of using science and scholarship for the benefit of society, with a mandate encompassing all scholarly disciplines that use an open-minded and evidence-based approach to build knowledge. ASSAf thus adopted in its name the term 'science' in the singular as reflecting a common way of enquiring rather than an aggregation of different disciplines. Its Members are elected, based on a combination of two principal criteria: academic excellence and significant contributions to society.

The Parliament of South Africa passed the Academy of Science of South Africa Act (No 67 of 2001), which came into force on 15 May 2002. This made ASSAf the only academy of science in South Africa officially recognised by government and representing the country in the international community of science academies and elsewhere.

CONTENTS

ACRONYMS AND ABBREVIATIONS

ADA	African Doctoral Academy
AIMS	African Institute for Mathematical Sciences
ANC	African National Congress
ANU	Australian National University
ARC	Agricultural Research Council
BEE	Black Economic Empowerment
CDC	Centre for Disease Control
CEO	Chief Executive Officer
CHAMPSA	Collaborative HIV and Adolescent Mental Health Project
CHE	Council on Higher Education
COBALT	Comorbid Affective Disorders, AIDS/HIV, and Long-Term Health
CSIR	Council for Scientific and Industrial Research
CRAC	Centre for Computational Relativity, Astrophysics and Cosmology
CREST	Centre for Research on Evaluation, Science and Technology
DBE	Department of Basic Education
DHE	Department of Higher Education and Training
DG	Director-General
DH	Digital humanities
DRC	Dutch Reformed Church
DST	Department of Science and Technology
E&M	Evaluation and monitoring
EIA	Environmental impact assessment
FABI	Forestry and Agricultural Biotechnology Institute
FET	Further education and training
GM	Genetically modified
GSH	Groote Schuur Hospital
HESA	Higher Education South Africa
HIV	Human immunodeficiency virus
HLT	Human language technologies
HOD	Head of Department
HSRC	Human Sciences Research Council
ICPP	International Congress on Plasma Physics
ISC	International Science Council
ICTR	International Criminal Tribunal for Rwanda
ICTY	Criminal Tribunal for Yugoslavia
ICU	Intensive care unit
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organisation for Standardisation
IUPAP	International Union of Pure and Applied Physics
IHESP	International Higher Education & Strategic Projects
IPCC	Inter-governmental Panel on Climate Change
LIGO	Laser Interferometer Gravitational-Wave Observatory
Mattek	Materials Science and Technology
MCC	Medicines Control Council
M&E	Monitoring and evaluation
MHaPP	Mental Health and Poverty Project
MHiNT	Mental Health Integration Project
MISTRA	Mapungubwe Institute for Strategic Reflection
MIT	Massachusetts Institute of Technology
MRC	Medical Research Council
NACI	National Advisory Council on Innovation
NASA	National Aeronautics and Space Administration
NASSP	National Astrophysics and Space Science Programme
NICRO	National Institute for Crime Prevention and the Rehabilitation of Offenders
NIMR	National Institute for Materials Research
NMU	Nelson Mandela University
NPRL	National Physical Research Laboratory
NRF	National Research Foundation
NSFAS	National Student Financial Aid Scheme
NSTF	National Science and Technology Forum
NWU	North-West University
OAD	Office of Astronomy for Development
OWSD	Organisation for Women in Science for the Developing World
PEP	Post-exposure prophylaxis
PRIME	Programme for Improving Mental Health Care
RAU	Randse Afrikaanse Universiteit
RNA	Ribonucleic acid
RU	Rhodes University
SAAO	South African Astronomical Observatory
SAAVI	South African AIDS Vaccine Initiative
SABS	South African Bureau of Standards
SADiLaR	South African Digital Language Resource Centre
SAIL	South African Institute of Physics Council
SAIP	South African Institute of Physics
SALT	Southern African Large Telescope
SANLI	South African National Literacy Initiative

ACRONYMS AND ABBREVIATIONS

SAWISE	South African Women in Science and Engineering
SKA	Square Kilometre Array
S-MhINT	Southern African Research Consortium for Mental Health Integration
SuperDARN	Super Dual Auroral Radar Network
STIAS	Stellenbosch Institute of Advanced Study
SU	Stellenbosch University
TB	Tuberculosis
THELMA	Times Higher Education Leadership and Management Award
TIA	Technology Innovation Agency
TRC	Truth and Reconciliation Commission
TYIP	Ten-Year Innovation Plan
UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UK	United Kingdom
UKZN	University of KwaZulu-Natal
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organisation
Unisa	University of South Africa
UP	University of Pretoria
UPE	University of Port Elizabeth
USA	United States of America
USAf	Universities South Africa
UWC	University of the Western Cape
WHO	World Health Organization
Wits	University of the Witwatersrand

FOREWORD

After the overwhelming success of *Legends of South African Science*, published in 2017 as part of the 20 year celebrations of the Academy of Science of South Africa (ASSAf), this edition of *Legends of South African Science II* continues with profiling Members who were elected between 1993 – 2000.

The 62 Members profiled in this edition represent some of the longest standing ASSAf Members. One of the strengths of a national Academy is the disciplinary diversity of its Membership. Collectively, the narratives of the Members profiled in this edition represent the apex of academic excellence and scholarship in fields such as physics, chemistry, medicine, education, law, agriculture, economics, education, environmental sciences, geology, ethics, engineering, architecture, political science, entomology, microbiology, statistics, molecular biology, infectious diseases, linguistics, marine science, psychology, zoology and botany. All these Members have used their formal academic training in their specific fields and demonstrated how, through engagement with scholars in other fields, both locally and internationally, contributed to them becoming champions and leaders in advancing knowledge. As Calie Pistorius reminds us, "Universities play an important role in society – in advancing knowledge, but particularly in inspiring and equipping their students to contribute proactively towards creating a better future, rather than merely participating as spectators in a world given to them by others."

In citing Plato, "Knowledge is justified true opinion", Johann Mouton shares with us that his academic journey has been shaped by the "principles of reasoning and the methodologies we use," and that "scientific endeavour is all about the search for truth, even if we don't reach it." Every narrative in this edition provides a unique perspective on contributions by accomplished South African scientists and scholars who, using an evidence-based approach have contributed significantly in growing the global knowledge production in their respective fields. Many of these scholars have held senior positions at academic institutions, been part of national and international committees, served at Governmental positions, and worked unstintingly in shaping the agendas of the post-apartheid South Africa.

Their stories are fascinating, their contributions to science invaluable, and their service to society diverse and inspiring. It is also touching and inspiring to see how many scientists during this era were supported, inspired and uplifted by the late President Nelson Mandela. They were all committed to building a democratic South Africa, even in the face of many adversities. Mamphele Ramphele acknowledges that while "ASSAf has gone a long way towards closing the gap between science, society and government, she stresses "that social and other scientists have to build more effective connections between their work and society." ASSAf strives in upholding its mandate of using evidence-based science in the service of society.
We are grateful to all the Members profiled in this edition who agreed to share their journeys with us. Sadly, three Members featured in this edition have passed away since starting this publication. They are Professor Anthony (Dave) Walker (2018), Professor Michael Feast (2019), and Dr Neville Comins (2020). ASSAf extends condolences to the families and friends of these Members.

It is hoped that the legacy of these inspirational champions featured in *Legends of South African Science II* will continue to inspire us all, and to grow the next generation of leaders in making science relevant to society.

MIRIAM ADHIKARI

AWARDS, HONOURS AND ACHIEVEMENTS

- Fellowship *Ad Eundem* of the Colleges of Medicine of South Africa (2015)
- Member of the Executive Council's Annual Service Excellence Award – Special recognition for overall contribution to health care in the field of Paediatrics (2014)
- Durban South Doctors' Guild Lifetime Award – In recognition of dedication and contributions towards Paediatric Medicine and Child Health Care (2014)

DEFINING MOMENT

As a trained neonatologist and paediatrician, she dealt with many sick newborns but one moment stood out for her: "One thing in neonatal care that broke my heart was when we diagnosed human immunodeficiency virus (HIV) and Tuberculosis (TB) in newborns in 1996. Those were the most difficult conditions to accept in the newborn."

WHAT PEOPLE MIGHT NOT KNOW

Although it was not expected of her, she took it upon herself to pass on to those around her any new skills she acquired – a practice she has followed in training nurses for 45 years.

ADVERSITY INSPIRED CHANGE

"Even with the many traumas we experience in our country, I remain positive and I still believe that we can go forward. I don't think we see all the goodwill that is out there," says Miriam Adhikari, who spent much of her life in neonatal wards, working with and leading the men and women who care for newborns. Her research has focused on gaining a better understanding of the clinical situations experienced in neonatal care, especially kidney disease in neonates and young children.

ESTABLISHING NEW REGIMENS

Adhikari opened a neonatal intensive care unit at King Edward Hospital in 1979 after her training in the United Kingdom and she trained nurses to use the services. "The babies came to the unit in very poor clinical condition, so I started training the nurses and this was something I continued for many years." Some of the nurses she trained now work in national health – a source of pride for Adhikari and testimony to her dedication to her work.

She later set up a dialysis unit and helped to establish paediatric transplantation in the neonatal unit at King Edward. "It was the most amazing thing to see a child after transplantation get better and go home." She recalls that at the time she was working with great teachers such as Professors YK Seedat and Hoosen Coovadia, and their supportive involvement helped her to make a success of the programmes she introduced.

Adhikari established many similar units in hospitals all around the country, working closely with the mothers to help them understand their babies' problems and accept them.

She seems to have a way with people, and they in turn find it easy to help her and to show kindness in helping others. Setting up the dialysis facility, which was crucial for treating kidney disease in children, helped her see the goodness in her fellow human beings.

EXPERIENCING DISCRIMINATION

During her training as a doctor, in her early days, she was placed in a 'coloured ward', and she describes this time as like being forced to work in a straitjacket. "Hospitals like Groote Schuur had segregated wards, so as a student of colour I could not go to the white wards," she says.

Her family had very little, but that did not diminish her ambition to study medicine at the University of Cape Town (UCT) at a time when students of colour had few prospects of attending such institutions. At one point she was told that she could not be trained at UCT because the places allocated for people of colour were full. As a person of colour and a woman, these interactions fuelled her determination and encouraged her to try to change things at grassroots level in every position she held over the years.

And so she became an activist, highlighting injustices and the need for things to change. "My school principal used to say, 'Be quiet, you are talking too

much, you might be sent to prison', and I thought to myself 'If I go to prison, I will not be able to become a doctor. So I decided to quieten down and to work within the system and do whatever I had to do," she says.

As an Indian female, she was subjected to all sorts of difficulties, and at one point she was rejected several times for a promotion despite being more than qualified and fully meeting the criteria. "That made me angry, but it also made me determined to do what was necessary for the children in my care."

After receiving the fellowship at the College of Medicine South Africa she was relieved to be able to work in a non-segregated environment.

CURRENT AND RECENT WORK

Since officially retiring in 2010 from her position of Head of Department of Paediatrics at the University of KwaZulu-Natal (UKZN), Adhikari has published on various topics, including HIV-infected infants, setting up breastmilk banks in resource-limited environments, and best practices in dealing with fever in children. She has continued to use her teaching skills to train undergraduate and postgraduate medical students in general paediatrics, as well as train sub-specialists, including other doctors, in neonatal and paediatric nephrology.

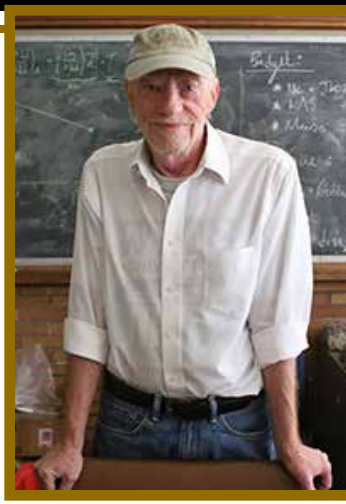
"When I learn something new myself, I always want to share the new knowledge with others." She has trained advanced midwives in post-exposure prophylaxis (PEP) and neonatal Intensive Care Units in both public and private hospitals. She was also involved in establishing the Neonatal Outreach Programme that was accepted by the Department of Health as a training programme at the King Edward Hospital. The programme is still running.

She is currently a scientific advisor for the Postgraduate Office of the School of Clinical Medicine at University of KwaZulu Natal (UKZN) where she works with both undergraduate and postgraduate students. She is still hopeful that the lives of children born in South African hospitals will continue to improve as more professionals are trained and mothers are educated in improved neonatal facilities around the country.

Giving so much of herself to others and pushing forward in an often challenging career has not always been easy and she is thankful for the support she received from many different people.

"I would not have succeeded in my career had it not been for my husband," says a very appreciative Adhikari. "Having two small children and responding to night calls was quite a challenge, but because my husband is very supportive, we could do it together." She is also grateful to all the senior staff, heads of department and consultants who worked with her and encouraged her throughout her career.

| LEWIS ASHWAL |



AWARDS, HONOURS AND ACHIEVEMENTS

- A2-rated scientist, South African National Research Foundation (NRF) (2011 to the present; A-rating reinstated for 2017 – 2023)
- Presidential Award, Geological Society of South Africa (2008)
- Jubilee Medal Geological Society of South Africa for best paper of the year (2005)

DEFINING MOMENT

In 1981, he and a colleague worked on a paper in which they wrote that certain types of meteorite from outer space came from Mars. They were the first to make this discovery.

WHAT PEOPLE MIGHT NOT KNOW

His father owned a chocolate factory in New York City called Ashwal's Chocolates.

ALWAYS THE GEOLOGIST, NEVER THE TOURIST

Lewis Ashwal has been to so many places all over the world that it would be easier to name the places he has not been to. As a world-renowned geologist he has done fieldwork in North America, Europe, Africa and India, and on many of the islands in the Indian Ocean.

"Doing the kind of work that I do as a geologist, I get to weird and interesting places and not only do scientific work there, but also experience what life is like in those strange places," he says. And one of these strange places is the island of Madagascar, which he has visited more than 30 times in his career.

"It is a big place, about half the size of South Africa. It is very different from Africa, from the culture and language to the food and the scenery," he says. He has studied the geology of almost the whole island and describes it as wonderful and unique.

Ashwal was born in the Bronx, New York, in the United States. As a young man he happened to hear that geologists do fieldwork out in the countryside and in weird and exciting places – an attractive idea for a city-born boy who preferred not to be city-bound.

Today, after nearly thirty years in the country, he spends most of his time at the University of the Witwatersrand (Wits), but the Bronx accent is still there.

"In the late 1980s, my job was coming to an end and I was looking for a new job," he says, explaining how he came to South Africa in the first place. At the time, he was a staff scientist at the National Aeronautics and Space Administration's (NASA) Lunar and Planetary Institute in Houston, Texas. He got a call from what is now the University of Johannesburg (UJ), offering him a job at the Department of Geology.

"It completely surprised me," he remembers. A week passed, and the university called again, offering to double the salary they mentioned in the previous phone call. "They said, we heard that you have a girlfriend and we will get her a job too."

"Now, that is a phone call you don't get every day!"

He decided to take it on as an adventure, planning to stay in South Africa for only a few years. But over the following three decades he became a professor in the School of Geosciences at Wits, and the director of the African Lithosphere Research Unit.

"And now my family is here, both of my children, and I am a grandpa and I don't want to go anywhere else – I like it here," he announces.

FROM MARS?

Apart from building a life here, he has made major scientific contributions in Africa and beyond. In 1981, he worked with a colleague to write a paper, "SNC meteorites: Igneous rocks from Mars?" claiming that there are certain types of outer space meteorite that came from Mars. "This was an outlandish idea! It was thought at the time that meteorites did not come from planets, they only came from asteroids. Nobody believed us."

Their claim was proven correct within six months. "So now, there are maybe a hundred pieces of meteorite that are identified as pieces of Mars and we were the first to propose that possibility."

In 1993, he penned the book *Anorthosites,* in which he described a type of rock that is found on the earth, on the moon and on other planets and he has since become one of the world's foremost experts on these rocks.

He edited another book in 1997, *Greenstone Belts*, which is a definitive work explaining how geology reveals the secrets of the early stages of the earth's development.

"Very recently I wrote a paper about identifying a new piece of continent under the island of Mauritius," referring to a discovery he made with his colleagues that made headlines all around the world. "We wrote that there must be a piece of ancient continental crust under the small island in the middle of the Indian Ocean, which was surprising since there is a piece of continent in a place where it should not be".

"Oh boy! When that paper came out in January of 2017, it went viral," he jokes, referring to the huge popularity the story garnered on social media at the time. "I think I did about 40 live interviews on TV and radio, and for about a month, I was doing nothing else but interviews."

There were articles written about the discovery in the *New York Times*, *Time* magazine and many other international publications. "There was even an article about it in the *Cosmopolitan* magazine – now that's something you don't expect!" He found the coverage of his work rewarding and says talking to the media and explaining science in an easy-to-understand way is an important part of being a public scientist.

Lewis Ashwal's impact on the field of geology was recognised by the National Research Foundation with an A2-rating which acknowledges him as a leading international researcher.

| SALEEM BADAT |

AWARDS, HONOURS AND ACHIEVEMENTS

- Three honorary doctorates – from the University of the Free State (UFS) for outstanding achievement in the shaping of policies and practices of the higher education environment (2004), from his *alma mater* York University (2008), and from Rhodes University (2015) for his outstanding contribution to higher education in South Africa over 25 years
- The Inyathelo Exceptional Philanthropy Award in recognition of Excellence and Leadership in Personal South African Philanthropy (2008)
- Hubert Humphrey Fellowship at Boston University (1995 – 1996)

DEFINING MOMENT

In December 1980, when his Economic History Honours supervisor Daniel North-Coombes implored him to choose the University of Cape Town (UCT) to pursue his Masters. North-Coombes believed Badat's scholarly and intellectual interests would be better nurtured there than in KwaZulu-Natal. The move to Cape Town in 1981 was a defining moment in his life and for his career.

WHAT PEOPLE MIGHT NOT KNOW

He was a provincial junior tennis champion, representing KwaZulu-Natal. He also has a soccer coaching certificate from the English Football Association.

COMMITMENT TO KNOWLEDGE AND ACTION

If the 1976 Soweto uprising first sparked Saleem Badat's political consciousness, the long periods of detention, solitary confinement and brutal torture at the hands of the apartheid security police in the 1980s entrenched a life-long commitment to social justice and transformation in and through education. He has spent his personal and academic life seeking to understand how social structures, policies and actions sustain inequalities and injustices, in universities specifically, but also in society as a whole.

"My principal concerns have been thinking about, designing and implementing strategies, policies and mechanisms to advance social justice in and through universities," says Badat, who has been hailed for his outstanding contribution to higher education in South Africa over nearly three decades.

In June 2006, he became the first black Vice-Chancellor in Rhodes University's (RU) 102-year history, and today he heads up the Andrew W Mellon Foundation's International Higher Education and Strategic Projects (IHESP). The move to New York wasn't on his agenda, he says, but like all his other commitments which have taken him around South Africa and the United States, he followed where his career led him. "The wonderful thing about my life has been having people around me who encouraged me to take on new posts and responsibilities; almost like guardian angels guiding me in the direction of what was meant to come next for me. Their nudging got me to move out of my comfort zones, which is a very important thing for growth and development," he says.

POLITICAL AWAKENING

But first came Badat's political awakening thanks to the Soweto uprising, which developed into activism during his student days. He joined the Release Mandela Committee and was chairperson of the Student Wages Commission. He became more deeply involved in the anti-apartheid struggle in the 1980s when he faced the wrath of the security police, spending 42 days in solitary confinement in Pollsmoor Prison in 1985, followed by 83 days in a single cell, during which time he embarked on a five-day hunger strike. The following year a banning order saw Badat go into hiding, then leave the country.

"My activist history might have taken me on a different path, perhaps into politics, but my dream of becoming a scholar never died. Knowledge and action, theory and practice are in my blood. Like many other people in the liberation movement who had plans to become film directors or writers and the like, dreams had to be delayed and aspirations put on hold. But I never forgot my dream. I did not subscribe to the credo of liberation before education," Badat explains.

His move to Britain in 1986 – he earned his PhD at the University of York – is a period Badat refers to as "powerfully formative". It was here that he met one of his most important intellectual mentors, Professor Harold Wolpe, when he worked as a research assistant on the Research in Education in South Africa project at the University of Essex.

His return to South Africa, along with the ten "immensely happy, stimulating and productive" years that followed at the University of the Western Cape (UWC), were critical turning points. UWC was particularly important for his development as a scholar thanks to the space, opportunity and support the institution afforded him. Badat spent much of the early 1990s conducting policy research on higher education and science and technology for the mass democratic movement and was an integral part of the National Education Policy Investigation that informed democratic South Africa's national education policy.

COUNCIL OF HIGHER EDUCATION

He went on to become the Chief Executive Officer of the new Council on Higher Education (CHE) in 1999. He was the only staffer when it began, but when he left seven years later the council had a staff of 55 and was tasked with providing policy advice to the Minister of Education, undertaking quality assurance in higher education issues and helping to monitor policy. "I had always said that after the CHE was firmly established I'd return to a university," and he did, in 2006, when he became Vice-Chancellor of Rhodes University.

Transformation, along with a need for modernisation, was top of his agenda. His goal was to steer an institution shaped by colonialism, apartheid, racism and patriarchy to becoming equitable and inclusive internally, while also contributing to equity, development and democracy in South Africa. During his eight-year term at RU, Badat saw a rise in overall student numbers from 5 900 in 2006 to almost 7 500 in 2014, the number of black students increasing from just under 3 000 (about 51% of the total student enrolment) to more than 4 700, or 64% of total enrolment. The university also notched up a 70% increase in the number of postgraduate students by 2014, with 60% black students and 48% women. He also facilitated a threefold increase in the number of postdoctoral students, from 19 to 68, and increased the staff complement of black academics from 16% to 25%.

"I worked 80-hour weeks and it was very tough, but I'm proud to say that it was during that time that I published my book, *The Forgotten People* (2012), a history of those banished from South Africa during the apartheid era." He also managed to add to his extensive output of books, book chapters, articles, conference papers, keynote addresses and guest lectures.

Universities are still top of his agenda at the Mellon Foundation in New York, the move to which was a "major matter" as it entailed leaving not only a prominent university, but also his beloved South Africa. "But I stay close to South Africa and to its universities because my programme supports seven universities here, along with one each in Uganda, Ghana, Egypt and Lebanon, as well as three pan-African and pan-Arab higher education institutions. I'm still giving effect to my belief that universities can be vital institutions in the effort to build prosperous, just and democratic societies in which all citizens can lead rich, rewarding and productive lives."

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Doctor of Science from Durham University in recognition of his contribution to science and higher education (2015)
- Foundation for Research Development President's Award (1991)
- His matriculation results during the divided South Africa. Coming from a small-town school, he was surprised to find himself ranked first among Indian South Africans

DEFINING MOMENTS

A theoretical physicist at heart, Bawa enjoys having experimental physicists validate theoretical calculations. His interactions with his professors as a young physicist, and in turn seeing the progress of his own young students, have defined his career.

WHAT PEOPLE MIGHT NOT KNOW

He and his wife, Rookaya, have been together for 42 years and they have two daughters. Their two grandsons, now six and eight, have completely changed their lives.

SCIENCE DESIGNED AS A MIRROR TO SOCIETY

"I think of theoretical physics the same way other people think of poetry: it helps us understand who we are, our place in the universe, and how we relate to each other."

Having worked at universities for most of his life, Ahmed Bawa asserts that we can't have a well-functioning society unless it admits the importance of enterprises like theoretical science.

As a young student of mathematics and physics in the early 1980s, he wondered if it would be sacrilegious to ask: "Does theoretical physics speak to the South African reality?" A decade prior, he had matriculated with distinction at what was then the Greytown State Secondary School, a state school in KwaZulu-Natal that did not even offer physics as a subject. Bawa started his working life in sales until his political activism landed him in prison for some years during which time he was able to complete a BSc in physics and mathematics from the University of South Africa.

As he worked his way up to an MSc in theoretical physics and eventually a professorship at the then University of Durban-Westville (UDW), Bawa wondered if his field could contribute to national development or help address race and gender imbalances in society. "It is too easy for science systems to become locked into the institutions where the work is done, without facing realities and context. For example, it really bothers me that after 24 years of democracy, we still use apartheid race categories to describe ourselves – it is like a failure of the humanities and social sciences to challenge social constructs. I'm not suggesting nothing has happened or changed, but I think science has let us down."

In the field of physics, Bawa regrets that South Africa has not made sufficient progress with racial transformation. South Africa has had some success in training young graduates to contribute to industry and thus to national development, and during his tenure as Vice-Chancellor of the Durban University of Technology (DUT) from 2010 to 2016 he was particularly proud of the engineering graduates who went on to work at the massive Square Kilometre Array (SKA) astronomy project in the Northern Cape. "As a spin-off, that project is building capacity in areas like data science, which is also applicable to social issues," he adds.

"Look at how well we've done in renewable energy – it depends a lot on research in physics and on young people who are passionate about understanding how the South African environment lends itself to enterprise in renewable energies. But on the subject of nuclear energy there has been no decent national conversation. If you want a strong democracy you must increase the capacity of the public and scientists to engage, otherwise big decisions are left solely to politicians. For me, a new interest and fascinating challenge is how to bring young people into conversations on science and knowledge."

SCIENCE INTO THE CONVERSATION

He suggests one way to bring scientists into the conversation is for government to support the universities' use of their resources to solve large and small

development and reconstruction challenges, as was done during the apartheid nuclear programme. "Engagement should permeate through research and teaching, and South Africans of all communities should be able to see their realities, cultures and arts reflected in the work of universities."

Bawa mentions an example of researchers studying how fermentation evolved in food preparation in Durban communities: "They spoke to women of different ages about food preparation, then tested and published those methods. A group from China saw the publication and reached out to collaborate on the research. That knowledge, deeply embedded in a local community, now has global relevance and the women who participated in the study feel that their knowledge was taken seriously."

A number of local and international research, development and higher education organisations rely on Bawa for this kind of insight. As he puts it, he brings "knowledge of South Africa's knowledge systems" to several boards and to Universities South Africa, in his role as its current Chief Executive Officer.

"It's about how our knowledge systems work, how they are built and funded, and how they relate to national development and innovation. And it's about growing an understanding of how important research is in building a globally competitive and socially coherent society," he explains. Much of his experience in the sector came from his time as the Programme Officer for Higher Education and Scholarship for the Ford Foundation in the early 2000s. He was tasked with strategic grant-making to help develop universities in southern Africa and the continent.

"I had to learn that higher education systems across continents are very different and there is no solution that applies to all systems and countries. Universities are expensive and as social institutions we have to fund them properly. Even in South Africa, the level of funding could be improved, and we have to be concerned about that" he remarks.

He adds that academics should be paid adequately: "The best academics will go where they will be paid the best; otherwise they need to moonlight and that comes at a cost for research".

Regarding the more alluring opportunities abroad that has resulted in a 'brain drain', he says we have to encourage students to return, and if they do not, we should at least encourage them to remain connected to the South African knowledge project. The solution has to be deliberately designed, by building world-class research programmes that will attract students from all over the world.

He mentions the astrophysics group at the University of KwaZulu-Natal (UKZN) and the particle physics group at University of Cape Town (UCT) as success stories: "No-one leaves those groups because they are doing so much good work; they attract other nationalities and retain South Africans."

Recalling his own experiences as a theoretical physics researcher and lecturer in KwaZulu-Natal and abroad, he adds that the most wonderful thing, still, is doing a range of calculations and seeing experimental physicists test and validate them. "That is particularly gratifying."

He appreciated the influence of his physics professors during the early stages of his career and enjoyed the opportunity to influence MSc and PhD students during his tenure at City University of New York.

Since his return to South Africa in 2010, Bawa contends that the biggest challenge local universities face is alienation. He explains that during the #FeesMustFall campaign, for instance, no-one came to the defence of universities except themselves.

"Why did communities not say, 'We have to protect our universities'? We have to think hard about how universities can engage with society so that there is a kind of ownership of these important social institutions by communities at large.

"For this, citizens have to see themselves and their communities represented in those institutions, particularly in their knowledge production and dissemination projects. The same applies to industry, government and other constituencies. This is not to suggest that universities should lose their right to perform teaching and research in an unfettered fashion; only that they should also be firmly located in the contexts in which they find themselves," he states.

In the same way that poets' works speak to and reflect the communities they find themselves in, Bawa hopes his work with universities will continue to cultivate a culture of science that serves society.

| SOLOMON BENATAR |

AWARDS, HONOURS AND ACHIEVEMENTS

- Global Forum for Bioethics Research Award (2015)
- Henry Knowles Beecher Award, Hastings Centre, New York (2011)
- Elected Honorary Foreign Member of the American Academy of Arts and Sciences (1996)

DEFINING MOMENT

When he was inspired to grow beyond caring for individual patients to include an interest in bioethics and in improving population and planetary health in South Africa and the rest of the world.

WHAT PEOPLE MIGHT NOT KNOW

He enjoys encouraging critical thinking in his students, especially the learning associated with the unlearning of old prejudices and ideas.

SERENDIPITY SHAPING A CAREER

"Serendipity" is the answer you get when asking the humble Solomon Benatar how he has achieved his colourful career and impressive set of accolades. Serendipity re-shaped his life on multiple occasions throughout his career, from choosing to become a doctor through several shifts in career and interests.

Unlike getting married, he says that he was never really fully satisfied with many of his life and career changes, as he was frequently challenged by new horizons of intellectual interest. After starting out as a general practitioner in Port Elizabeth, he trained in anaesthesia at Groote Schuur Hospital and University of Cape Town (UCT) and received his fellowship from the Colleges of Medicine of South Africa.

As an anaesthetist he felt unfulfilled in not having any responsibility for patients after they left the operating theatre, so he went on to specialise in internal medicine and lung diseases. As luck would have it, he received a scholarship to pursue research in London, where he studied the mechanisms of gas exchange in critically ill patients and airflow in the lungs of asthmatics.

His humility has been challenged by the many awards peppered throughout his career, including the Henry Knowles Beecher Award for his lifetime contributions to ethics and the life sciences, as well as a career devoted to excellence in scholarship, research, and ethical inquiry. His work transcending clinical medicine, including opposition to apartheid in healthcare in South Africa and his concern for human rights issues in South Africa did not go unnoticed and he was elected to honorary foreign memberships of the American Academy of Arts and Sciences, and the US National Academy of Sciences' Institute of Medicine (now the US National Academy of Medicine).

After working in London for two years, he was offered long-term opportunities at the Brompton Hospital but he chose to return to South Africa in 1974, where he was appointed as a respiratory and critical care physician. The lack of access to sophisticated physiological research facilities in South Africa at the time nudged his research interest towards the public health aspects of lung diseases and how social factors affected health in South Africa.

Throughout his life, his colleagues have seen great potential in him, perhaps more than he saw in himself. He was caught by surprise when he was encouraged to apply for and was appointed to succeed his mentor, Professor Stuart Saunders, as Professor of Medicine at UCT in 1980. He found himself rebuilding the department by enabling younger colleagues to fill the gaps that had been left by the exodus of many highly accomplished physicians following the 1976 Soweto riots.

LEARNING TO UNLEARN

"I enjoy unlearning myself, getting rid of old prejudices and old ideas, developing new perspectives and stimulating young people to unlearn and relearn. This requires open minds, rigorous thinking and a critical outlook that avoid dogma."

His desire to tackle dogma led him to question the structure and funding of health care systems in South Africa, and to more deeply understand the impact of apartheid on health and health care.

"How could it be that there was such disparity in health in the country?" To find out, he studied the economic, political and health services contexts within which health care is embedded, as well as anthropological and sociological perspectives on medicine. His goal was to widen his knowledge beyond those

aspects of human health and disease that he had been trained to consider as a physician.

He also became aware of a burgeoning global literature on bioethics that was not exciting much interest in South Africa. He formed a multidisciplinary academic group and created a Bioethics Centre within the Department of Medicine at UCT. In 1994 and 1995 he was a Visiting Professor in Social Medicine at Harvard University, and a Fellow in Ethics and the Professions at the Kennedy School of Government where he studied with a small group of colleagues who worked in the fields of philosophy, law, business and medicine.

It seemed that those who saw potential in him were correct. In 1999, after 19 years as head of the Department of Medicine at UCT, he was confident that, together with close colleagues, he had successfully contributed what he valued dearly: training the next generation of clinicians to think critically and practice a high standard of clinical medicine. He left the department in good shape and in good hands when he resigned as head of the department some years before his retirement, while retaining his appointment as a full-time professor.

His experiences in bioethics have included annual invitations since 2000 to continue with his teaching, research and mentoring at the University of Toronto. This enabled him to secure significant grant funding for a ten-year period from the United States National Institutes of Health for a programme to build capacity in the International Research Ethics Network for Southern Africa (IRENSA).

Never one to settle down, even after mandatory retirement in 2007 as a professor at UCT, he continued on his evolving journey of interests in the political, ethical and other social forces shaping global and planetary health. His ongoing research and teaching at the University of Toronto broadened his horizons through collaborative projects and publications with anthropologists, sociologists, political economists and philosophers.

The serendipity that shaped his colourful career and life began at the age of 15 with his decision to study medicine, inspired by a general practitioner in his childhood village in what was then Southern Rhodesia. It is serendipitous, in turn, that through the world of medicine, the country of South Africa is home to this legend of medicine and critical thinking.

ARVINKUMAR BHANA

AWARDS, HONOURS AND ACHIEVEMENTS

- Becoming an Executive Director of the Human and Social Development Research Programme (2007)
- Joining the newly-formed Human Sciences Research Council as Director of Research in the Child, Youth, Family and Social Development Research Programme which brought together an elite team (2002)
- Head of Department of Psychology at the University of Durban-Westville (UDW) now the University of KwaZulu-Natal (UKZN) (1998)

DEFINING MOMENT

Being admitted into a PhD programme at one of the top universities in the United States in which he competed against 400 top-rated students from the United States.

WHAT PEOPLE MIGHT NOT KNOW

He is an avid hiker and he has come to appreciate the incredible beauty of the natural heritage in South Africa, as well as places like Kilimanjaro in Tanzania and Machu Picchu in Peru.

A CAREER DEDICATED TO MENTAL HEALTH

Arvinkumar Bhana's passion for community psychology was a natural progression of his political conscience, which first manifested while working as a clinical psychologist in Durban in the 1980s. "A political agenda infused much of my work at the time," he says of those years. "Part of my activism involved working with groups under threat of assault from security police and other state apparatus, trying to bolster their psychosocial and mental health and help them cope with what they were faced with every day." It was also at this time that he knew he needed more than just clinical training to be able to make a major impact on South African health systems.

It was only several years later, when he enrolled for a PhD in clinical community psychology at the University of Illinois at Urbana-Champaign, that his scientific training began in earnest. There, he learned the true value of science and research in promoting change. "My training at the University of Illinois strongly reinforced how to link mental health issues to people's lived experience, and how this knowledge could be used to strengthen and improve their lives. Everything I did thereafter was about asking, what is the evidence, and how well is that evidence established? How can we use this to make a difference?"

He got his first taste for the power of scientific thinking during his time as a knowledge-hungry undergraduate, studying psychology at the then UDW. Having had no access to a library where he grew up, he spent large amounts of time in the university library, reading anything he could get his hands on. "It was as if all this knowledge had been kept from me, and I needed to take it all in."

His oldest brother was one of the first in the family and in the community to attend a university, and along with the culture of literacy and a diverse range of books at home, this set him on a course of lifelong enquiry. "Studying psychology showed me how science can discover truth or determine merit and validity. The power of the scientific method was and still is fascinating to me."

Now an NRF B-rated scientist and Chief Research Specialist at the Health Systems Research Unit of the South African Medical Research Council and an Honorary Associate Professor at the Centre for Rural Health at UKZN, Bhana applies his passion for knowledge, scientific thinking and community health to expanding public health services to include the treatment of mental health for patients in primary care.

After completing his PhD, Bhana realised that knowledge about psychological health is quite poor in general, and what little we know comes from the developed world and may not be relevant to South Africa. For that reason, his early work looked to better understand the perceptions and stigmas around mental health in South Africa, where no information had existed before. This also gave him a better grasp of where he really wanted to focus his research efforts in future. He started working in the area of substance abuse as he saw the devastating impact it could have on impoverished communities.

ADOLESCENT MENTAL HEALTH

Another area that he chose to work in was adolescent mental health. One of his major research projects was the Collaborative human immunodeficiency virus (HIV) and Adolescent Mental Health Project (CHAMPSA), which aimed to

improve resilience among adolescents and their caregivers in poor households and impoverished families, particularly those with adolescents facing health challenges associated with the growing HIV/Acquired Immunodeficiency Syndrome (AIDS) epidemic.

This theme of strengthening and empowering families to protect children's mental and physical health continues in his research today. However, the work has evolved over time: the projects have grown larger and now aim for population-scale interventions rather than working at the family or community level.

He has participated in several large collaborative projects with other African countries that have continued to build local knowledge around public mental health. In fact, he says that collaborations began to strengthen his own work by providing new perspectives and solutions as soon as he completed his PhD. "At that time, PhD researchers in this field were few and far between in South Africa – I suddenly become part of an exclusive club of like-minded researchers. We started to share interests and form partnerships and collaborations." Now, some of his most important work has come out of those collaborations – projects like CHAMPSA, CHAMP+SA and the VUKA Family Programme to supporting perinatally HIV-infected youth in South Africa.

In recent years, his collaborations have changed from bilateral collaborations to multinational and he works with research programmes like the Mental Health and Poverty Project (MHaPP), Programme for Improving Mental Health Care (PRIME), the Comorbidity of AIDS/HIV Affective Disorders and Long-Term Health (COBALT) trial, Mental Health Integration Project (MHiNT), the African Regional Partnerships for Scaling up Child Mental Health Implementation Research (SMART-Africa), and the newly-established Southern African Research Consortium for Mental Health Integration (S-MhINT). All these projects seek ways to support and empower those with mental health issues in the developing world and to provide evidence-based knowledge of mental health in the African context.

"The more we collaborate, the more we build towards true partnerships between us and the more developed countries. We are learning to innovate together in building the international science of public mental health," says Bhana.

He works closely with national and provincial departments of health, and the projects he works on have contributed to public mental health policy. "There is a critical need for mental health to be part of an everyday public health service experience, not a specialised service and only for those who can afford it. That's our mission."

On top of multiple international collaborations and an active research career that has produced more than a hundred journal articles, Bhana has served as the editor for several international mental health journals, sat on the UNESCO Global Advisory Group on HIV and Sex Education, and has been Lead Investigator at the NRF's Department of Science and Technology Department of now Department of Science and Innovation Centre of Excellence in Human Development since 2015.

He says his motivation as a researcher comes from a desire to make a significant difference. "If you really want to be a great scientist, the first lesson to learn is humility, because there is so much you don't know and so much you can learn from others. You just have to keep learning and doing."

NIGEL BISHOP

AWARDS, HONOURS AND ACHIEVEMENTS

- South African Mathematical Society World Mathematical Year 2000 Gold Medal (2001)
- Chancellor's Prize for the best researcher in the Faculty of Science, University of South Africa (Unisa) (1999)
- Senior Scholarship, University of Cambridge (1972)

DEFINING MOMENT

In the 1980s he realised that research in gravitational waves would become very important in the future.

WHAT PEOPLE MIGHT NOT KNOW

His very first scientific article, during his PhD, was published in *Nature*.

HUNTING FOR GRAVITY WAVES

Everything in the universe exists within space-time fabric that can be stretched, pulled, bent and disturbed. Learning this sparked a young man's interest in how the universe works. Albert Einstein changed the field of physics with his theories of how gravity is an effect of space bending and rippling, and this thrilled Nigel Bishop from the very start.

As an undergraduate at Cambridge University, he was fortunate enough to be tutored by the most famous astrophysicist in the world, Professor Stephen Hawking. There he developed his passion for studying black holes (Hawking's speciality): exotic objects that bend space-time so much that they create gravity waves as they move through space and ripples that can be heard across the galaxy when they dance around each other and collide.

"I remember as a child being fascinated by astronomy and generally reading a lot of encyclopaedias. I was fortunate to attend Cambridge University, which stimulated my interest in that border area between mathematics and physics," he says. He would continue in his teaching career lecturing both mathematics and physics subjects at institutions in South Africa and the United Kingdom.

He completed a PhD in gravitation theory and cosmology at the Department of Mathematics at the University of Southampton in 1976 with a thesis titled *A trip through gravitation theory*, and was elected a Fellow of the Royal Astronomical Society.

Inspired by his love of mathematics and the teachings of Professor Hawking, Bishop's interest in the nature of these heavenly bodies that twist and knot the fabric of space and time burgeoned. He would dedicate his career to studying what happens at the boundaries of black holes, how they bend space-time, and how their movements ripple across the cosmos.

"From the mid-1980s, I came to realise that the study of gravitational waves research was going to be very important in the coming years," he says. His prediction was spot-on as the study and detection of gravitational waves has become increasingly important both in the public discourse and the scientific field as detectors have been built and research has been conducted to make sense of the new data streaming in from the cosmos.

The detection of gravitational waves has been in the news regularly for the past five years, but it took many years of work by researchers like Bishop, starting in the 1960s, to make such every-day detections possible. "At the time, we had no idea just how infrequent the events we were looking for could be," he says. "If an event causing gravity waves in space is close by, it would have been easy to detect it with the technology that existed in the 1960s. The probability of that was just very low back then."

"What has changed the field is doing calculations that are relevant to the results," he says. "The first successful gravitational wave experiment, the original Laser Interferometer Gravitational-Wave Observatory (LIGO) machine, came online in 2001." LIGO has gone on to detect gravitational waves from events such as the collisions of neutron stars.

"After I got my PhD in the late 1970s, there were no real opportunities to do what I wanted in my preferred field." Bishop then moved to South Africa to take up a position as Lecturer at the University of the Witwatersrand (Wits). While at Wits he was promoted to senior lecturer and later associate professor where he taught gravitational theory and cosmology among other subjects. His first appointment as full Professor of Mathematics was at Unisa, where he lectured

in second-level computer algebra and general relativity at the honours level, among others.

BEHAVIOUR OF BLACK HOLES

Throughout his career, he has focused on calculating the properties of the boundaries of black holes. This would allow him to measure or predict gravitational wave emissions from events involving black holes. His work that had the most impact saw him developing computer models of the behaviour of black holes, using methods that optimised computational efficiency.

Thanks to recent advances in computing technology, supercomputers can now render fully three-dimensional models of the Einstein equations. Along with recent instruments such as LIGO being installed around the globe, these advances have allowed Bishop to make sense of the data coming from deep space and to understand what it says about gravitational waves.

He was recognised for his work as Director of the Research Centre for Computational Relativity, Astrophysics and Cosmology (CRAC) while he was at Unisa. He was also President of the South African Mathematical Society from 2003 to 2007, as well as a founding Director of the South African Mathematics Foundation that he chaired in 2006, from 2009 to 2010, and from 2013 to 2014. He further held numerous appointments as Visiting Professor at the Universities of Cambridge and Southampton, the Max-Planck Institute for Gravitational Physics and the University of Pittsburgh.

The universe continues to hold many mysteries that Bishop still wonders and is passionate about. He is currently the Emeritus Professor at the Department of Mathematics and Applied Mathematics at Rhodes University.

GEORGE BRANCH

AWARDS, HONOURS AND ACHIEVEMENTS

- International Temperate Reefs Award for Lifetime Contributions to Marine Science (2006)
- Gilchrist Gold Medal for contributions to marine science (1994)
- University of Cape Town's (UCT) Distinguished Teacher's Award (1984)

DEFINING MOMENT

Publishing *Living Shores* in 1981 was pivotal for two reasons: first, getting our science out to the next generation of scientists and inspiring them, and second, it was the start of a conscious decision to make sure my science gets out to the public.

WHAT PEOPLE MIGHT NOT KNOW

He sang in the Cape Philharmonic Choir for many years.

IN SERVICE OF SOUTH AFRICA'S SHORELINES

George Branch first felt the excitement of discovery on a trip to Cape Town in his childhood. Having grown up in Zimbabwe, while exploring the coast he collected a number of creatures from rock pools and took them to what is now the Iziko Museum, to be identified.

"I showed them to Frank Talbot (who later went on to become a Director of the Smithsonian Institute), and I was clearly a pest to begin with. But he went through what I had brought him and then his eyes lit up," says Branch. "I had found something that had never been seen in South Africa before."

Branch returned to Cape Town as a university student to study botany but was quickly absorbed by his love of the sea. His early research was on limpets and the flat-shelled, seemingly staid molluscs proved pivotal to understanding the ecology of rocky shores. Their study was made all the more attractive by the fact that South Africa has the greatest biodiversity of limpets in the world.

"Limpets in South Africa do some crazy things," he explains. "It's a remarkable story for a group of creatures with no brain to speak of." One group cultivates and tends to gardens of seaweed instead of roaming around rocks feeding on what they find. They grow specific seaweeds and display behaviour like weeding, fertilising and territorially chasing other herbivores away. Juveniles even grow tiny gardens on the backs of adults until they are large enough to find their own spot.

Another group gives up feeding on the rocky habitat altogether, instead grabbing onto floating blades of kelp – a rich and abundant source of food. Up to 30 individuals can be found feeding cooperatively on a single blade, another unusual behaviour for these normally solitary and aggressive animals.

"Limpets are how I really established my reputation as a scientist. But more importantly, that research set me on the road of deep conceptual thinking about marine ecosystems. I came to the idea of using rocky shores to explore how and why things change around the coast."

As it turns out, South Africa is a fantastic place to do that sort of research, with two contrasting ocean environments on the south-east and the west coast, and plenty of variation in nutrients and habitats along the long coastline from Namibia to Mozambique.

URGENT QUEST TO UNDERSTAND

In the course of his career, marine ecosystems' research has gone from an interesting basic science to an urgent quest to understand our fragile global biosphere and the impact humans are having on it.

When Branch started out, no-one was talking about the effects of commercial fishing on ecosystems, or about ecosystem management, or about the interaction of marine ecosystems and fisheries' policy. But that all started to change, and with that change he was asked to step out of his comfort zone.

"I had begun to work at the interface between applied and basic science, using commercially important species like abalone to probe the ecological significance of commercial activities in the ocean," he explains. "Then after 1994, I was asked to chair the Access Rights Technical Committee to advise

those working on the new fisheries policy on the thorny issue of allocating resources."

His work with this and other policy bodies in post-apartheid South Africa has shaped the country's marine management policies and helped steer commercial fishing towards being a sustainable and profitable part of the economy. Branch finds policy work challenging, because the success rate is much lower than pure research, but he says it made him realise that he has a responsibility as a scientist to communicate his work to people in power, and make sure the scientific knowledge is applied effectively.

This sense of responsibility to society shows itself in other aspects of Branch's career, most notably in his book, *Living Shores*, which he first published in conjunction with his wife Margo in 1981. The book was originally her idea, but they then worked jointly to write and produce it. The book was a resounding success and became a non-fiction best-seller and remains a common sight on bookshelves around South Africa to this day.

"*Living Shores* was pivotal in two ways – it got our science out to the next generation of scientists. And it was the start of a conscious decision to make sure my science was available to the public." George and Margo Branch have recently released a second edition of *Living Shores* (2018), and so much has changed in the science of marine ecosystems that they effectively had to start again and rewrite the book. All those changes in how marine ecosystems are understood and managed had to be incorporated, and of course, the basic science has advanced as well.

Despite retiring several years ago, Branch still supervises postgraduates, and he is fondly remembered by thousands of undergraduate students who passed through his first-year evolutionary biology lectures over the years. He, in turn, loved to teach and cherishes his Distinguished Teacher's Award.

He has spent a great deal of time on outreach, particularly teaching the public about evolution. As a Christian and an evolutionary biologist, he is uniquely suited to reaching out to sceptical or anti-science audiences.

"An undergraduate student in one of my lectures taught me a hard lesson: if you don't respect other people and listen to their views, even if you don't believe them, you're going to be butting heads rather than persuading people to a different view." He is now a vocal proponent for tolerance, respect and open conversation around controversial ideas, and strongly believes in the importance of talking to all sectors of society about scientific concepts.

Many decades have passed since Branch first took his 'beasties' to the museum, but that sense of curiosity and excitement for the natural world lives on through his scientific contributions, his students and his legacy of teaching and outreach.

CHRIS BRINK

AWARDS, HONOURS AND ACHIEVEMENTS

- Created a Commander of the Order of the British Empire in the Queen's Birthday Honours (2018)
- Appointed Convenor of the Implementation Group for the 2020 Research Assessment Exercise in Hong Kong (2017)
- Freedom of the City of Newcastle upon Tyne (2016)

DEFINING MOMENT

When he overslept but his kindly professor nevertheless allowed him to write his first-ever postgraduate examination in philosophy.

WHAT PEOPLE MIGHT NOT KNOW

He was a fairly skilled knife-thrower as a youngster.

QUALITY NEEDS DIVERSITY

Chris Brink is clear about what an involved, civic-minded university should be: it is about academic excellence, but it is also about playing a definitive role in civil society. He has perfected these ideas while working on four continents and notably as Rector of Stellenbosch University (SU) and Vice-Chancellor of the The University of Newcastle in England.

He believes universities should ask two questions: "What are we good at? And what are we good for?" Most universities easily answer the first, but many have difficulty with the other equally important question about how to contribute to the city, region and society they find themselves in, explains Brink. He elaborates on these questions in his most recent book, *The Soul of a University: Why Excellence is Not Enough* (2018).

EARLY YEARS

Brink, who comes from a long line of builders, was born in Upington on 31 January 1951 and matriculated from Upington High School in 1968.

"I'm the black sheep for not having followed in my family's footsteps," jokes the man who rates thinking as his top pastime and hates stereotypes. He has however regularly applied a builder's sense of logic, problem-solving and practicality to challenges.

Without having seen a computer before, Brink went to the then Randse Afrikaanse Universiteit (RAU), now the University of Johannesburg, to study towards a BSc in mathematics and computer science. At the time, there was only an IBM 1130 at the university, holding a meagre 16Kb of memory.

Through postgraduate studies at Rhodes University (RU), he could improve his English and combine mathematics with studies in philosophy and logic. He received an MSc in mathematics with distinction in 1974 and was the top student in his 1975 MA philosophy class. The Elsie Ballot Scholarship opened doors to Cambridge University and ultimately a PhD in algebraic logic in 1978. Later, in 1992, he completed an interdisciplinary DPhil at RAU about power structures.

From 1979, Brink lectured mathematics at SU and founded the student mathematics society, *WiskUS*. A sabbatical in 1986 at the Australian National University's Automated Reasoning Project introduced him to the basics of artificial intelligence. Other research positions and visits to Australia, the United Kingdom and United States followed.

During his time at the University of Cape Town (UCT) from 1987 onwards, this former President of the South African Mathematical Society received his A-rating from the NRF. He invented algebraic structures called Boolean Modules and worked on program semantics in computer science, logic and philosophy. He spent three years commuting between Cape Town and Canberra as a part-time senior research Fellow at the Australian National University.

LEADER

Between 1991 and 1999 Brink led UCT's Department of Mathematics, and later also the merged Department of Mathematics and Applied Mathematics. He participated in the institution's Academic Support Programme for disadvantaged students, headed the Laboratory for Formal Aspects of Computer Science, and founded the Numeracy Centre. He was Vice-Chancellor Dr Mamphela Ramphele's Coordinator for Strategic Planning before becoming

pro Vice-Chancellor (Research) and mathematics professor at the University of Wollongong in Australia in mid-1999.

Back in South Africa in 2002, Brink became the first Vice-Chancellor and Rector of SU to be appointed from beyond its own ranks (or those of the Afrikaner Broederbond). "Through Vision 2012, I committed SU to a diversity of people and ideas, playing a constructive role in the development of South African society, and contributing to scientific and technological capacity-building in Africa," explains Brink, who introduced a new language policy committed to multilingualism.

His idea of "quality needs diversity" did not always find favour, as the British newspaper *The Guardian*, summarised in 2005: "Brink's five years at Stellenbosch were spent pushing a university that had been the intellectual heart of apartheid into opening its doors to black students. Unsurprisingly, his drive to multiply several times over the number of black students, and for classes to be conducted in English rather than Afrikaans so that blacks could participate, were often misconstrued as ringing the death knell for Afrikaans."

The book, *Chris Brink: Anatomy of a Transformer* (2007), contains tributes by Stellenbosch colleagues and students. It includes his speeches, essays and documents, along with many extreme responses, the latter often elicited in especially the Afrikaans media. In the book, his wife Tobea describes Brink as an extremely dedicated, thorough man who is precise in meeting goals and deadlines, someone who is passionate not only about "doing things right" but primarily about "doing the right thing", and someone "who belongs to himself".

During his tenure, SU was positioned as one of the three top academic institutions in the country. The African Institute for Mathematical Sciences (AIMS) and the Stellenbosch Institute of Advanced Study (STIAS) were launched with his support. Within five years "other-than-white" students rose by 70%, and to 28.3% of the overall student population. African black students increased by 91%.

He initiated a regional development project called Reinventing Stellenbosch, but political shifts within the Stellenbosch Municipality saw his hopes of better relationships with surrounding communities only partially realised.

HIS NEWCASTLE YEARS

Brink's ideas about civic universities crystallised between 2007 and 2016 while he was head of the The University of Newcastle in England. Key partnerships helped establish the urban sustainability hub, Science Central, the Campus for Ageing and Vitality and a national centre for offshore and sub-sea engineering. Brink sat on numerous boards within the United Kingdom higher education community, co-authored a Newcastle Fairness Commission report and joined a peace initiative in the city.

The university's international footprint was extended to branch campuses in Malaysia, Singapore and London. It twice won the national *Times Higher Education Leadership and Management Award* (THELMA), and its advancement of gender equality was acknowledged. Upon his retirement, city leaders hailed Brink as "an exemplary vice-chancellor" who helped Newcastle regenerate itself from an old industrial city into a sustainable science-driven one.

Brink has recently finished his latest book in his new Boland hometown of Franschhoek. He was a critical reader for South Africa's then Department of Science and Technology, now Department of Science and Innovation, and chairs the implementation panel of the 2020 Research Assessment Exercise of Hong Kong's eight public universities.

PETER CLEATON-JONES

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Doctorate in Medicine from the University of the Witwatersrand (Wits) for training in research techniques and ethics (2017)
- Distinguished Service Award from the International Association for Dental Research (2000)
- South Africa Medal (Gold) of the Southern Africa Association for the Advancement of Science (1999)

DEFINING MOMENT

In 1972, the head of the Dental Research Institute managed to get him a British Council travel grant to the United Kingdom for three months, and spent time at the University of Bristol Dental School and their Medical Research Council research unit. From there he went on to the Radboud University at Nijmegen in the Netherlands. He had the typical South African syndrome where he thought that everybody working overseas were gods and we in South Africa didn't know anything. That three-month period made him realise that it is up to individuals to grow and develop their talents. He learned a lot about how to train people.

WHAT PEOPLE MIGHT NOT KNOW

He has an interest in genealogy and has been tracing his multi-national family history for many years. "I am an 1820s settler descendant, and my French great-grandfather was the mining engineer at De Beers, in charge of digging the Big Hole. Cecil John Rhodes tried to bribe him to slow down the water seepage to let all the claims flood so he could buy them cheaply. In response my great-grandfather tried to push Rhodes into the Big Hole but was stopped by bystanders."

INTEGRITY AND EXCELLENCE SAW CLEATON-JONES RISE TO THE TOP

Sometimes the smallest things can change the course of a man's life, or even the course of a university or a country. When Peter Cleaton-Jones received a travel grant for a three-month research visit to the Netherlands and the United Kingdom, he could never have predicted where it would lead him. The trip came in 1972 while he was completing his PhD in dentistry, and it rerouted the path his career and his life would take from that point.

"When I was doing my PhD, there was no training in how to plan a research study," says Cleaton-Jones. "On that trip I learned a lot about how to train people, so when I finished my PhD I started running a course at Wits on how to do research, presented by me and a colleague in the Dental Research Institute, Prof Elly Grossman."

That course was the first of its kind at the Wits, where Cleaton-Jones was to spend the best part of his career, spanning more than 30 years and only coming to an end in 2010. He estimates that almost 2 000 researchers passed through that training programme, from undergraduates to internationally acclaimed researchers.

Another unforeseen consequence of that trip saw him become involved in health research ethics at Wits, thanks to the way he designed an anaesthesia study he wanted to conduct. "In 1974, I applied for ethical clearance from the Human Research Ethics Committee, and I had to answer their questions and debate the good and the bad of the study," says Cleaton-Jones. "Eventually they gave me permission to do it and a week later, the chair of the committee gave me a call. He said 'we don't get people here that think the way you do', and asked me to join the committee because of that application. I served on it until December 2017."

The 44 years on that committee, which included a period as Chair from 1985, as well as serving on the Research Ethics Committee of the South African Medical Research Council from 1990 to 2002, were years well spent for him. He started the Research Ethics Committee at the Human Sciences Research Council in 2003 and is still serving on that committee. In those posts he learned that integrity remains one of the most important qualities of his personal and professional life.

REPUTATION A VITAL REALITY

"Whatever direction in life you decide to take, a vital reality is your reputation. It takes time to build a reputation but your reputation can be lost in an instant, perhaps forever. The word 'ethics' concerns morality, and I believe integrity that includes honesty and trustworthiness is a core of morality," he says.

Cleaton-Jones has pursued excellence in every walk of life from a very young age, not just in ethics.

His father, a Captain in the 3rd Transvaal Scottish Regiment, died after an operation in the Western Desert in 1941, without ever meeting young Peter. He was raised in Johannesburg by his mother and grandmother, who posed increasingly challenging reading tasks to him as a young child. "My grandmother would buy me a book and say 'when you can read these passages I just gave you, I will give you another book', and that worked," he explains. "Eventually I found that I wasn't looking at fiction at all, I was reading non-fiction, trying to understand science."

A visit to the dentist to have an abscess removed at the age of 12 impressed him greatly and set him on the road to studying dentistry after matriculating from Marist Brothers College in Observatory, Johannesburg (now the Sacred Heart College) in 1957. Five and a half years later he graduated with a Bachelor's degree in dental surgery, at the top of his class and winning all but two of the undergraduate prizes on offer at the time.

He was qualified but found that he did not want to go into private practice. "I decided in the last six months of my dentistry degree that I would not stay in dentistry because I found that I needed something further. I applied to go back to medical school to complete a medical degree as well."

Having worked for six months in the Orlando Clinic in Soweto as a dental officer during his undergraduate studies, he returned to Soweto to complete his medical internship at Baragwanath Hospital in Soweto in 1968, before joining the MRC/Wits Dental Research Institute to study further. It was during this time that he completed his PhD and received his life-changing international travel grant, becoming Chief Research Officer at the Institute in 1973.

By 1977, he was Director of the Institute and Professor of Experimental Odontology. Under his leadership, the institute grew to include research into dental caries, dental epidemiology and anaesthesia, and he built research capacity and an international reputation for the Institute through the research training programme he developed.

His research at the time focused on anaesthesiology (dentists were the originators of general anaesthesia), as well as the epidemiology of dentistry, for instance the causes of tooth decay. "You will find that 20% of children get 80% of the dental decay," he says, and he wanted to know why.

Despite holding positions of leadership, conducting his own research and running training programmes, Cleaton-Jones still found time to pursue several more degrees throughout his career. On top of the Bachelor of Dental Surgery, MBChB and PhD, he was awarded two further doctoral degrees – a DSc (Dent) from Wits in 1991 and a PhD *Honoris causa* from the Medical University of South Africa (Medunsa, now the Sefako Makgatho Health Sciences University) in 2001. He also obtained a Diploma in Tropical Medicine and Hygiene and a Diploma in Public Health from Wits in order to learn about epidemiology and statistics. Finally, he completed a Diploma in Anaesthesia from the Colleges of Medicine in 1975 and was awarded a fellowship of the College of Dentistry *ad eundem* by the Colleges of Medicine in 2005.

Despite retiring more than a decade ago, Cleaton-Jones is still involved in ethics through the Steve Biko School of Bioethics at Wits, and remains an Emeritus Professor at the university where he has made his career and his impact.

NEVILLE RAYMOND COMINS

AWARDS, HONOURS AND ACHIEVEMENTS

- Arthur Child Award for the advancement of aviation in South Africa through innovation (1994)
- Merit Awards (2) of the Council for Scientific and Industrial Research (1988 & 1993)
- Elsie Ballot Scholarship (1967)

DEFINING MOMENT

The transition from being a 'lab rat' into facing the challenges of the real world through learning to understand clients' needs and the value of teamwork.

WHAT PEOPLE MIGHT NOT KNOW

He is an accomplished cabinet-maker who has produced first-class work and is currently the Chair of the active local Woodworking Association in Pretoria.

THREE CAREERS ALL BASED ON INNOVATION

Neville Comins is a Cambridge PhD Physicist whose career has been devoted to innovation. Founded firmly on his expertise as a physicist and on the roots and substance of his discipline, he has long been engaged with the need for research to be developed into substance.

Born in Pietermaritzburg in the KwaZulu-Natal Midlands, he attended Merchiston Preparatory School and Maritzburg College before registering for a BSc degree at what was then the University of Natal (now the University of KwaZulu-Natal). On graduating in 1971, Comins was appointed to a Postdoctoral fellowship in the Pure Physics Division of the National Research Council of Canada, where he worked for two years before being offered a Research Officer's post in the Electron Microscopy Division of the National Physical Research Laboratory (NPRL) at the Council for Scientific and Industrial Research (CSIR) in Pretoria.

In order to broaden his experience and also to have the advantage of working with postgraduate students and leading experts in the field, Comins spent six months as a Visiting Scientist at Oxford in 1973. This decision turned out to be intellectually rewarding and extremely valuable as he chose to work with the group developing the 'weak-beam technique' led by Drs MJ Whelan, ILF Ray and D Cockayne that was – at that time – at the cutting-edge of the application of electron microscopy to metals and semiconductors, combined with computational capabilities to quantitatively interpret the images. The work undertaken at Oxford was the start of a well-adapted transition from his previous field to electron microscopy. At the end of his six-month appointment he returned to CSIR, bringing with him considerable new scientific and practical experience. So began the first of his three careers – in each of which physics and innovation played key roles.

Initially, his work entailed two sets of responsibilities: the first was research work – some of which was aimed at solving an international debate about the behaviour of metal surfaces undergoing deformation, while he continued to apply the weak-beam techniques to complex dislocation configurations in copper alloys. Comins obtained excellent results leading to a paper in the *South African Journal of Physics* that, in 1981, won the prize for the best paper of the year. The second was supervising and developing methods for the Scanning Electron Microscope housed, as a national facility, at the CSIR. As the microscope was available to scientists who needed results in their particular fields, Comins found himself working with a wide range of researchers from fields including metallurgy, geology, dentistry, gas chromatography and a range of industrial and mining applications.

This second aspect of Comins' first career resulted in two important changes in his view of the world and his approach to work. This required developing the skill of listening and talking to both research and industrial scientists from a range of disciplines, in order to understand their real needs, as they were effectively his 'clients'. This was matched by realising the extent to which effective teamwork is key to producing valuable and usable results. Together, these lessons were life changing, defining moments in his career, lessons that lasted throughout his working life. In Comins' own words, this period "marked my transition from being a 'lab rat' into facing the challenges of the real world". During this phase of his career at the CSIR, Comins enjoyed a considerably wider and increasingly more demanding set of responsibilities. He was charged with establishing a Metals Division in the Nanoscale Physics Research Laboratory (NPRL), of which he subsequently became the Head, before being appointed as the Assistant Director of the newly formed National Institute for Materials Research (NIMR),

where his responsibilities included work on the extension of foundry activities to include vacuum techniques and precision casting, and on studies of high temperature alloys and alloy development for advanced industrial use.

This appointment led to Comins' second career, now as a leader in the field of Materials Science – a growing international topic – when, as part of the restructuring of the CSIR, he was appointed Programme Manager for Speciality Metals in the Division of Materials Science and Technology (Mattek). Here he was responsible for the growth of the programme and provided leadership and co-ordination for a series of project teams from four different programmes, two CSIR divisions and a number of universities in the field of aeronautical materials. This work achieved significant success in developing a local capacity to produce advanced investment castings and single crystal turbine components to meet demanding industrial standards, allowing performance enhancements in gas turbine engines.

A VISIONARY PROJECT

Following the successes of the Mattek team, Comins was appointed Director of Business Development (Integrated Projects) at CSIR Corporate where he was responsible for stimulating the growth of interdisciplinary projects across the CSIR and with other institutions. This position effectively signalled the beginning of his third career, focusing on innovation. While Comins was director, the then Premier of Gauteng province approached the CSIR with a request to develop a Gauteng Trade and Industrial Strategy, in the form of concept projects.

Comins was appointed Project Manager for the science park development which followed and became Gauteng's Innovation Hub – the project being aimed at further developing the concept and establishing a major high-tech business initiative in the province. In this capacity, he acted jointly for the province, the CSIR and the University of Pretoria (UP). In 2001, he became the Chief Executive Officer of The Innovation Hub Management Company, (Pty) Ltd., and in 2003, a member of its Board. In these positions, he established and ran an excellent Management Team who created the Maxum Business Incubator to stimulate and support high-tech start-ups and small and medium enterprise development, the 'CoachLab' Leadership Programme (linking university post-graduate students and business) and the 'INNOV8' networking community.

The Hub became one of the first institutions to appreciate the necessity of achieving alignment of the 'Triple Helix' and was internationally recognised as being the first accredited Science Park in Africa when it achieved full membership of the International Association of Science Parks. In 2005, The Innovation Hub was nominated for the Visionary of the Year Project by the Intelligent Communities Forum (New York). When Comins 'retired' in May 2008, The Innovation Hub had all the available buildings fully occupied with technology companies and start-ups.

Comins' career-long position has been that research findings and scientific discoveries are just that, while 'innovation' is the process of making those findings and discoveries work positively for society.

RICHARD COWLING

AWARDS, HONOURS AND ACHIEVEMENTS

- Gold Medal of the South African Association of Botanists (2014)
- Elected Foreign Associate of the National Academy of Sciences, United States (2008)
- Distinguished Service Award from the Society for Conservation Biology, United States (2004)

DEFINING MOMENT

There are so many things, both inside and outside of his work, that have piqued his curiosity that it is not possible for him to identify any single one, let alone moment, which had a defining effect on him as a scientist.

WHAT PEOPLE MIGHT NOT KNOW

He is a published poet.

WON OVER BY A PASSING LANDSCAPE

Richard Cowling's itinerant childhood provided a strong foundation for his fascination with vegetation change in space and time. Born in 1955 in the cane fields of Zululand, he spent his primary school years in Polokwane, graduated from high school in Klerksdorp, and after enrolling at the University of Cape Town (UCT) in 1973, his parents moved to the Eastern Cape where he now lives. His parents were enthusiastic travellers and each year would '*trek*' with children and dogs, often towing a caravan, to the Eastern Cape coast. The trip to the coast could last up to three days. "I got to looking out of car windows and marvelling at how vegetation in the landscape changed. Why the sudden shift to forest, and why the gradual disappearance of grass? These questions fascinated me from an early age. They still do."

Cowling showed no flair for science and mathematics at high school but did excel in geography. Despite his father's disapproval – he wanted his son to study medicine – Cowling was set on a BA at UCT, aiming to become a teacher. "There was no way I was going to punish myself with university level science, but on registration day, I changed my mind. I walked onto north campus where I enrolled for a BSc with majors in botany and zoology. I had no idea what I was in for. Our high school did not offer biology at any level. I had to work very hard just to keep afloat."

Cowling found aspects of both subjects compelling, particularly intertidal and plant ecology under the mentorship of George Branch and Eugene Moll respectively. In the end, plants won and Cowling completed a PhD in 1983 on the vegetation ecology and history in the south-eastern part of the Cape region, where several biomes mix and interlock. "This project fed my curiosity about what controls the distribution of plant species and vegetation. There is no better place to study this than where biomes meet." Cowling has retained his interest in his postgraduate study domain: he has lived there for the past 20 years and continues to refine and research questions he posed there 40 years ago.

Intrigued by the ecological convergence hypothesis, which predicts that plant communities under similar environmental conditions exhibit similar structure, Cowling spent a postdoctoral year in Perth with Byron Lamont, the start of a long and fruitful collaboration. The striking similarities and differences in plant form and function between Cape fynbos and its analogue in Western Australia stimulated a flurry of papers. Cowling recalls: "There are places on the south-west coast of Australia which, were it not for banksias instead of proteas, could be mistaken for somewhere near Cape Agulhas." The comparative evolution of the world's five regions with Mediterranean climates has endured as one of Cowling's major research topics.

Cowling returned to South Africa in 1984, worked for the Council for Scientific and Industrial Research (CSIR) as a scientific coordinator for the Fynbos and Karoo Biome projects, and in 1987 was appointed to the academic staff at UCT's Botany Department. He established a team of associates and postgraduates focusing on plant ecology and conservation of the Fynbos and Succulent Karoo biomes and threw himself into academic and civic life.

Faced with escalating pressures, diminishing budgets and policy paralysis of the late 1980s, the conservation status of Cape ecosystems was in a state of rapid decline. Consequently, Cowling's team increasingly shifted its focus to conservation research and engagement, stressing the utilitarian value of the

Cape plant life as a justification for its preservation. This produced some of the earliest research globally on the economic valuation of ecosystem services in a real-world context.

In 1992, Cowling was appointed to the Leslie Hill Chair in Plant Conservation and established the Institute for Plant Conservation, which had a big impact on conservation research as well as implementation. His group provided the rationale and means to conserve 150 000 hectares of priority habitat in the fynbos and succulent Karoo regions. Cowling remained at UCT until 2000, when he joined the Nelson Mandela University (NMU) in the Eastern Cape, where he is now a Distinguished Professor.

CONSERVATION IS ABOUT HUMAN CHOICE

In the first decade of this century, Cowling and his team achieved world leadership in conservation science, notably in systematic conservation planning. Their research was underpinned by excellent data, rigorous analysis and – in contrast to almost all research elsewhere – was deeply engaged in the social processes that determine implementation success.

"In reality" says Cowling, "conservation is about human choice: it is a social science with input by natural scientists. The science input must be top-notch, capturing both biodiversity patterns as well as the processes that underpin it." The team's work had a big impact, particularly their research into conservation planning and implementation in the Cape.

At NMU, Cowling continued his engagement in conservation projects by directing the science behind the Subtropical Thicket Ecosystem Project, a conservation action initiative funded by the Global Environment Facility. His group also made the case for the biome-scale restoration of degraded subtropical thicket, and thus began a long and complex process of mainstreaming restoration by conducting relevant research, engaging with implementers and building awareness. The *spekboom* (*Portulacaria afra* or Elephant's Food) restoration programme is now a flagship project of the Department of Environmental Affairs.

Throughout this time, however, Cowling continued with his curiosity research, focusing on the evolution of biodiversity in the Cape and other Mediterranean-climate systems of the world. Over the past ten years Cowling has rekindled his long-standing interest in the Pleistocene vegetation history of the Cape by joining a team researching the emergence of cognitively modern humans on the region's south coast. This research, largely funded by the National Science Foundation, has provided a wealth of environmental proxies for generating predictive models of vegetation change. Recently NMU and Department of Science and Technology (now referred to as the Department of Science and Innovation (DSI)) have started investing in a local institution – the African Centre for Coastal Palaeoscience, which is directed by Cowling – to build South African capacity for researching this fascinating story of human and plant evolution.

Cowling has published some 400 peer-reviewed items and, according to Google Scholar, attracted 35 000 citations producing an *h*-index of 103. He is recognised by ISIHighlyCited.com as among 250 most-cited researchers in Ecology and Environment between1981 and 2005. His papers have been published in leading journals including *Nature, Science* and *Proceedings of the National Academy of Sciences.* Cowling has also made an impact as a mentor, having trained 84 postgraduate and postdoctoral students.

He has also served as a scientific advisor on 66 external, conservation-related committees and participated in the activities of 22 civic organisations. "I like working with non-specialists in conservation organisations. I learn a lot from them," he says. "One of my favourite tasks is managing the network of nature reserves in our area. It gives me great pleasure to see nature unspoilt but valued. So much of conservation is like swimming upstream. It's great to have in your back yard a resting place from the relentless torrent."

| DAVID DEWAR |

AWARDS, HONOURS AND ACHIEVEMENTS

- South African Planning Institute Lifetime Achievement Award (2010)
- Mayor of Cape Town Medal for Community Service (2010)
- Elected Fellow of the University of Cape Town (UCT) (1996)

DEFINING MOMENT

When he joined a Cape Town architecture firm and met future collaborator Roelof Uytenbogaardt.

WHAT PEOPLE MIGHT NOT KNOW

He enjoys the bush and scuba-diving.

CITIES FOR PEOPLE ON FOOT

Emeritus Professor and senior research scholar, David Dewar's sunny little office in the School of Architecture and Planning at the University of Cape Town (UCT) provides him with a view over a city that he loves yet finds frustrating.

"South Africa does not have cities," states this honorary life member of the Urban Design Institute of South Africa and winner of numerous national and international design and planning awards. "Proper cities are ordered around space and institutions. Those two things go together. Proper cities are not organised around roads and houses, but in South Africa that's all you get."

"Our cities were built on the assumption that everyone would have a motor car, which is just fundamentally wrong," Dewar emphasises. "Most South Africans use non-motorised transport, and that's the way that we have to operate. If you do not have means, it is almost impossible to live in our cities."

Prague, Paris and Istanbul are among his favourite cities for more than just their history and aesthetics. "Those cities work because they were built for people on foot," he explains emphatically. To make his point, he notes that South African cities have been judged to be among the world's most inequitable and most inefficient.

"My passion has always been to get a way of thinking going that results in cities that work for people who do not have great resources, but that are also spatially very beautiful," explains Dewar, who believes that urban planning should be an interdisciplinary exercise. "Most people do not buy into this way of thinking. Our cities are run by engineers without spatial sense."

FORMATIVE YEARS

Dewar was born on 9 October 1945 in the Zimbabwean city of Bulawayo. At school he played cricket for his country's schools' team. After arriving at UCT in 1963 with a teaching bursary in hand, he played for Western Province's B-team and was 12th man for the South African Universities cricket team.

His interest in cities was sparked during his Bachelor of Arts' years while studying economics and geography. An Honours degree followed in 1966, and in 1969 a Master's in urban and regional planning (with distinction). In 1981, Dewar completed a Doctorate in Philosophy about South Africa's low-income housing policy.

Europe called after Dewar had completed his initial studies, but he was lured back to Cape Town by a telegram: He was offered a job in one of his former teacher's architectural planning and urban design practices. One of the partners was Roelof Uytenbogaardt, who was to play a major role in forming Dewar's line of thinking about urban order and city form. For nearly two decades, the two collaborated on numerous projects until Uytenbogaardt's death in 1998.

In 2018 Dewar and another long-standing collaborator, architect Piet Louw, were invited to deliver the prestigious Roelof Uytenbogaardt Urban Design Memorial Lecture and to exhibit their own work. Uytenbogaardt's appointment as a professor in urban and regional planning had given Dewar a foot in the door as a young academic at UCT. He had helped Uytenbogaardt set up a full-time programme in Urban and Regional Planning during the time of sanctions, when planning was seen as a so-called 'handmaiden' of apartheid.

"Without access to much literature, we had to think out the profession from first principles as we thought it should be. We decided to argue for alternatives," he remembers. "You can only teach what you believe in." Dewar then adds:

"We didn't pursue politics directly but took on discriminatory policies from a professional or ethical viewpoint."

LINKS WITH UCT

"My whole life has been around this university," he reflects on nearly sixty years of memories connected with UCT. He started as a senior lecturer in 1971, became an associate professor in 1978 and Professor of Architecture and Planning in 1986. He rates the period between 1975 and 1991 as among the most interesting of times, when he was a founding member, and after 1980, Director of UCT's Urban Problems Research Unit. In 1991 Dewar became the first incumbent of the BP Chair of Urban and Regional Planning.

His numerous leadership roles include that of Dean of the Faculty of Fine Arts and Architecture (1993 – 1995) and Deputy Dean and Acting Dean of the Faculty of Engineering and the Built Environment (2002 – 2006).

A NEW WAY OF THINKING

Dewar has always kept one foot in private practice, either working solo or in partnership with others. This has allowed him to consult on land management issues, draw up plans, do assessments and provide legal evidence on matters. He worked on projects from Pinetown in KwaZulu-Natal to numerous small South African '*platteland*' towns, as well as in Namibia and Mauritius. In Cape Town, he was involved in projects in Khayelitsha, the Milnerton lighthouse site, the Klipfontein Corridor and the high-density, lower-income inner-city housing project, Springfield Terrace, in Woodstock.

His writings and talks on matters such as urban structure and form, self-help housing, the role of spatial design in helping to prevent crime, and integrated housing in a post-apartheid South Africa have been extensive. Also included are thoughts on open space, urban corridors, the planning of university campuses and the impact of climate change on city planning. Dewar's advice has been sought by many a sub-committee, planning commission and advisory board. These include the Executive Committee of the South African Council of Town and Regional Planners (1995 – 1998) and the National Development and Planning Commission (1998 – 1999). He also contributed, as an invited lead author in Working Group 3, to the 5th Assessment of the Inter-governmental Panel on Climate Change (IPCC) from 2011 to 2013.

He has thrown his weight behind numerous land-related community initiatives and in the 1980s consulted to many communities resisting Group Areas Act removals. Dewar was a founder board member of the Hostel Dwellers' Association and of the Hostels to Homes initiative from1989 to 1998. From 2001 to 2017 he served on the board of the Community Organisation Research Centre, a research arm of the Federation of the Urban Poor.

He believes these activities have allowed him to be a better academic and researcher: "When you teach an applied profession, it is very important to know about doing."

Two of the nine books he has been lead author of were recently reprinted without the publishers asking for any updates. This says something about the forward thinking of Dewar and his colleagues in matters related to African cities. One book was initially published in 1990 on how urban markets can help develop the informal retail sector and another, in 1986, focused on regional development and settlement policy.

"My whole life has been spent trying to persuade people to see things differently. We have persuaded many. The rhetoric about planning in South Africa has changed, but unfortunately not the practice. This is because most planners have been trained – not educated – to implement an entirely inappropriate model," he concludes.

Suburbia is to Dewar "a kind of rural mindset applied to cities." And even though he thinks that local planners often do not have a sense of possibilities, he does not believe all is lost for South African cities.

ANTON EBERHARD

AWARDS, HONOURS AND ACHIEVEMENTS

"I have loved seeing those who have attended our courses, or who used to work with me, now making a significant contribution to the energy sector both here in South Africa and across the African continent."

DEFINING MOMENT

His energy sector advisory work for the African National Congress (ANC) at the birth of democracy and, more recently, his advisory work for President Cyril Ramaphosa.

WHAT PEOPLE MIGHT NOT KNOW

He drives only 1960s cars, maintaining them himself and keeping them wholly original. However, after seeing Prince Harry drive his bride away in an E-type Jaguar that had been converted to electric, he is contemplating a similar conversion. In the meantime, he glides around town silently on his electric scooter.

ENERGY FOR A BETTER SOUTH AFRICA

The energy sector has gone full circle in the 40-odd years that Anton Eberhard has been involved in the field. For his PhD in the early 1980s, he investigated how small-scale solar applications had the potential to revolutionise energy access for rural communities in the mountainous kingdom of Lesotho, with no access to electricity and relying on fuelwood and animal dung for heating and cooking. That was in the wake of the 1970s energy crises, when soaring oil prices sent energy-thirsty nations scrambling for alternative sources of power.

In the decades that followed, investments in renewable energy ebbed as the oil price recovered. However, the global interest in renewables has recently bounced back. Eberhard, who since 1999 has directed the University of Cape Town (UCT) Business School's Management Programme in Infrastructure Investment, Reform and Regulation, says change in energy technology is happening more rapidly now than at any point in his career. "It is an incredibly exciting time," he says.

Solar and wind energy are now, in most countries, the cheapest grid-connected sources of electricity. And as storage prices plummet, off-grid power solutions are more competitive on cost. The electricity system is becoming decentralised as a multitude of smaller, incremental investments are made by utilities, industries and households. The last are becoming producers as well as consumers of power, he says, while networks and mini grids combined with innovations like blockchain and the Internet of Things will democratise energy services, resulting in services that are better matched to individual and community needs.

But energy policy is also a highly contested space, with power tussles in South Africa between proponents of new nuclear builds, coal power and renewables. "When I started work on solar and rural development, I did not foresee that the energy transition would be so fundamental and so contested," he discloses. But the ferocity of the tussles makes sense, he adds. "There will be winners and losers. Those who have links to old utilities will resist these changes and question the reliability of the new ones."

FROM POLITICS TO PHD

Eberhard grew up in Port Elizabeth and started his working life as an engineer with a first degree in chemical engineering from UCT. After a few years in the industry, and using his free time to read widely, he realised he wanted to explore ways in which science and technology could contribute more directly to improving people's lives and to building a more just world.

This being in the late 1970s, Eberhard's emerging personal philosophy and politics was a poor match with that of the apartheid government. In fact, he received a 12-month sentence, subsequently spending two months in military detention barracks, for refusing to do military service prior to leaving the country to study for his PhD. In a way, he was lucky: He was one of the first conscientious objectors in the country. Later ones earned up to six years in jail for the same act of resistance.

Eberhard pursued his PhD at a multidisciplinary research unit that linked science and engineering with social and developmental issues at the University of Edinburgh in Scotland. Those years abroad presented him with a melting pot of ideas and cultures. "There we were, 12 PhDs coming in from all over the world,

looking at different aspects of science, technology and society." Eberhard enjoyed the study immensely, especially the time he got to spend in the rural villages of Lesotho doing his field work. But he always planned to return and work for a better South Africa. Eberhard came back to South Africa in 1983 and joined UCT's Energy Research Institute as a senior researcher. He championed renewable energy and alternative energy technologies, which became a key component of a new master's programme offered by the institute linking energy and development.

In the 1980s it was difficult for academics like Eberhard to gain traction with South Africa's policymakers on innovative ways to broaden energy access in the country. As a result, Eberhard and his students focused on small-scale local innovation. He set up a field station in the Transkei where his students were able to experience the context of under-development – a rarity for them in the tumultuous last decade of apartheid. "We were trying to have an impact on a micro-level, exploring models of good practice at a local and regional level."

MORE INCLUSIVE POLICIES

Everything changed in the 1990s with the arrival of a new political dispensation that focused on social redress. Eberhard was one of the experts who worked with the new African National Congress (ANC) government to formulate more inclusive policies for the new democracy. As his team grew, he established the Energy and Development Research Centre at UCT. This group helped design the country's new electrification programmes and contributed to the 1998 White Paper on Energy Policy. "It was an exhilarating time, we had a very direct impact on policy," he recalls.

In 2001, driven by a desire to focus more on his own research, Eberhard moved across to the UCT Business School. Here, he created a smaller and more specialist research group which he leads to this day as a Professor Emeritus and senior scholar, despite reaching retirement age at the end of 2017. The group leads international research projects and has worked in 25 different African countries to date. It also works with global organisations like the World Bank and the African Development Bank on power sector reform. With the breakthrough in renewable energy, he and his colleagues have also been working on the design of solar and wind energy auctions across Africa.

His unit runs executive education courses for senior leaders and professionals from public and private sectors globally, helping them to understand energy transitions, power sector reform and investment issues. His short courses typically each attract about 80 participants from more than 20 different countries.

He maintains a high public profile and keeps advising governments on energy and infrastructure policy. Recently, his group assisted with a Parliamentary enquiry into Eskom state capture and corruption, and he has also chaired an electricity sector advisory panel for President Cyril Ramaphosa. He values his university base which helps him to maintain a high level of integrity and independence in the contested energy policy space. "Being in the university, one is committed to having open and rigorous inquiry, as opposed to working for a specific energy sub-sector, sector or interest group." His group's research helps inform evidence-based policy. And its involvement in real-world challenges in turn informs the group's research and teaching. "I love the combination of activities and the feedback loops."

Eberhard has no plans to slow down. In fact, since retiring he has been publishing more than ever. "It feels like a very productive time." His unit remains exceptionally popular with young researchers: the last time his group advertised a PhD fellowship, it received 140 applications competing for that one post. Working with talented young people is "one of the biggest joys of my life at this stage," he remarks. "I love my work, because we can make a difference."

PETRA ENGELBRECHT

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Doctorate in Education, awarded by the University of Eastern Finland (2014)
- Stellenbosch University (SU) Vice-Chancellor's Award for outstanding research in faculties, awarded for the first time in 1999
- Elected Member of the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (1991)

DEFINING MOMENTS

Getting to grips with research and the theory and practice of cognitive control therapy of children and adolescents at Harvard Medical School in Boston changed the trajectory of her life towards research in 1989. A few years later, her research focus shifted again to inclusive education after meeting a young boy who challenged her ideas about the rights of all children to have access to quality mainstream education.

WHAT PEOPLE MIGHT NOT KNOW

She loves her grandchildren, reading, classical music – especially opera – her dogs and gardening.

A RIGHT TO QUALITY EDUCATION

In the 1990s, a member of Down Syndrome South Africa asked to visit Petra Engelbrecht at her home. "She arrived with her little boy. We had tea," recalls Engelbrecht. "I had a Labrador dog – I love dogs – and I saw the little boy, Kosie Schoeman, following the dog outside. I had a swimming pool without a fence, so, worried about his safety, I joined them outside. Within ten minutes I wasn't seeing Down syndrome; I was seeing a wonderful child playing spontaneously with a wonderful dog."

At the time of Schoeman's visit, Engelbrecht, an educational psychologist by training, had been doing research in the field of interventions on critical thinking skills for children. She had worked her way up the academic ladder at the University of Pretoria (UP) to become associate professor of Educational Psychology by 1995, and Down Syndrome South Africa saw her as an expert who could potentially help them forward their cause.

"The parents of children with Down syndrome were the first group to say, 'yes, our kids do have specific educational needs, but we want them to go to school in our neighbourhood'." Children like Schoeman had been excluded from mainstream schooling because of their special needs. Engelbrecht shifted her research focus to developing 'inclusive education' and she is still at the forefront of the field today. "I regard quality education for every child, in their neighbourhood school, as their human right. Inclusive education is about recognising the rights of children to be included in mainstream schools," she says.

Today there are many schools in South Africa that are partially or totally inclusive, thanks in large part to the work done by Engelbrecht and her colleagues after 1996, when she moved to SU to take up a professorship in Educational Psychology and Specialised Education.

She began researching in earnest the state of inclusive education in South Africa and elsewhere, investigating teachers' attitudes and training, and how they cope with the stress of teaching children with diverse educational needs. She also looked into the role of educational psychologists as well as policy reform at a national level. Engelbrecht helped develop inclusive education standards and support programmes for South African teachers and she took up advisory and executive roles in several professional bodies, including the South African Association of Educational Psychology and the Professional Board for Psychology.

In 2007, she became the first female Dean of Education Sciences at North-West University (NWU), Potchefstroom campus, and after 2010 she focused solely on research, first at Canterbury Christ Church University and then again at NWU after 2015. Her work locally made waves abroad and created opportunities for collaboration with several countries, including Finland, which is widely seen as having an almost 'perfect' schooling model.

"During my time co-leading the project on teachers' roles in inclusive education in Finland and South Africa, I once again became aware that understanding local versions of inclusive education in diverse contexts is important in learning from each other, and that inclusive education is a continuous process," says

Engelbrecht. Whereas South Africa focused on bringing human rights into teacher education but struggled to provide practical support to teachers especially in rural areas, Finland had developed many practical solutions for dealing with children with diverse needs and so, despite their differences, the two countries could learn much from each other. "The approach of the Finnish government," says Engelbrecht, "is that teachers are on the front line; teachers need to find solutions in the classroom first before referring children to specialists – otherwise it is not inclusive."

Engelbrecht has helped take such insights straight into policies around teacher education for inclusion in countries like Malawi and Guatemala.

PERSONAL IMPACT

Her time in the Palestinian West Bank and Gaza between 2011 and 2015 had the biggest impact on her personally, she says. "You can't enter Gaza and exit the same person," she explains, noting that the experience challenged her own views of human rights because of the complex geopolitical situation.

She led two development programmes funded by the World Bank and the Palestinian government for pre- and in-service teachers there. The first project was originally planned for a short period. "I was the only South African in the research team, and as a South African I soon realised just how important cultural sensitivity was in this context. Within a few weeks, we told the World Bank we needed to extend the first project by a year because we needed more time for people to get to know and trust us and to ensure sustainability."

"It was a critical journey of self-reflection for me because I was so aware of the cultural competences needed for sustainable collaboration," she says. "The Gaza and West Bank experience reminded me of the impact of my own work." She recalls a reviewer of her published work once stating that her conclusions were often that "attitudes need to change" or "teachers need to be trained" – an unfortunately pervasive trend in academia in general.

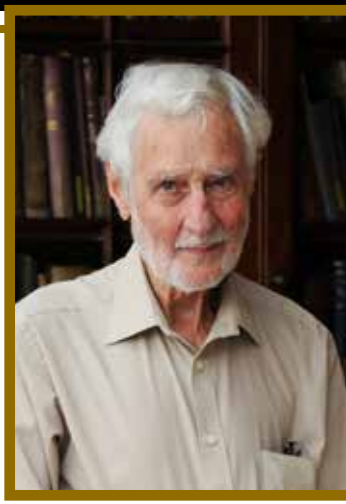
Her research on inclusive education and the training of teachers focuses strongly on sustainable solutions and some of the recommendations in research reports she co-authored were taken up in policy documents in Palestine and Malawi.

In 2018, the NRF rated her as an internationally acclaimed researcher, something she had never envisioned for herself when she completed her first degree back in 1969. "At that time, I married a farmer and gave him my full support," she says. She raised children and took over the farm management for a time after her husband became terminally ill. "I was 34 when my husband died. I moved to Pretoria because I realised I had to create a new future to support my children financially." Engelbrecht went back to university in 1985, relying on life-long family friend, Jeanet Modikwe, to help take care of her daughter and son.

"The trauma in my personal life gave me a different frame of reference," she says. "I went into academics with life experience and I was very aware of the challenges for women in academia in the late 80s." Although the first years back at university was a difficult journey of adaptation, she had worked her way up to PhD level by 1991 and she knew she had found her calling as a researcher.

"I wrote to Dr Sebastiano Santostefano at Harvard Medical School. He was working on a therapeutic technique that interested me. He invited me to spend several months at his clinic in Boston." And so, with her children, she boarded a plane to Boston in 1989. This was where she first discovered what good research was really about. "It changed my life. I met amazing people and it changed my focus to who I would like to become."

MICHAEL FEAST



AWARDS, HONOURS AND ACHIEVEMENTS

- National Research Foundation Lifetime Achievement Award (2015)
- Gold Medal from the South African Institute of Physics (1992)
- Having a minor planet named after him in 1977, called 10985 Feast

DEFINING MOMENT

He came to South Africa's Radcliffe Observatory in 1952 and has stayed in the country ever since.

WHAT PEOPLE MIGHT NOT KNOW

He went door to door in Pretoria and Johannesburg canvassing on behalf of Allan Paton's multiracial liberal party in the 1950s and 1960s.

A HEAD AMONG THE STARS

Michael Feast has always been fascinated by star light. While many astronomers start off being mesmerised by the constellations and the names of the stars, Feast has always wondered about light from the stars and the secrets it holds. "How did the stars make light and what were the stars made of? That seemed very interesting to me and when I began to read school textbooks, it seemed to me that there was still a lot to learn about the stars." World War II would inhibit opportunities for him to do astronomy, but the light never stopped shining.

"I would have liked to have gone into astronomy, but I was at school during World War II and I got an opportunity to go to university during the last year of the war," he says. He saw physics as the closest thing to astronomy that he could do and at the time it was encouraged as it was believed to be important for the war effort. During his degree at Imperial College, he lived through what he calls 'an interesting time,' when London was being bombarded with V-2 rockets.

After some physics postdoctoral work in Canada, Feast made a career move that would begin to merge astronomy and physics in South Africa – a merger that had already come naturally to him. He received a letter from his old supervisor in London asking if he would be interested in a job at the Radcliffe Observatory in Pretoria. Having never visited the observatory, he was pleasantly surprised to find that they were in need of someone specialising in his speciality, spectroscopy. "I came to Pretoria in 1952 and that's where my life has been since. I worked there doing research on astrophysics of stars and of galaxies."

He had finally gone into astronomy and he learned quickly on the job, at a time when astronomy required a great deal of actual looking through a telescope and photography, different from today's reliance on digital technology. Living in isolation at the observatory with a handful of colleagues, he found a lot of time for research and this allowed him to contribute to raising the profile of the observatory. "We eventually developed quite a reputation in the international community for doing research," he says. Urban development meant the telescope at the observatory had to move to the South African Astronomical Observatory at Sutherland in the Northern Cape in 1974, and Feast moved to Cape Town and later became the Director of the observatory until he retired in 1992.

He has been an Emeritus Professor at the observatory and the University of Cape Town (UCT) since then. "I am not as active as I used to be but I'm still fairly active."

A NAME IN SPACE

This physicist-turned-astronomer has grown his field with important work that has gained South African astronomy international recognition. While working on the astrophysics of stars in the 1960s, Feast split the light from a star very much like our sun and discovered that it had large amounts of lithium, a substance not expected to be present in such stars – a discovery that took other researchers 30 years to explain.

In the 1950s, he worked with colleagues to study the structure of our Milky Way galaxy and they found a way to use the motions of young stars in our galaxy to see how far the sun was from the centre of our galaxy, which turned out to be roughly 25 000 light years. Scientists all over the world are constantly making new discoveries about the structure of the Milky Way galaxy, and in 2014 Feast

and his colleagues found that the disk of our galaxy was not flat all the way out, but instead found stars that should belong to this flat disk but which were far away from it.

"We did a lot of work studying the structures of the Magellanic Clouds and showed that one of the Magellanic Clouds formed in the same way as our galaxy, although it is around 100 times smaller."

An important aspect of astronomy is being able to know the distances to the stars and galaxies that astronomers point their telescopes at. In order to do this, astronomers need to calibrate Cepheid variables – stars that glow and change brightness in repeating patterns, Feast had a breakthrough in the 1990s when he and his team gained access to space satellite data. "It gave us the best calibration of galaxy distances known at the time, by using Cepheid variable stars. In 2011 we were able to use the Hubble Space Telescope together with a group of American astronomers to improve calibration further," he says, anticipating further work in the field.
His move to South Africa was a welcome transition for him into astronomy, but when he arrived, he was welcomed by a country where astronomy and physics were fragmented and where science had fewer resources than he was used to. As with other aspects of his work, he learned quickly and made the best use of the available resources. "The driving force for my career since I came to South Africa has been to use the available resources and equipment to its full extent," he says. "As astronomers we are very privileged to do what we do, and we should do the very best we can."

While he was never one to be fascinated about the names of heavenly bodies, his name can be found floating in space as a minor planet named after him – '10985 Feast'. While having a minor planet named after you would be a wonderful milestone for most people, the humble professor says smilingly, "it is rather amusing, but then there are vast numbers of minor planets out there."

BRIAN FIGAJI

AWARDS, HONOURS AND ACHIEVEMENTS

- Chancellor's Honour's Award from the University of the Western Cape (UWC) (2014)
- Honorary Doctorate in Education from Coventry University, England (2002)
- Silver Springbok Award from Scouts South Africa (2000)

DEFINING MOMENTS

There have been three major defining moments in his career: the first was when he left engineering and returned to education in 1980. The second when he challenged Kader Asmal's merger of the Peninsula Technikon and Cape Technikon and handed in his resignation in December 2004 after 25 years of service. The third was in 2009 when Naledi Pandor appointed him as the candidate for election as the South African representative on the Executive Board of UNESCO.

WHAT PEOPLE MIGHT NOT KNOW

He is very proud of his two children who are well-balanced, responsible adults with good careers.

COMMUNITY LEADER AND ARCHITECT OF TRANSFORMATION

Brian Figaji unlocked the secrets to good leadership, honesty and integrity as a result of his involvement in Scouts South Africa. These skills, honed early in life, have served him well in his professional achievements as an educator, consulting civil engineer, student-focused academic leader, country representative to UNESCO in Paris, and as one of the architects of the initial blueprint for higher education transformation in the democratic South Africa.

After obtaining his BSc at UWC in 1969, Figaji continued his studies and completed a Diploma in Tertiary Education (with distinction). He is also a graduate of Harvard University, holds other degrees from South African universities and is the recipient of several honorary doctorates.

EARLY CAREER

In the late 1960s, Figaji chose a career in science, somewhat by accident, at a time when promising young black students faced many challenges in getting a good education. "I enjoyed science at high school and thought of studying medicine, but there were very few bursaries available in that field and I ended up getting a bursary to study teaching instead. I selected mathematics and physics as my majors."

After qualifying, he started work as a science teacher. "While I enjoyed teaching, I realised that the system did not welcome young people who were a bit rebellious. I had youthful exuberance and after having been the President of the Students' Representative Council at the UWC, I wanted to change the world. In my first year of teaching we had a visit from the education inspectors and I had a little clash with them," he says mischievously, "so I changed careers. Despite knowing very little about engineering, I took a job working in civil engineering surveys."

While working as a civil engineering technician, he managed to secure a bursary at the University of Cape Town (UCT) to study engineering. He was one of two black students in a class of 70. He completed the degree with honours – despite being excluded from working on certain sites because of his race. He then worked for ten years as a consulting engineer.

SHAPING HIGHER EDUCATION LANDSCAPE

When called upon to return to the education sector in 1980, Figaji joined the Peninsula Technikon (now the Cape Peninsula University of Technology) as Head of Engineering, and soon rose through the ranks at the institution, eventually serving as Principal and Vice-Chancellor from 1994 to 2004. During this time he made provision for significant expansion of the computer facilities on campus in an effort to realise the dream of the Peninsula Technikon of becoming the Massachusetts Institute of Technology of Africa.

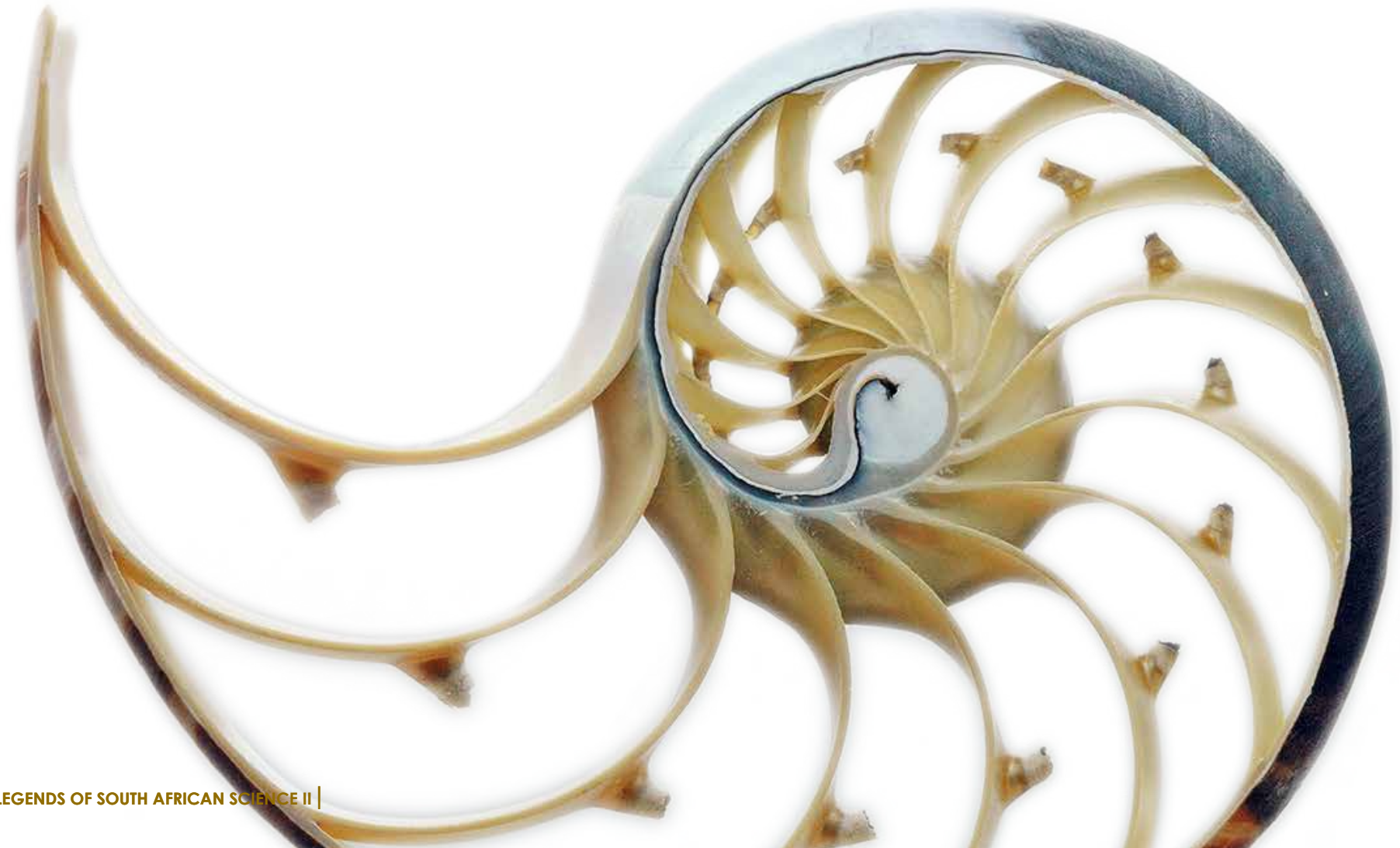
He was appointed to the National Commission on Higher Education in 1995 by President Nelson Mandela to develop a framework for the transformation of higher education. "In drafting the blueprint, tough decisions had to be made, but this gave me access and opportunities to look at other systems internationally. We had to report to the Minister, Professor Sibusiso Bengu, and this gave me good exposure and recognition." But Figaji left higher education in 2004 as a result of his opposition to the merger of institutions as proposed by then Minister Kader Asmal.

BRIAN FIGAJI

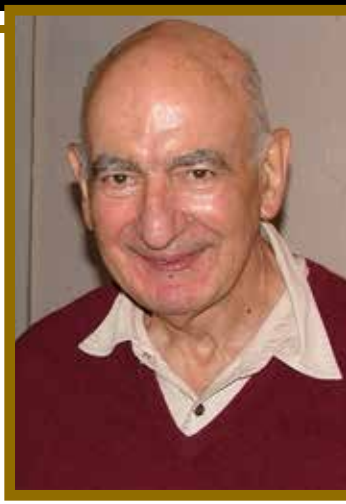
A passionate community leader, he has played an important role in the transformation of South Africa over the past 20 years. He was a Director of the Youth Development Trust, a member of the Engineering Advisory Committee, a member of the Desmond Tutu Trust and President of the Boy Scouts in the Western Cape.

Figaji became a Director of the Nedbank Group in November 2002 and retired from this position after serving the required period of appointment. He was a board member of the Development Bank of Southern Africa and currently he still serves as the non-executive Chair of Irvin and Johnson (Pty) Ltd. He is still an active member of several boards and continues to serve the community in his retirement.

Figaji is a Fellow of the SA Institute of Civil Engineers, a Fellow of the SA Society for Professional Engineers, a Fellow of the Academy of Engineering and a Member of the Academy of Science of South Africa.



PETER FOLB



AWARDS, HONOURS AND ACHIEVEMENTS

- Established the discipline of clinical pharmacology in South Africa
- Chair of the South African Medicines Control Council for 18 years
- Led the investigation of the apartheid government's chemical and biological warfare programme for the South African Truth and Reconciliation Commission

DEFINING MOMENT

Folb's decision to combine medical practice and scientific research eventually propelled him to develop pharmacology into a clinical discipline in South Africa.

WHAT PEOPLE MIGHT NOT KNOW

Folb is a poet, author and artist. He writes Japanese *haiku* and *tanka,* as well as Danish *grook*-poetry. Folb has exhibited his art (linocuts, woodcuts and computer-generated paintings) on numerous occasions. He has published four books combining his art and poetry, two of them for children.

GUARDIAN OF THE DRUGS

During a hike up Table Mountain in the early 1960s, Peter Folb wrestled with a difficult choice: Should he pursue the practice of medicine, which he was studying at the time, or focus on scientific research? By the end of the hike, he had resolved to combine his love for both disciplines.

Folb's unconventional path, along with his keen sense of justice and service, led him to the tumultuous intersection of science, health care and politics in South Africa. It wasn't always an easy path, but Folb believes it was important: "Very few doctors go into science and there's so much science that needs to be done."

EARLY LIFE

Born in London in 1938 to a South African businessman and his English wife, Folb grew up in the shadow of World War II. When the war was over, the family moved to South Africa. Their arrival in Cape Town after a long sea voyage left an indelible impression on the young boy, who became aware for the first time of the prejudice and injustice endemic to the country as he watched labourers working at the harbour.

Folb went to school in Johannesburg and began his studies at the University of the Witwatersrand (Wits). He transferred to the University of Cape Town (UCT) to learn from doctors including the legendary Chris Barnard, whom Folb describes as a genius: "He showed what could be done by brilliant application of oneself and one's career to development."

After graduating as a medical doctor in 1961, Folb entered into general practice in the Karoo town of Oudtshoorn. He also worked at a hospital that served a large and impoverished Coloured community. "I was inspired by our teachers, the work that had to be done and the situation of many of our patients," Folb recalls. "I was also inspired by the opportunity to do something about it."

A SHIFT IN FOCUS

The young doctor returned to Cape Town in 1963 and took a job as a registrar at Groote Schuur Hospital. Four years later, he decided to further his research overseas, taking a post as a senior lecturer at Guy's Hospital in London. He was awarded a Doctor of Medicine in research for his work on understanding the mechanisms of invasion of simple organisms in immune-suppressed patients.

"I was very interested in the early experience of heart transplantation. We gave patients intensely powerful drugs and suddenly simple organisms that usually caused little or no harm became highly invasive and pathogenic. I wanted to understand why."

BUILDING A NEW CLINICAL DISCIPLINE

In 1976, after a five-year period working as a physician and researcher in Israel, Folb returned to South Africa. He was appointed Professor of Pharmacology at UCT: "I got that post on the understanding that I would develop pharmacology, which at that time was a basic science, into a clinical discipline." And that's what he spent the next 27 years doing.

Folb gained an international reputation as a scientist and leading expert on drug development and safety. He was appointed chairperson of South Africa's Medicines Control Council (MCC) in 1981, a post he held for 18 years. Under his direction, South Africa became a world leader in drug regulation and the MCC became the go-to reference and training centre for the World Health Organization (WHO) in the developing world.

In the early 1990s, Folb was approached to assist the WHO in its fight against eradicable diseases. "I did a lot of work with them in their efforts to ensure vaccine safety worldwide and eradicate diseases, including polio."

SCIENCE AND POLITICS COLLIDE

In the late 1990s, two more challenges landed at Folb's door: A battle over the testing of a controversial Acquired Immunodeficiency Sydrome (AIDS) drug and the Truth and Reconciliation Commission's (TRC) investigation into the apartheid government's chemical and biological warfare programme, headed by medical doctor Wouter Basson.

Folb was tasked with heading the investigation team that sifted through three trunks full of Basson's documentation. He set up a system for examining Basson's records and what he'd done and determined what the scientific approach would be to his actions.

He also apologised on behalf of the MCC to the family of slain activist Steve Biko, who was tragically let down by the doctors who saw him when he was in police detention. "I was at the TRC to speak about medicine, apartheid and forgiveness," he says. "It was very satisfying to me to be able to do that on a scientific level."

At around the same time, Folb also dealt with another charged issue: The Virodene scandal. The MCC tested claims made by a drug manufacturer, peddling an industrial solvent as a cure for AIDS. "It was hopeless," Folb says, "they didn't understand what they were doing and had made some fundamental mistakes, so we stopped it."

What should have been a clear-cut case instead became a highly political affair. The MCC stood firm against government pressure and refused to allow testing. "It was loyalty that drove me to take this position," says Folb. "I'm very pleased I stood up for what was right. I don't have any regrets around Virodene." Nevertheless, Folb's brave stand eventually took its toll; when his term as MCC Chair ended in 1998, he was not reappointed. He believes it was the right time for him to leave.

UNEXPECTED HONOUR

Folb continued his work with the WHO and UCT until his retirement from the university, having travelled and worked in 35 different countries and supervised more than 80 Master's and PhD students to completion: "I'm deeply grateful that I had the opportunity to serve and that I was able to create the opportunity for others."

From 2004, he worked full-time at the South African Medical Research Council for another nine years, guiding and developing South African programmes for new drug development.

In 2016, the Emeritus Professor received an unexpected but very welcome surprise when he was awarded an honorary Doctor of Science degree by UCT. "I was thrilled by it," he says. Folb had qualified as a doctor, but never as a scientist. At last he had managed to combine his passions for patient care and science. It had taken more than half a century, but the young man on Table Mountain finally achieved the goals he had set out for himself.

RICHARD FUGGLE

AWARDS, HONOURS AND ACHIEVEMENTS

- Rose Hulman Award from the International Association of Impact Assessment (1999)
- Environmental Planning Professionals' Interdisciplinary Committee Premier Award for his contribution to training environmental professionals by means of the annual professional short courses (1990)
- Cape Times Tercentenary Medal for his unit's contribution to Environmental Conservation in South Africa (1986)

DEFINING MOMENTS

The first defining moment in his professional life was when he was invited to be part of a team designing the first environmental science course in Canada. The next was when he was appointed the Shell Chair of Environmental Studies and took up a professorship at the University of Cape Town (UCT) that cemented his career. And after that, working for the Council for the Environment to shape environmental policy for South Africa – "it is not often you get to feel that you are right at the coal face! And now, nearing the end of my career, being able to give advice on big international projects is gratifying."

WHAT PEOPLE MIGHT NOT KNOW

Fuggle is part of the geocaching community. Geocaching is a global treasure-hunting hobby where enthusiasts use GPS to find hidden caches. "I'm keen on Earth Caches because of the educational side of it – they provide an earth science lesson through a visit to a unique geological feature."

A STEWARD OF CREATION

The forest people said the mine's sewage water was destroying their rice paddies. The mine people said, 'Impossible', and were prepared to put their cups in the outflow to show that the water was clean enough to drink.

Who was in the right? What was really going on? Richard Fuggle, a world-renowned environmental expert, was sent in to investigate the problem by the World Bank, which had been supporting the sewage treatment plant in question.

"We trekked out through the steamy Indian jungle," says Fuggle. "There was a small pump station that had to pump sewage from a village to the mine's treatment plant. That pump station was leaking, indeed spilling sewage out onto the fields, so both parties were correct, but the people in the forest village didn't have the language to explain or the expertise to know that the problem was the pump station, so they blamed the entire sewage treatment project."

Fuggle has been serving as an advisor to the World Bank's Inspection Panel for nearly 20 years. The role has taken him to interesting places all over the world, looking at projects as diverse as the sewage treatment facility in India, constructing a dam on the Nile and planning the world's largest earth-wall hydropower project, all of which could cause inadvertent harm to the environment.

When things go wrong, the World Bank's Inspection Panel investigates, drawing in needed scientific expertise," explains Fuggle. His work has helped the Inspection Panel to shape the environmental policies of the World Bank and these policies then trickle down to many other financial institutions.

What originally brought Fuggle to their attention at the turn of the century was the Rose Hulman Award from the International Association of Impact Assessment, in recognition of his global contribution to environmental management.

At the core of his contributions to environmental management is his notion that people are not distinct from their environment. "Unfortunately, in modern science we tend to compartmentalise things too much, focusing on either natural science or social science, rather than the whole," he says. "If you're looking at housing, you have to look at the soil and the climate to understand how people have adapted the structures. When I see people planting crops, I put it into context by looking at the geology and the economy. In environmental science, if you look only at natural science, or if you rely only on computer models and don't go out into the field, you'll miss the bigger picture."

As Fuggle puts it, "I am a product of my environment and my environment is a product of me." For him it is a question of ethics – he is committed to conservation because, as a Christian, being a steward of Creation is the right thing to do, and destroying it is plainly wrong.

IMPACT OF HUMAN ACTIVITY

In 1973, when Fuggle, a trained meteorologist, joined UCT as Professor of Environmental Studies, the concept of environmental management was still in its infancy. "People couldn't even spell 'environmental'; they said it was just a phase. I said it is a rising tide, but individual waves will always ebb and flow."

Fuggle's work and teachings began to establish the idea that the impact of human activity on the environment needed to be considered and assessed as a matter of national policy in South Africa. "We had to look at air pollution, estuarine requirements of rivers and radiation monitoring around the Koeberg nuclear power station, for instance. And we needed to make sure the public was involved and informed," he recalls.

In the 1980s and 1990s he served on various advisory bodies including the Council for the Environment which later put forward proposals for South Africa's environmental impact assessment (EIA) legislation.

"When I started, there was no such thing as environmental consultancy," says Fuggle. "We had to invent it and build it into law by writing the White and Green Papers with the help of lawyers. We had to give people background on how to measure noise or pollution, or how to conduct social surveys." He set up the short courses under UCT's Environmental Evaluation Unit and over those two decades, trained over 3 500 people. "It is incredible to see how many people involved in environmental management these days I may have influenced."

One of the strongest supporters of environmental assessments at the time was the African National Congress (ANC), because EIAs were one of the few mechanisms that allowed new developments to be put on the table for people to comment on, says Fuggle. Before that, development plans that affected communities didn't have to be made public.

Fuggle also advised on how the environment should be handled in South Africa's new Constitution and says the country's new government demanded sound scientific advice with regard to the environment. A scientist's role is to provide that information and to help enforce policy, but environmental activism may compromise a scientist's neutrality, he warns.

Fuggle, now Emeritus Professor of Environmental Studies at UCT, still consults internationally, most recently assisting the World Bank Inspection Panel in its investigation of the Uganda Transport Sector Development Project.

A special mention in a recent *Oxfam report* describes Fuggle as 'a brilliant environmental consultant,' noting that Fuggle would spend weeks in the field and would provide reports that helped shape the project. Fuggle says it was very gratifying to have an independent body like Oxfam commend the work he had done on an international oil and gas pipeline project.

He has always tried to be ethical in his work and says he has garnered respect for his candour. "If I disagree with someone, I'm prepared to look them in the eye and tell them so, and I have always been available to have a beer with them afterwards."

CHRISTOPH GARBERS

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary doctorates in science (DSc *honoris causa*) by the University of South Africa (Unisa) (1989), University of Cape Town (UCT) (1990), Stellenbosch University (SU) (1991) and University of Pretoria (UP) (1994)
- The Order for Meritorious Service Class 1: Gold (1989)
- Ernest Oppenheimer Memorial Trust Fellowship (1964)

DEFINING MOMENT

When just nine months into his doctoral study at the University of Zürich he, a 22-year old with a rural background, was appointed as Research Assistant to Nobel Laureate Paul Karrer.

WHAT PEOPLE MIGHT NOT KNOW

After his retirement from science and education-related activities, he moved into a retirement village and devoted much time to the plight of the elderly, the applicable legislation and the management of retirement villages. He 'celebrated' his 80th birthday at the Supreme Court of Appeal in Bloemfontein on behalf of his fellow retirement village residents. Needless to say, the favourable verdict was a crowning experience.

A FASCINATION WITH NATURE THAT CAN CHANGE THE WORLD

"My lifelong fascination with nature and science has given me the opportunity to live a fulfilling life and contribute to shaping future South African research endeavours." This fascination led Christoph Garbers to fulfil his dreams by meeting his heroes in science and allowed him to transform the Council for Scientific and Industrial Research (CSIR). The manner in which this transformation came about even astonishes Garbers.

"Not in my wildest dreams could I have foreseen this sequence of events." It all started 60 years ago when opportunities for research in chemistry were very limited. After completing his studies, he applied to a number of organisations and secured a job at the CSIR with a remuneration of £53 per month (equivalent to R106.00). At that time the CSIR staff was small enough to allow each new employee to be introduced to the then CSIR President, Dr Meiring Naudé. "Unbeknown to me, Naudé had a farm in the Piet Retief district and my father had rendered services to him. Naudé related that my father, without my knowledge, had consulted him about the future education of his two sons, my brother and I," he says. He had recommended that the boys pursue study in the sciences.

Garbers' brother, Johan majored in chemistry and physics and pursued a career in education, while Christoph majored in chemistry and mathematics and pursued a career in chemistry. After 20 years at SU, Prof Garbers returned to the CSIR as Vice-President responsible for research funding at universities, technikons and museums in the sciences. During his first day at the CSIR, Garbers received a phone call from his brother. "He informed me that he would be joining the Human Sciences Research Council (HSRC) as Vice-President responsible for research funding at universities in the human sciences," he said. The then President of the HSRC passed away seven months later and was succeeded by Garbers' brother. Dr Chris Brink, then President of the CSIR, died unexpectedly 14 months later and I succeeded him," says Garbers, the surprise still in his voice.

Christoph Garbers graduated with a BSc *cum laude* (majoring in chemistry and mathematics) in 1948 at the tender age of 18. In 1950 he completed an MSc *cum laude* and in 1951 joined Klipfontein Organic Products Corporation – a factory that was involved during World War II in the production of chemical warfare agents and which in the post-war years used its chlorine production to manufacture the pesticides dichlorodiphenyltrichloroethane (DDT) and benzene hexachloride (BHC).

MEETING THE LAUREATES

"In February 1951, UP notified me that I had been awarded a Union Scholarship for two years for overseas study," he remarks. "I turned my attention to Professor Paul Karrer at the University of Zürich because Karrer was a Nobel Laureate in the field of organic chemistry."

"To be part of the main-stream of science was fulfilling and this was further augmented by the privilege of attending many lectures by visiting authorities in world science," he says. "I specifically recall the lectures by Niels Bohr and

Werner Heisenberg."

During a sabbatical at Imperial College in 1964 and 1965, he found himself at the laboratory of Professor Derek Barton who was awarded the Chemistry Nobel Prize in 1969.

As if meeting and working with some of the biggest names in science wasn't enough, Garbers was offered an appointment as Research Assistant to Professor Karrer on condition that he stay for a further two years. He completed his D Phil *cum laude* in 1953 and continued researching the structure of the newly isolated Vitamin B12 until the middle of 1954.

The transition from the CSIR to SU in 1958 was not an easy one. The SU Physical and Organic Chemistry Department's physical chemistry curriculum was not up to date with developments that had taken place since the 1920s and research in organic chemistry was non-existent at the institution. Garbers embraced the challenge and started with two talented PhD students; this was a major challenge because equipment and chemicals were not readily available, he adds.

In 1978, he was approached to take over from Professor Danie Joubert as Vice-President of the CSIR with executive responsibility for the Research Grants Division. "In considering the change I realised that through many people's efforts I could experience the pleasure of research, of probing the unknown and of working with keen minds."

He decided to make a clean break from his now well-equipped research department and accept the position where he would be responsible for facilitating the research careers of the upcoming science and engineering generation. After re-joining the CSIR as Vice-President in 1979, he was promoted to Deputy President in 1980 and succeeded Brink in 1980 as President of the CSIR.

The liberation struggle, increasing international isolation and demands on the State budget impacted on the CSIR during his time there. During that period, the role and accountability of research institutions all over the world was also being questioned and in response to substantial budget cuts, the CSIR decided against a policy of 'equal misery for all'.

Garbers led efforts to help the CSIR become more autonomous through greater self-sufficiency, greater market orientation and client participation, while remaining involved in research focusing on South Africa's needs. Among many other changes at the CSIR, Garbers helped bring about the emergence of a leaner CSIR with a young, capable, dynamic and motivated leadership. He also established the responsibility by the CSIR for funding research in the sciences at universities, technikons and museums in a new statutory council, the Foundation for Research Development – the forerunner of the National Research Foundation (NRF).

During his active career, Garbers served as an advisor to or on the boards, councils and commissions of many institutions. He was also a member of the National Commission on Higher Education which helped establish the National Student Financial Aid Scheme (NSFAS). His fascination with science and his dedication to research has created a better today, and untold tomorrows.

"I have come to realise that you pass this way but once, and what you leave behind is what you instil in fellow travellers. Unlocking the latent talent of particularly our youth is a cornerstone of the future."

RICHARD GOLDSTONE

AWARDS, HONOURS AND ACHIEVEMENTS

- The International Human Rights Award of the American Bar Association (1994)
- Honorary International Member of the American Academy of Arts and Sciences, and a member of its International Committee
- Honorary Bencher of the Inner Temple, London

DEFINING MOMENT

As head of the Standing Commission of Inquiry Regarding the Prevention of Public Violence and Intimidation, it was most important to be able to confirm the third-force role in the violence leading up to democracy. The Goldstone Commission has been hailed for doing more than any other inquiry or investigation to uncover the illegal activities of the South African security forces in the period overlapping the transition to democratic governance in South Africa. His reports exposed high-ranking officers who were forced to resign by former President FW de Klerk, along with other security force members. Earlier, he found that police had unlawfully shot unarmed protesters near Sebokeng and recommended they be charged with murder. Judge Goldstone considers the findings pivotal in his life and in the life of all South Africans, critical as they were to averting permanent harm to the peace negotiations.

WHAT PEOPLE MIGHT NOT KNOW

Very little, says Judge Goldstone. But he reveals that he inherited a love of classical music and opera from his mother. "There was always music in our home during my young years, morning, noon and night."

CUT OUT FOR A LIFE OF LAW

His English grandfather, in whose flat Justice Richard Goldstone spent much of his time as a child, always told him he was cut out to be a barrister. So there was never any question, he says, from the age of just six or seven, that he would study law. What his grandfather could not have known as they spent that formative time together all those years ago was that Goldstone's deep moral integrity would see him play a critical role in undermining apartheid from the inside, often tempering the worst consequences of the country's racist laws.

Goldstone's renown was not, however, confined to his home country, he won global acclaim for his outstanding legal career and for his contribution to the development of international criminal justice.

Beyond the early decision to pursue law, very little about his life and career was pre-planned, says Goldstone. "Things happened and I seemed to be around at the right time. I certainly didn't plan any of it. I wanted to be an advocate and never foresaw for a moment that I would be a judge by the age of 40."

After 17 years of practising commercial law in Johannesburg, he was appointed to the Bench of the then Transvaal Supreme Court in 1980 in the face of much opposition from those who believed he should not be associating himself with an institution of the apartheid government. From 1989 he was a Judge of the Supreme Court of Appeal, until his appointment to the new Constitutional Court by former President Nelson Mandela In 1994, where he served until 2003.

Goldstone, who was fiercely opposed to apartheid, always believed he could use his profession to fight the scourge. He successfully challenged these laws on several occasions, taking such a firm ethical stance regardless of popular opinion that he won the respect of not only apartheid President FW de Klerk, but also of future President Nelson Mandela and the African National Congress.

DUTY TO ACT MORALLY

He has been quoted as saying that "if a judge is to err, it should be on the side of defending morality". He believes judges have a duty to act morally and has always been adamant that if the laws they are dealing with have an unjust consequence, it is their duty to use their powers – however limited – to "interpret the laws and give judgments which make these laws less harsh and less unjust."

Among his important rulings Goldstone is credited with making the Group Areas Act almost unworkable by restricting evictions of people from 'whites only' areas, an intervention that saw a virtual end to prosecutions under the Act. In 1986, he was the first judge under apartheid to free a political prisoner

detained under the draconian laws imposed by a recently declared state of emergency and, in another case, he ruled that a detainee should be released because the police had failed to inform him he was entitled to consult a lawyer.

Later, as the Chief Prosecutor for both the International Criminal Tribunal for the former Yugoslavia (ICTY) and the International Criminal Tribunal for Rwanda (ICTR), Goldstone contributed to precedent setting judgments on genocide, war crimes and crimes against humanity. The invitation in respect of the ICTY, from the United Nations Secretary-General Boutros Boutros-Ghali, saw Goldstone become the first South African to be offered a major international post after the country re-joined the international community following the first democratic elections.

When he conferred a Doctor of Laws (*honoris causa*) degree on Goldstone in 2012, Head of Law Procedure and Law of Evidence at the University of the Free State (UFS), Professor Neels Swanepoel said the Judge had contributed to laying the foundation for conflict resolution in societies 'that have transformed from repressive to democratic rule,' or what is now referred to as 'transitional justice'.

Goldstone says that while he could never have predicted the direction his life and career would take, he is grateful and humbled to have played such an important role during crucial world events. He adds that he has President Nelson Mandela to thank for his international experiences in Yugoslavia and Rwanda: It was South Africa's first democratic President who allowed him to take leave of absence from the Constitutional Court at that time.

He refuses to take any special credit for his role and says that while war crimes commissions are extremely tough for everyone, including him, the real heroes are the investigators who gather the crucial evidence. "They are really the people who carry the biggest burden. They're out there in the field gathering information about the losses and the atrocities. By the time that information came to me, all the hard work had already been done.

"That doesn't mean it was easy for me, and I certainly lost a lot of sleep. It's the individual stories that really get to you, when you hear about what one single person had to endure. The bigger picture is much easier to cope with than those stories," he says.

Prisoners and their welfare and rehabilitation were another important focus for Goldstone who in 1985 was elected national president of the National Institute for Crime Prevention and the Rehabilitation of Offenders (NICRO), a position he filled until 2000.

He has been quoted as saying that he tried to balance his commitment to the Bench, which "often required me to make morally compromising and politically difficult decisions", with assisting with ways to rehabilitate former prisoners.

It is no surprise that Goldstone says he "likes to be busy", considering that since his retirement from the Constitutional Court in 2003, he has been a visiting professor at seven different law schools in the United States in what has become an entirely new profession.

DIANE GRAYSON

AWARDS, HONOURS AND ACHIEVEMENTS

- University of Pretoria (UP) Laureate for Education Innovation (Team Award) (2012)
- Honorary PhD (Science Teacher Education), Umeå University, Sweden (2006)
- Journal of Research in Science Teaching: Best paper of the year (with two co-authors) (1999)

DEFINING MOMENT

Inspired by her students who worked hard in spite of their difficult circumstances, she decided in the early 1980s that what she really wanted to do was to teach physics to students who were committed but who had to overcome enormous disadvantages.

WHAT PEOPLE MIGHT NOT KNOW

"Perhaps what most people don't realise is that I am a very adventurous person. I like new things, new ideas, new people, new places. I like change and I like innovation."

ALWAYS A BETTER WAY TO TEACH AND LEARN

A trained physicist, Diane Grayson was inspired at an early stage in her career to become involved in teaching the science she so loved to do. "I am driven by the desire to try and help people fulfil their potential. I think at heart that is what a teacher is," she says.

"When I was given a temporary part-time position as a junior lecturer at the then University of Natal, now University of KwaZulu-Natal (UKZN), the first students I was assigned to teach were medical students." At that time, almost 40 years ago, the University of Natal (part of what later became the UKZN) was reserved for white students only, while the medical school was only for black students. "I remember being incredibly impressed by the students' commitment and diligence, despite how difficult their circumstances were."

Some of those students, she recalls, would miss meals during the week so that they could save a little of their bursary money to send back to their families. "I was also struck by the fact that they were working against difficult odds in terms of the kind of schooling they had. They were remarkably intelligent and diligent." These young people, she says, drew her to her calling. She decided that she wanted to teach physics to students who were committed and needed a chance in life to allow them to excel.

Her own journey to a lifelong love of physics began as a young girl, inspired by the space race of the 1960s. "Our science teacher had us singing 'space songs' and I remember telling my parents that I wanted to be an astronomer," she recalls. "My father was very supportive of my science dreams and we would have many dinner conversations about science." At school she already found herself stepping into the shoes of a teacher, often helping her fellow pupils understand the science they were learning in the classroom. While pursuing her undergraduate physics and mathematics degree at the then University of Natal in the late 1970s, she continued tutoring other students.

"I had considered becoming a school teacher when I first started at university but I thought the schooling system was oppressive so I didn't want to go back into it," she says. "But I really wanted to teach, so it seemed natural that I would consider teaching at a university by becoming a lecturer." While working on her MSc in plasma physics at the then University of Natal, she was appointed as a temporary junior lecturer. But she really wanted to focus more on improving the teaching and learning of physics and she got her chance when she was awarded a Fulbright fellowship to do her PhD in physics education at the University of Washington.

Since her return to South Africa in 1990 she has worked in numerous ways, including through research, to improve the learning and teaching of not only physics but other sciences and engineering in the country. It concerns her that so much science teaching puts students off science instead of making them excited about it. "Many students don't get good science teaching from people who have a deep understanding of the subject matter, and so their chances of becoming professionals in scientific fields is often taken away from them."

"Every society, particularly in developing countries like South Africa, needs professionals in science-based careers," she says. "My involvement in physics education was a way for me to pursue the things that I was good at, while at the same time making a significant contribution to national development."

As the new millennium rolled in, there was great excitement as digital technology and the rise of the Internet were touted as the key to changing education for the better. However, Grayson says technology in science education today is underused, and in places where it is used, there is often a lack of imagination. "It is potentially a very powerful tool in the hands of someone who understands how people learn," she says. "Computers are often merely used for online quizzes, or searching the Internet, or watching YouTube videos of someone giving a lecture. These, to my mind, are very unimaginative and I am not sure that they actually promote learning."

UNDERSTANDING HOW PEOPLE LEARN

She believes that the most important thing when using technology is to understand how people learn. "Cognitive science tells us that people do not learn through passively receiving information, but that they learn by being actively engaged with physical phenomena, with ideas and with other people."

While the poor use of technology in science education was a major issue for her as programme chair of the local organising committee for the 4th International Union of Pure and Applied Physics (IUPAP) International Conference on Women in Physics (2009 – 2011), she was also well aware of another major issue: "For some reason, of all the sciences, physics is the one that has the lowest proportion of women in it."

She has dedicated her whole career to promoting good science teaching, that leads to effective learning, both to give more students a better chance to enter science-related professions, and to help more people experience the joy of learning about the universe and everything in it.

"While I don't do any classroom teaching anymore, I think that my whole being is that of a teacher. All of my work is in some way related to helping people to develop themselves and their abilities and to be the best that they can be."

FRITZ HAHNE

AWARDS, HONOURS AND ACHIEVEMENTS

- South African Mathematical Society Award for the Advancement of Mathematics (with Neil Turok) (2010)
- De Beers Gold Medal of the South African Institute of Physics (1995)
- Havenga Prize for Physics (1991)

SIGNIFICANT MOMENT

Being approached to be a part of the creation of the African Institute for Mathematical Sciences (AIMS). "AIMS was unbelievable."

WHAT PEOPLE MIGHT NOT KNOW

I used to play chess and I jog.

BUILDING SCIENCE ON THE CONTINENT

Fritz Hahne grew up in KwaZulu-Natal speaking English and German. The son of a German pastor, he went on to study physics and mathematics at the University of Pretoria (UP), where he managed – after a while – to also master Afrikaans. At UP he met Chris Engelbrecht, a fellow physicist who had just returned from a PhD at the California Institute of Technology. Drawing on cutting-edge material picked up on the other side of the Atlantic, Engelbrecht taught Hahne at postgraduate level. The two became firm friends and colleagues, and when Engelbrecht got a job at Stellenbosch University (SU) in the early 1980s, Hahne followed him there.

Hahne had already fallen in love with the Cape, having completed his PhD at the University of Cape Town (UCT) in 1967. At the time, UCT was one of the few institutions in the country able to provide doctoral supervision in theoretical physics. After his PhD, Hahne returned to Pretoria to work at the National Physical Research Laboratory, followed by a period at the Atomic Energy Board. In 1981 he joined SU as a professor of physics.

In the 1980s Hahne and Engelbrecht and others started a series of summer schools in theoretical physics. The schools invited lecturers from abroad to come and share their expertise. "We built a group of young South Africans, mostly white but some black and some Indians as well." This was at the time of the academic sanctions against South Africa, which meant that not everybody wanted to come here. "I had some very nasty letters from people who said they would never come to South Africa and what were we thinking, inviting them? It was shocking for us, but in a sense we understood. We were living in an unnatural environment and trying to do the best we could."

Many of the students who attended the summer schools went on to become leaders in physics in South Africa. These schools, now called Chris Engelbrecht Schools for Theoretical Physics, continue to the present day, thanks to ongoing efforts by Hendrik Geyer and Frikkie Scholtz. Many of the courses appeared as separate volumes of the Springer series, *Lecture Notes in Physics*.

Hahne became chairman of SU's Department of Physics in 1985 and Dean of Science in 1991. As a leading member of South Africa's physics community, he was also involved in supporting the creation of major infrastructure projects including the Southern African Large Telescope (SALT), inaugurated in 2005. However, as South Africa's physics community blossomed, he could also see the challenges that his colleagues elsewhere in Africa faced. After the apartheid-era travel restrictions eased up, Hahne travelled with an SU delegation to Gabon to visit a science university in the Central African country. Relationships were formed and his Gabonese colleagues visited Stellenbosch. Then, one day in the late 1990s, they stopped replying to his emails. "I thought, what have I done wrong?" Only later did he discover that for more than a year they had been hamstrung by university strikes. "Everything had closed down, including the email servers." He saw it happen again in the Congo and his frustration grew. "A lot of them are really talented, but then there is a strike and the whole place where they work is shut down."

REACHING OUT

Hahne got another chance to reach out to young scientists across Africa in 2002, just as he was looking forward to his retirement. He was on his second five-year term as Dean of Science at SU with a long and illustrious career as a physicist behind him. But then he met Neil Turok, a much younger physicist with big plans. Turok, the son of anti-apartheid activist Ben Turok, was a professor at

Cambridge University at the time. He wanted to create a mathematics training institute for African students in his home country. In 2002, he approached several institutions and leading academics in South Africa with the idea. But few thought it would work. Then he went to see Hahne: "I said it's a wonderful idea, we *have* to make it work."

The African Institute for Mathematical Sciences (AIMS) opened its doors in Muizenberg, a beachside suburb of Cape Town, in July 2003, with Hahne as its founding director. "It took a little over a year from the time Turok knocked on my door to AIMS taking on its first students." The institute accepted a few dozen students from around Africa for year-long courses. The students had undergraduate science degrees but needed additional preparation – especially in mathematics – to attain an academic level where they would be able to pursue international-level postgraduate training.

With AIMS, Hahne was able to feel that he was doing something concrete to help build science on the continent. That feeling buoyed him and Turok even though they were going through some tough times. The big challenge was funding, and six months before welcoming the first batch of students, the two had a long phone conversation about money. Simply put, there wasn't enough. "Eventually, at 3 am, we said let's just do it" It was a big chance we took, but shortly after that call the money began to trickle in. The first students had to help them carry the furniture into the building, which was still being renovated. But they did it with big smiles on their faces, says Hahne. "That was wonderful."

Hahne stayed on as Director of AIMS for seven years. A research centre was linked to AIMS in two separate buildings. In that time, the project snowballed and today there are several AIMS institutes dotted across Africa. Its headquarters have moved to Rwanda's capital Kigali. AIMS gave birth to the Next Einstein Initiative – a multimillion-dollar project to make sure that African scientific talent is given the opportunity to develop and thrive, to nurture a generation of 'Einsteins' in Africa. It's all got very big, Hahne admits. But at the start it was small, yet very effective, he says. "We started AIMS with four staff. Much of the curriculum was left to the visiting lecturers to design. Everyone worked on a first-name basis. I really enjoyed breaking out of the stiff university environment."

After leaving AIMS, Hahne was approached to chair the Science, Technology, Engineering and Mathematics (STEM) Education Standing Committee of the Academy of Science of South Africa. Among several projects, he got involved in school education, and with the help of colleagues of the French Academy of Sciences, Hahne remains involved in furthering inquiry-based science and mathematics education in the Western Cape and beyond.

RAYMOND HAINES

AWARDS, HONOURS AND ACHIEVEMENTS

- National Research Foundation A-rating (1985; one of the first two original awardees in chemistry)
- Senior Research Fellow/Scholar at Corpus Christi College at Cambridge University (1982)
- Raikes Medal (1973) and Gold Medal (1993) from the South African Chemical Institute

DEFINING MOMENT

His appointment at the University of Cape Town (UCT) when he was still working for the South African Iron and Steel Corporation (Iscor) was significant because he went into academic life from then on.

WHAT PEOPLE MIGHT NOT KNOW

"I've always loved sport – as a student I was captain of the University of Natal soccer team in Pietermaritzburg, second-team university cricket, rugby for three years while in the United Kingdom, social squash, club dinghy sailing with the family and competition golf with my wife until work pressures made both of us give up sport."

A LIFE OF SCIENTIFIC LEADERSHIP

Raymond Haines would like to believe he missed a chance at a Nobel Prize in Chemistry by no more than a few months. All the same, he has made his mark on the scientific world through decades of leadership at higher education and research institutions around South Africa.

In the late 1960s, industrial and academic chemists around the world were trying to understand an important and recently discovered reaction known as alkene metathesis (referred to as 'olefin dismutation' at the time) – a very efficient way to bond two organic molecules. Haines and a colleague at the University of Sussex studied the mechanism of this reaction and thought they had found the answer.

"There was a lot of conjecture about alkene metathesis around the world at the time," says Haines. "We believed we had found the actual mechanism; it was a most unusual procedure. Unfortunately due to teaching pressures at UCT, it took us some time to report our findings and the article, a review later designated a citation classic, came out much later than we had hoped."

In the meantime, French chemist Yves Chauvin had published similar findings with what Haines now admits was better evidence. Chauvin won the Nobel Prize in Chemistry in 2005, along with Richard Schrock and Robert Grubbs. The process they described is now widely used in industrial processes, particularly in manufacturing pharmaceuticals. For his part, Haines turned to other pursuits and in particular metal cluster chemistry.

Now retired, Haines has left an indelible mark on the South Africa research landscape. After a three-year period at UCT, he joined the Chemistry Department of the University of Natal in Pietermaritzburg (now part of the University of KwaZulu-Natal), and became Head of Department in 1978. He was appointed Dean of Science in 1992 and subsequently Science and Agriculture, a position he held until his retirement from the post at the end of 2001. He also served on many different review boards and committees, including the Council of the University of Natal, numerous Senate committees of the University, the Advisory Committee of the National Chemistry Research Laboratory of the Council for Scientific and Industrial Research (CSIR) and the Board of the South African Chemical Institute. After his retirement, he spent 13 years as a Chair of the National Research Foundation's (NRF) Subject Assessment Panels and as a member of the Executive Evaluation Committee.

"After my retirement, my wife and I moved to Cape Town in 2005." He explains: "I worked closely with Professor John Moss at UCT until his sudden and unexpected death led me to cut ties to some extent with chemistry."

"I never lost touch with science though. I chaired NRF-ratings committees for virtually every research discipline in the country, and learned much about all the research being tackled in South Africa." He is extremely proud of the contribution he has made to South African science through his involvement in these NRF-ratings committees.

"I think the rating system is very important. The assessor and chairperson have to be from very different areas to ensure objectivity and consistency. It was quite fascinating, and I've always felt it was a very important contribution."

Born in the United Kingdom and a member of a family of engineers and scientists, young Raymond Haines had little doubt that his would be a life of scientific rigour. "I'm the second oldest of six brothers; my next brother down from me has a PhD in chemical engineering, becoming the technical director of a major South African mining house; the next one down took over my father's construction business; the next was a civil engineer; and the youngest is a mechanical engineer and senior lecturer at Stellenbosch University (SU). And my older half-brother was a biochemist at the Medical Research Council at Cambridge University."

Completing a BSc in Chemistry and Physics at the then University of Natal exposed Haines to a strong chemistry department and he followed his heart towards chemistry and inorganic chemistry, completing an Honours and Master's degree there. "I enjoyed inorganic chemistry most; I can't really explain why but something about it grabbed me. In a way it contains the full spectrum of the physical world. I was also fascinated by the remarkable range of colours produced by inorganic compounds and materials."

His undergraduate and initial postgraduate studies were funded through an Iscor bursary and subsequently a prestigious Shell Undergraduate Scholarship but after 5 years of study he was ready for a change of scenery. Under contract to the parastatal company (later ArcelorMittal) he joined their research division, serving out 18 months contract in their research division. That led to an opportunity to complete his PhD at University College London under one of world's leading inorganic chemists at the time, Sir Ronald Sydney Nyholm. Haines was awarded the PhD in 1966. It was here that he met his wife, a fellow academic and now an internationally acclaimed statistician.

Returning to Iscor, he soon found himself drawn back to academia and to a post at UCT. However Haines' academic career quickly transformed to one of leadership as at the University of Natal he soon became a Head of Department and subsequently, a Dean. He says that one of his best contributions at the university as Head of Department of Chemistry was to ensure that the department and its research groups remained strong. Although a small department, it attracted a good number of Honours and MSc students and stayed competitive with the other major universities at the time such as UCT and the University of the Witwatersrand (Wits). He oversaw the setting up and the development of a science foundation programme at the university designed to help promising disadvantaged students prepare for a BSc degree. It attracted its first group of students in 1993 and is still running.

He is pleased with another major contribution he has made to South African science: As an original Member of Academy of Science of South Africa (ASSAf), he contributed the chemistry chapter of the publication on the *State of Science in South Africa* (2009) published by ASSAf.

MANFRED HELLBERG

AWARDS, HONOURS AND ACHIEVEMENTS

- SAIP De Beers Gold Medal of the SA Institute of Physics (2014)
- Elected Fellow of the Institute of Physics (UK) in 1998; Emeritus Fellow since 2011
- Secretary of the Plasma Physics Commission of the International Union of Pure and Applied Physics (1993 – 1996)

DEFINING MOMENT

Having the opportunity to do a PhD at Cambridge, an experience that was challenging but stimulating and exciting.

WHAT PEOPLE MIGHT NOT KNOW

"One of my big hobbies at school was cricket statistics. I went to the newspapers in Cape Town and offered them my statistics and it developed into a lucrative hobby as I became the resident cricket statistician for two newspapers."

A LIFE DEDICATED TO DEVELOPING PHYSICS IN SOUTH AFRICA

Like the stories of many prominent physicists, Manfred Hellberg's fascination with the universe started at a very young age, and with the help of a committed teacher he found his calling. "As a kid I was always curious about things and where they came from. In fact, in my junior high school days I was also very interested in history and biology – I had very broad interests.

"I was drawn to theoretical physics by a teacher who never actually taught me," says Hellberg. "I was at Rondebosch Boys' High and there was an excellent mathematics teacher who was very short and was affectionately known as 'Tickey' de Jager." Hellberg recalls how Tickey would give afternoon talks about atomic and nuclear physics. "He gave lectures which were outside the curriculum, in fact they were based on a university textbook at senior undergraduate level," he says. "He had a degree in physics and mathematics, and that strongly influenced my interest in theoretical physics."

When Hellberg got to university, he had already decided that he would study mathematics and physics, and that he wanted to be an academic. "I was actually interested in theoretical nuclear physics as an undergraduate, and I wanted to do a Master's in it." But he changed fields as Professor John Irving, the professor of Theoretical Physics at the University of Cape Town (UCT) in the late 1950s, had switched his own research from theoretical nuclear to plasma physics.

The defining moment in his career came when he received a scholarship to go to Cambridge to complete his PhD. "It was a totally different ballpark when I got there; everybody around me was very smart indeed: For instance, I shared an office with Stephen Hawking. I also took every opportunity to go to international conferences."

He considers the networking he did at those conferences incredibly important since not many South African academics had this kind of exposure in the 1960s. After completing his PhD in 1965, he took up a post as a lecturer in physics at the University of Natal in Durban (now the University of KwaZulu-Natal). During his career he played an active role in student development, teaching development and research development, and was involved in university leadership.

His research on waves in plasmas (high-temperature ionized gases, found for instance in the space environment), together with students and international collaborators, included some pioneering works that have led to numerous citations and significant international recognition.

Over the years, he has also contributed to the development of physics and science in South Africa, serving on the Council of the SA Institute of Physics for ten years. When the South African Nuclear Energy Corporation's (Necsa) laser-based isotope separation project was threatened with closure in the late 1990s, Hellberg stepped in as President of the South African Institute of Physics to garner support from the Department of Science and Technology (DST), now Department of Science and Innovation as well as the National Research Foundation (NRF). He argued that the laser facilities and expertise should not be lost, ultimately leading to the successful National Laser Centre, on whose board he served for six years. He refuses to take all the praise for that and many of his other achievements, instead emphasising the contributions of many colleagues and organisations whose "ears were receptive to his pleas".

TO THE RESCUE

Another important contribution came a few years later, as fears were mounting within the physics community that a drop in student numbers would weaken the future of physics and science in South Africa. The South African Institute of Physics (SAIP) Council once again obtained the support of DST and NRF, and in 2004, the latter appointed an eight-member international panel with Hellberg as convenor to look into shaping the future of physics in South Africa.

An intensive two weeks of travelling around the country, involving wide-ranging consultation with all stakeholders led to a 110-page report with recommendations aimed at concerned groups such as funders and university physics departments. "Many of the proposals fell on receptive ears, and thanks to the continued drive by successive SAIP Councils, and support from the DST and NRF, a number of important recommendations came to fruition," he says.

In 2010, then Minister Naledi Pandor appointed Hellberg to prepare a report on strategies and policies to develop astronomy in South Africa. He again consulted widely and was supported by a small expert group, including renowned cosmologist Professor George Ellis.

Internationally too, Hellberg's expertise has been in demand. He served on the Plasma Physics Commission of the International Union of Pure and Applied Physics (IUPAP) for three terms, on the editorial board of the *Plasma Physics and Controlled Fusion Journal*, and on the Editorial Advisory Panel for the IOP Plasma Physics book series from 1990 to 1996.

He has been on advisory committees of numerous international meetings, including 25 years of service to the International Congress on Plasma Physics (ICPP), covering 13 conferences. Together with his former student and later colleague, Professor Ramesh Bharuthram, he also brought the International Conference on the Physics of Dusty Plasmas to Durban in 2002. Hellberg was elected a Fellow of the University of Natal (now the University of KwaZulu-Natal) and the Royal Society of South Africa in 1992 and the Institute of Physics in London six years later. In 2000, he was elected a Member of the Academy of Science of South Africa (ASSAf) and served on its Council from 2004 to 2010.

Elected an Honorary Member of South African Institute of Physics (SAIP) for services to the institute in 2002, he received its highest honour, the SAIP De Beers Gold Medal in 2014 for his outstanding, internationally recognised research career in plasma physics, and the numerous contributions he has made in his service to physics in South Africa.

Since his 'retirement' more than a decade ago, Hellberg's research has flourished and his citation rate has regularly exceeded 300 annually. However, he is slowing down and is looking forward to spending more time with his wife Karin who has patiently supported him for more than half a century as he pursued his love of research and helped build and invigorate the field of physics in South Africa.

| EUGENE JULIES |

AWARDS, HONOURS AND ACHIEVEMENTS

- Poynter Fund for Media Studies (1987 – 1988)
- Aurora Fellowship (1984 – 1988)
- Alec Brook Scholarship (1975 – 1976)

DEFINING MOMENT

The first time he travelled overseas he saw the world outside apartheid South Africa and realised he had been denied opportunities to engage with people as equals and to express his opinions on politics and anything else without fear of repression.

WHAT PEOPLE MIGHT NOT KNOW

"I like to do 'colouring-in', not just using adult colouring books but even children's books; I find it relaxing and at the same time expressive."

ENSURING QUALITY IN ALL THINGS

Ships and spies carved a decade-long gap between Eugene Julies' first enrolment to study chemical engineering at the University of the Witwatersrand (Wits) in 1975, and his eventual *cum laude* graduation overseas. "I was moderately successful at Wits until the Soweto Boycott in 1976 when I became involved in politics on campus." At that time, a comrade he had suspected of being a government spy had tried to recruit him to join the resistance movement. "Fortunately I did not join because that person indeed turned out to be an *impimpi*, responsible for the arrest of several of my university friends."

Nevertheless, he was forced to leave university. He joined the Unicorn Shipping line where he became a navigating cadet and was part of the first black group to enter into the officer corps, which had previously been reserved exclusively for whites. "There I spent four years before graduating with a government Certificate of Competency as Second Navigating Officer (Foreign Going), among other certificates."

After four years at sea for Unicorn Shipping, he got married and returned to South African shores in 1981. "This part of my life was one of the most interesting. If I had my way, I would still be doing it today," he says.

"However, getting married and the birth of my first child really made me understand that the world revolves around others too."

He found work as an assistant to a metallurgist in the automotive sector and learned the skills of photomicrography (photography using a microscope) and fracture analysis.

He also worked as a quality supervisor and while doing research one day he walked into the American Library in Cape Town and discovered an opportunity for a scholarship to study in the United States. He decided to take it and his studies in Florida opened his eyes to the possibilities available outside apartheid South Africa.

He obtained a BSc in Mechanical Engineering (*cum laude*) and was awarded a plaque for Best Engineering Student at the Florida Institute of Technology in 1988. He would go on to complete a Master's at the University of Florida, and he was awarded the University President's Award for Service to the Community.

SERVICE TO THE COMMUNITY

Part of service to the community for Julies meant helping engineering students at a community college with their instrumentation and measurement coursework while at the same time teaching instrumentation and measurement to engineering students at the university. While working for Aircraft Porous Media, where he designed fuel, lubricant and hydraulic filter units, he was also part of their 'Big Brother' programme to motivate scholars who were at risk of dropping out of school.

It was here that he did his first designs for aircraft parts, including a small lever for the B2 bomber and a small component for the Airbus A340. "It was amazing to have one of my designs actually manufactured and fitted to an aircraft – even if it was only a ten-millimetre long hinge pin. I felt as if all my training had finally come together to create something physical and concrete."

Julies registered as a professional engineer back in South Africa in 1992 and joined the Elektrode Maatskappy van Suid Afrika (EMSA) as head of Industrial

Engineering. Even at that level, he still offered tutoring to local matric students from time to time and he became a member of the Vereeniging Further Education and Training (FET) College. He would later consult at what is now Denel on the manufacturing of components for the Oryx and Rooivalk helicopters.

In 1998 he became the first black head of a science council, serving as President and Chief Executive Officer of the South African Bureau of Standards (SABS).

His career up to that point had shaped his thoughts on management, so he naturally jumped at the opportunity to take on the leadership of SABS. "I could finally put into practice what I always preached about management," he says. "At SABS we had a direct impact on people's lives through product safety testing and we provided the South African consumer with assurance of safety and quality." Julies pioneered the SABS's policy of supporting small businesses by performing tests on products at a 50% discount, and his work there earned him a place on the Technical Advisory Group of the International Organisation for Standardisation (ISO), representing both South Africa and Australia.

His international influence included serving a period on the Executive Board of ISO, and extended as far as Afghanistan and other regions in the Middle East and North Africa, where he worked with the UN on standardisation and quality projects.

While at the SABS he served in many advisory roles locally and around the world including the South African Auditor Certification and Accreditation Association and the International Organisation for Standardisation Executive-Finance Committee.

He now lectures undergraduate students on a part-time basis at the University of KwaZulu-Natal in the Property Management and Quantity Surveying Programme. "It is always a joy when my students ask me to teach them again in the next semester because it shows that I must be doing something right," says Julies.

"It makes me proud to contribute to their education, as it is a confirmation that I am doing something of consequence."

JOHANN KIRSTEN

AWARDS, HONOURS AND ACHIEVEMENTS

- Exceptional Achiever Award from the University of Pretoria (annually, 2004 – 2016)
- Vice-President: International Association of Agricultural Economists (2006 – 2009)
- Agricultural Scientist of the Year Award (2004)

DEFINING MOMENT

Johann Kirsten considers his 1996 appointment as Head of Department at the University of Pretoria's Department of Agricultural Economics – at the age of 35 – to be a defining moment in his career.

WHAT PEOPLE MIGHT NOT KNOW

When he is not leading Stellenbosch University's Bureau for Economic Research, he rears sheep on the farm he bought in the Karoo back in 2010.

A PROBLEM SOLVER PAR EXCELLENCE

Johann Kirsten has dedicated his career to tackle some of South Africa's most stubborn problems and to protect some of its most cherished treasures. He has focused on the agricultural economy, food security and the land debate. He has masterminded the development of signature products like 'Karoo lamb' and 'Rooibos tea' into certified brands. Kirsten not only developed a university department into one of the most recognised in Africa, but also secured a multi-million-rand grant to keep igniting young minds.

Kirsten was born in Cape Town in 1961. The agricultural seed was planted early. As a young boy, he would look forward to holidays on his family's farm. He enrolled for a BSc Agriculture degree in Agricultural Economics at Stellenbosch University (SU) in 1980, following in the footsteps of his grandfather, Professor Frederik Tomlinson, who was seen as the father of the field in South Africa. "It helped me to understand how interesting, entertaining and complex agricultural economics could be."

As a young man he moved to Pretoria in 1987 to work as an agricultural economist at the Department of Agriculture and completed his Master's degree at the University of Pretoria (UP). He was posted to the South African embassy in London in 1989 as an agricultural attaché, where he gained a deeper understanding of international food systems, agricultural commodity markets and the global politics of agriculture and trade.

By early 1992, it was clear that change was coming to South Africa and Kirsten was among those embassy staff who were recalled from around the world. He joined UP under his mentor and former supervisor, Dr Johan van Zyl, who recruited him as a lecturer in the Department of Agricultural Economics, Extension and Rural Development. In 1994, as the new, democratic South Africa was born, Johann Kirsten obtained his PhD and was appointed a senior lecturer the following year.

Kirsten was involved in the crucial process of considering new agricultural and land reform policies for the State. In 1996 he joined forces with Van Zyl and several international colleagues to publish a seminal book, *Agricultural Land Reform in South Africa,* which highlighted the best ways to implement the process and warned against mistakes that could lead to delay or failure. Kirsten says it has been difficult to watch "each and every one" of those mistakes being made. "None of the lessons were taken seriously and therefore we're now in the terrible situation where we still have land being central to the argument for injustice and inequality."

In the same year that the book was published, Kirsten was elevated to associate professor and head of department, once again following in the footsteps of his legendary grandfather who had been Head of Department half a century before.

FROM THE GROUND UP

Kirsten spent the next 20 years rebuilding and cultivating a department that had been "left in tatters" by the sudden departure of its two previous Heads of Department. He engineered a series of changes and expansions: "I created a number of new units, recruited a set of interesting people and did a number of juggling acts that saved and expanded the department."

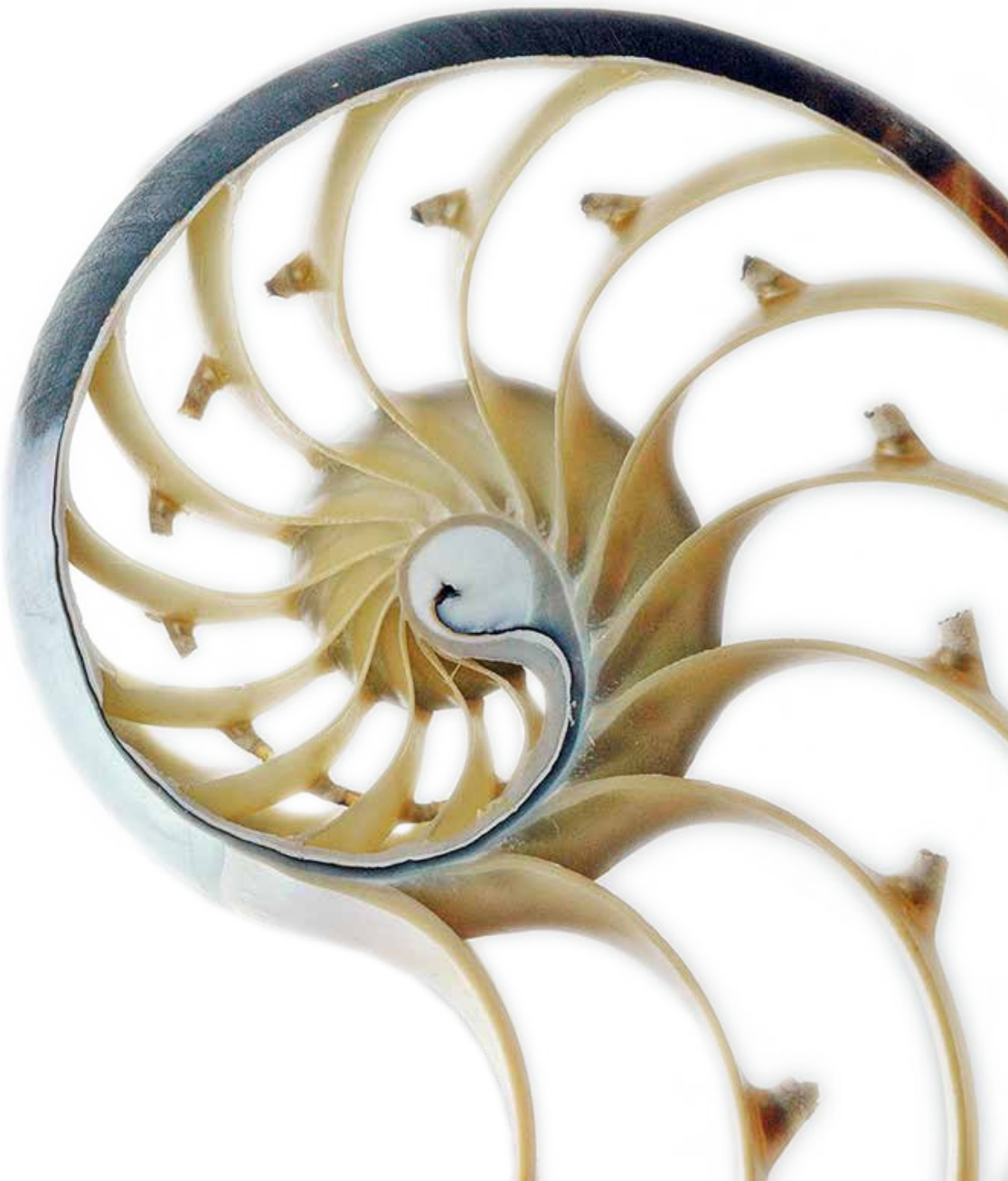
Kirsten redesigned the Master's-level agricultural policy analysis module to be on par with the best in the world and his institutional economics module became the only course of its kind in South Africa. He also supervised or co-supervised more than 100 postgraduate students: 75 at master's level and 28 PhD candidates. He played an important role in the establishment of the African Economic Research Consortium's collaborative Masters' programme in agricultural and applied economics, which brings scores of students together from 16 universities across Africa every year to share knowledge and skills.

In the early 2000s, Kirsten refocused on agricultural policy and helped write South Africa's draft *Agricultural Strategic Plan* under then President Thabo Mbeki, gaining insight into how the land reform issue was being handled and how "bureaucracy was stifling the entire project". He also drove the establishment of a new research unit, the Bureau for Food and Agricultural Policy (BFAP), which models agricultural policy scenarios. "From a small idea, we developed it into an institution that makes invaluable inputs into policy decisions."

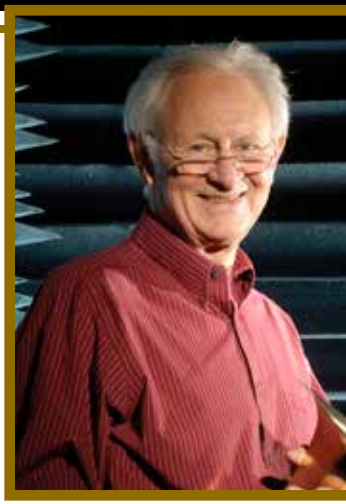
His academic achievements and personal perseverance helped him secure a string of national and international research grants at UP, culminating in a massive $4.8 million (over R80-million at the going exchange rate) grant from the Bill and Melinda Gates Foundation in 2011.

By 2008, Kirsten had shifted his focus away from pure agricultural economics and started to research the principles of institutional economics, specifically the economics of origin-based foods and the well-loved tastes of Karoo lamb, honeybush tea and Rooibos tea. His research into how they might be protected with geographical indications was instrumental in building protocols and systems of certification for all three South African products. "In the end, the sheep farmers challenged us to take the process even further," Kirsten says, "so we registered the certification mark for Karoo lamb, established an NGO and also started a non-profit company to protect the name 'Karoo Lamb'."

After 20 years at the helm of his department, Kirsten resigned from UP in 2016 and joined SU as a professor and head of the Bureau for Economic Research. There he focuses on economic research, consulting and policy-making. Kirsten has already left an indelible mark on agricultural economics and impacted the careers of countless students and professionals. His goals for the future are no less grand: "If we can turn the economy around, if we can finalise the land issue and if the Karoo Lamb initiative spreads to Europe, I would have achieved everything I set out to."



JAN MALHERBE



AWARDS, HONOURS AND ACHIEVEMENTS

- Identified in the University of Pretoria centenary celebrations as one of the university's Leading Minds of the last 100 years (2008)
- Life Fellow of the Institute of Electrical and Electronics Engineers (2008)
- Havenga Prize for Engineering (1995)
- Awarded the Institute of Electrical and Electronic Engineers (IEEE) Third Millennium Medal in 2000, "*For outstanding achievements and contributions*".

DEFINING MOMENT

Probably when he was identified for comprehensive support by the then Foundation for Research Development (forerunner of the National Research Foundation) and later having his section identified as the first Centre of Excellence by the Foundation.

WHAT PEOPLE MIGHT NOT KNOW

He is a romantic and he loves history and classical music – from the romantic composers to Mahler and Strauss. He is totally committed to the development and preservation of Afrikaans.

BEYOND THE CALL OF DUTY

After serving the engineering profession and the higher education system in South Africa in various capacities for decades, Jan Malherbe has returned to his original 'hobby' and his greatest fascination – research. He now works as a retired professor of Electronic and Computer Engineering at the University of Pretoria (UP), where he was previously Dean of Engineering and Vice-Principal of the institution.

"My research has been my hobby since I first started working at a university," he explains. "I did it because I believed it was necessary, but also because of the immense satisfaction of creating something unique. The first seven years after graduation were spent in 'engineering'. And then I started teaching and loved it: I discovered what I wanted to do when I grew up. And after the 15-odd years in academic administration, I am now again doing what I love."

Malherbe is considered one of the leading researchers at the Electronic and Computer Engineering Department at UP and was the first engineer to receive a B-rating from the National Research Foundation (NRF). Over the span of his career at UP he has received numerous awards for his research achievements and his contributions to the advancement of research in the department, faculty and university. He currently holds an NRF-rating of C2.

STARTING WITH A RADIO

Drawn to technology early in life he noticed the circuit diagram and instructions for building a simple radio set while flipping through a youth magazine. "I was interested because radio fascinated me then, more from a reception point of view than the electronics. Somewhere I obtained a simple kit for a one-valve radio, with earphones. I became more interested in electricity and wires and built my first hi-fi set while still at school. But I did not choose a career in science and after school, engineering seemed like a good idea – radios and amplifiers and antennas (then still called aerials) drew me.

"Here I offer a bit of philosophy: Very, very few youngsters know what a career means, how to choose it, and whom to ask for advice. You make one of the most important decisions of your life without the necessary knowledge. Some of us are just lucky!"

During the isolation period in South Africa he worked overseas in the 1960s and again in the 1970s, gaining insights and exposure that helped him career-wise and as a person. "When I started working in England directly after graduating, I worked with other young people and shared the things that young people are interested in, of which politics was the least important – even though we were registered as 'aliens' with the local constabulary. In the late 1970s, in the United States this time, we were again fortunate enough to be assimilated into an extremely cosmopolitan community, and your outlook on life is broadened by the experience and vision of others. From a career point of view, having the best people working with and for you is key to success, even more important than having superior facilities."

In the 1960s, Malherbe worked in the United Kingdom for General Electric. He returned to South Africa to the Laboratory of the Department of Posts and Telegraphs in Pretoria and then taught Electrical Engineering at Stellenbosch University. He left again in the late 1970s to study and work at the University of Illinois, Urbana and then at Stanford University.

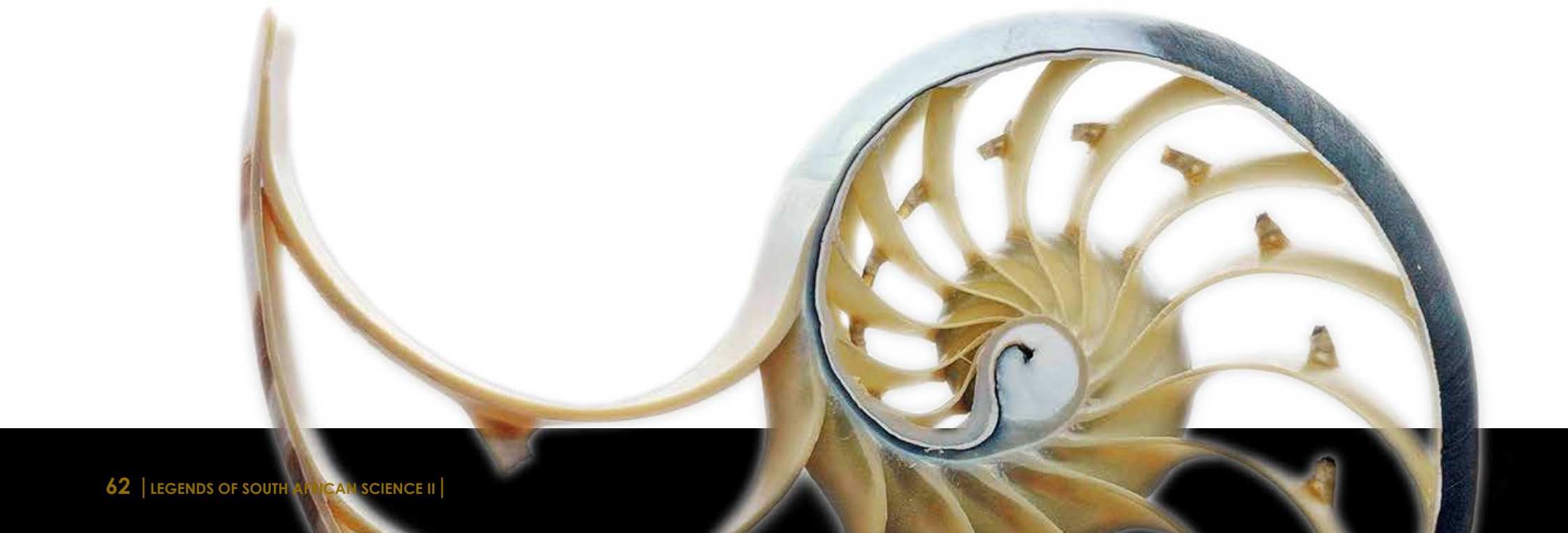
Upon returning, he joined UP and continued to work in the field of microwave and antenna engineering. This has been an area of specialisation at the university's Department of Electronic Engineering for a long time. In 1986 the Electromagnetism Group under the leadership of Malherbe was honoured by being named the first Centre of Excellence by the then Foundation for Research Development (FRD). In 1990, the Electromagnetism Group received a major stimulation with the opening of the Compact Antenna Test Range for antenna and radar cross section measurements. The facility was significantly upgraded during 2010. This facility, unique as a university-owned research laboratory in the southern hemisphere, enables the characterisation of antennas in the frequency range from 0.75 to 40GHz.

LEADERSHIP POSITIONS

During his illustrious career, Malherbe has occupied management positions at science councils and universities, and he has been part of the executive leadership at UP. "I tried to emulate two of the best leaders I had the privilege of working with: The first is the late Louis van Biljon, who was Head of the Department of Electronic Engineering, then later my Dean, and when I became Dean, he was Vice-Principal for a while. The other is Rein Arndt, then President of the FRD. They taught me that the successes of those for whom you have a responsibility are your successes – as opposed to 'leaders' who see the success of their colleagues as a threat to their own success. It implies that you have to have integrity – to do the right thing even if it might be to your disadvantage."

Malherbe is one of the 100 elected Founding Members of the Academy of Science (ASSAf) and he has served as a Council Member and as Vice-President. He is a Fellow, past Vice-President and past Council Member of the South African Academy for Engineering, a Fellow and past Council Member of the South African Institute of Electrical and Electronics Engineers, and founding (and past) Chair of the South African chapter of the Institute of Electrical and Electronics Engineers.

He has produced 72 journal papers, delivered 37 overseas conference presentations, and written three text books (one as co-author), as well as a chapter in the *John Wiley Encyclopedia of RF and Microwave Engineering*".



VINCENT MAPHAI

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Doctorates in Philosophy from University of Johannesburg (UJ) (2006) and University of Pretoria (UP) (2007)
- Working in leadership positions at two top global companies: South African Breweries (1998 – 2004) and BHP Billiton (2004 – 2008)
- Fellowships at Oxford (1983 – 1984), Harvard (1988 – 1989), Princeton (1989) and Stanford (1995) – all world-class universities

DEFINING MOMENT

When Vincent Maphai was in primary school, one of his teachers would say to him every day, 'My boy, you are going places in your life'. Looking back, he says it was through her encouragement that he discovered the power of affirmation; even in the midst of abject poverty, the teacher instilled positive personal values in him. "I wish she were still alive today," says Maphai. "I would tell her she was a good prophet and motivator."

WHAT PEOPLE MIGHT NOT KNOW

As much as Maphai's career has revolved around working with people, he is happiest on his own: "If I had my way, I would prefer to be reading and reflecting. It's heaven on earth for me." He loves fiction because it gives the reader a wider scope to understanding humanity, and recently he has been revisiting the literature that inspired him as a child.

MASTERING VARIATION

Vincent Maphai describes himself as an opportunist and a rebel. The philosophical maverick credits his distinguished and remarkably varied career to his ability to spot opportunities and act decisively when they arise. Over the course of his 44-year career in academia, business and public service, Maphai's background in philosophy prompted him to ask fundamental questions of himself and of the world: "I always said to myself, my university education is not there to frame my career; it's there to train my mind."

In 1955, when Maphai was just three years old, his family was forcibly removed from their home in Bantule location in Pretoria under the Group Areas Act. Atteridgeville was his first conscious home, a tightly knit but poverty-stricken community where he played happily in the streets. Maphai describes his primary school years as miserable; he became aware for the first time that his family of five was desperately poor, and it was not uncommon for them to go without money or food. "The sense of poverty became inescapable," he says.

To help support his family, the young Maphai took on multiple roles: He was a school pupil, a part-time worker, and a beer-taster and barman at his family's home-run shebeen. "I was taught how to make and sell home brew; obviously our quality control was tasting, so I started drinking as an 8-year old," he jokes.

As a teenager he would do homework by candlelight, inspired by several excellent and supportive high-school teachers. When Maphai was in Standard 9, a small group of highly politicised students joined the school and through them, he became increasingly aware of the injustices of apartheid. "At first we thought they were crazy," he recalls, "but they shattered our comfort zone."

After matriculating, Maphai registered for a part-time BA degree at the University of South Africa (Unisa), majoring in political science and philosophy. "To be honest, I did both courses for the wrong reason – because they sounded sexy," he quips. "But I did well, and I thought 'if it ain't broke, don't fix it'." In 1975 he was offered a prestigious scholarship to study philosophy at Belgium's Catholic University of Leuven. The opportunity gave Maphai a taste of freedom and adventure, and the chance to escape the grim realities of apartheid. "It was a total change from the dust of Atteridgeville to one of the capitals of Europe." He obtained his Bachelor of Philosophy degree *cum laude* and his MA *magna cum laude* before returning to South Africa in 1978.

It was a very difficult time to realise one's academic potential as a black South African, yet Maphai forged a path for himself. He began lecturing in philosophy, first at the University of the Transkei, now the Walter Sisulu University, and then at the University of the Witwatersrand (Wits). He was also invited to the North Eastern University in the United States as a Visiting Professor. In 1989, Maphai was given the opportunity to combine his love of political science and philosophy at the University of the Western Cape's (UWC) Political Science

Department, first as a senior lecturer, then an associate professor and finally, Head of Department. He also obtained his PhD from the then University of Natal, now part of the University of KwaZulu-Natal (UKZN) and was appointed a professor at the University of Cape Town in 1995.

INTO THE PRIVATE SECTOR

As South Africa began to chart a new course after democracy, so did Maphai. He joined the Human Sciences Research Council as an Executive Director and taught as an extraordinary professor at the UP before an unplanned pivot to the private sector in 1998, when he was approached by South African Breweries (SAB). "To be honest, I wasn't really interested – but SAB was very, very insistent," he laughs. "I told myself, if I don't like it, I can always go back to teaching." In fact, it turned out to be an exciting opportunity that further broadened his horizons.

Maphai didn't hurry back to academia; instead he reinvented himself and stayed in the private sector for 15 years, working for two high-powered global companies. As a Director at SAB, he spent eight years helping to develop its strategy with a particular focus on dealing with the socio-political environment. He left that position to head the Southern Africa business resources group BHP Billiton. "This also was not a result of planning – I was just responding to the demands of the moment," he says. Maphai was Chairman for five years before returning to the rebranded and expanded SABMiller as its Corporate Affairs and Transformation Director.

He looks back at his career in the private sector with great satisfaction. "There was a very different emphasis: University is about asking good questions, while the private sector is about giving good answers."

Ever the multitasker, Maphai also took on a host of other challenges during his academic and private sector careers. He was also made Chairperson of the Presidential Review Commission on Reform and Transformation in the public service by then President Nelson Mandela. Their goal was to evaluate government performance and map out what the public service should look like and how it should be structured.

In 1999, then President Thabo Mbeki appointed him Chairperson of the South African Broadcasting Corporation, a challenging post he held for four years. Maphai pushed his board to be decisive and accountable; he was nicknamed 'Mr Buffalo' for his consistent appeal to fellow board members to ignore the small stuff he termed 'the rats and mice'. Under his stewardship, the public broadcaster made a profit for the first time since 1994. "It was an honour to be on the SABC board," Maphai says, "but it was not the kind of position where you want a second term."

Maphai moved from one challenging environment to another when he took on the role of Chairman of the council of the University of KwaZulu-Natal (UKZN). He successfully shepherded UKZN through the complex merger of two seemingly incompatible institutions: the Universities of Natal and Durban-Westville (both incoperated as part of UKZN). Next, he was seconded to the National Planning Commission, an independent group of respected thinkers charged by then President Jacob Zuma with generating fresh ideas and insight into South Africa's long-term growth and development: "It was the most pleasurable and least difficult of experiences. We debated robustly at times, but I do not recall any really stressful moments."

Maphai was appointed to the Presidential Remuneration Review Commission in 2014. Two years later he left to take up a position as a visiting professor of Global Studies at Williams College in Massachusetts.

He is grateful to have been called on to serve South Africa under three Presidents, despite his lack of political affiliation: "Madiba, Mbeki and Zuma were all very generous in giving me the opportunity to be part of the country we are trying to build, particularly because I have never been a member of their party."

ANTHONY MBEWU

AWARDS, HONOURS AND ACHIEVEMENTS

- Foreign Associate of the National Academy of Medicine of the National Academy of Sciences, United States (2004)
- Fellow of the Royal College of Physicians in the United Kingdom (1997)
- Founder Member of the Academy of Science of South Africa (ASSAf) (1996)

DEFINING MOMENT

When he was asked to chair the task team that wrote the antiretroviral (ARV) treatment plan for South Africa. "After eight tumultuous weeks of work, assisted by 50 of the world's leading experts in the treatment of human immunodeficiency virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS), we won Cabinet approval in November 2003 for the R10 billion-a-year programme that has now become the world's largest AIDS treatment programme."

WHAT PEOPLE MIGHT NOT KNOW

Every morning he reads the New Testament in ancient Greek, side by side with the English version.

SHAPING SOUTH AFRICA'S FUTURE IN AIDS/HIV

The grandson of an anti-apartheid intellectual, Anthony Mbewu left South Africa at the age of three to live in exile with his family. Mbewu's grandfather had left the country in 1960, the same year Mbewu was born. The cardiologist and former President of the South African Medical Research Council (SAMRC) had felt that there was no future for him in his country. In 1963, he returned to fetch Mbewu. The family settled in Zambia but in 1967 Mbewu, his mother and grandmother moved to the United Kingdom, his home for the next 30 years.

At school, young Mbewu excelled. He gained entry to the University of Oxford aged only 16, having skipped a year of secondary school. In 1980, after completing his preclinical BA at Oxford, Mbewu finished his medical studies at the Royal London Hospital Medical School. After a few years in London working as a junior doctor he moved to Manchester where he specialised in internal medicine and cardiology. Mbewu was awarded his research doctorate (MD) in 1994 from the University of London for research into the role of lipoprotein(a) in coronary heart disease.

The choice of a medical career was partly due to necessity as a South African living in exile. "I was more inclined towards the arts, but I knew I had to choose a career that would grant me a welcome in any country in the world," he says.

The release of President Nelson Mandela from jail in 1990 came as a surprise to many of the thousands of South Africans living in exile across the globe, and Mbewu was no exception. "I had assumed I was never going to be able to return to South Africa. I had married a British woman and we had two sons." Mbewu and his wife resolved to head back to South Africa to witness the rebirth of a country. Some of Mbewu's British colleagues thought he was crazy to go back to a country still so suffused with racism. "I said to them 'I know that, but I want to be part of building the new South Africa'."

Mbewu moved to South Africa in 1994, arriving weeks before the first democratic election. "I voted twice in the United Kingdom before I got to vote in my own country." Caught up in the enthusiasm about the rainbow nation, Mbewu dreamt that South Africa would have its own equivalent of the United Kingdom's National Health Service within a few decades. He started at the University of Cape Town (UCT) as a senior research fellow, then a consultant cardiologist but he found racial and political transformation at the institution slow. In 1996 he was appointed Executive Director of Research at the South African Medical Research Council (SAMRC), on whose board he had served since his return to South Africa. He found the institution more dynamic than academia. "The MRC, because it was government-funded, had no choice but to change radically."

In 2005, Mbewu became President of the SAMRC, a post he held for five years. During this time he served on a number of international health committees and as an advisor to the World Health Organization's tuberculosis, non-communicable diseases and mental health programmes. "There were a lot of initiatives and I was at the right place at the right time."

In 2010, after serving his term at the head of the SAMRC, he was appointed as Executive Director for the Global Forum for Health Research in Geneva,

Switzerland. This was a challenging time for Mbewu: While serving at the helm of the SAMRC, the rapid rise of HIV in South Africa was recognised as a growing and urgent problem, with Thabo Mbeki, President of South Africa from 1999 to 2008, coming under fire for not rolling out life-saving antiretroviral treatment through the country's public health system. The controversy surrounding Mbeki and HIV did not spare the health officials who worked under his administration, including Mbewu.

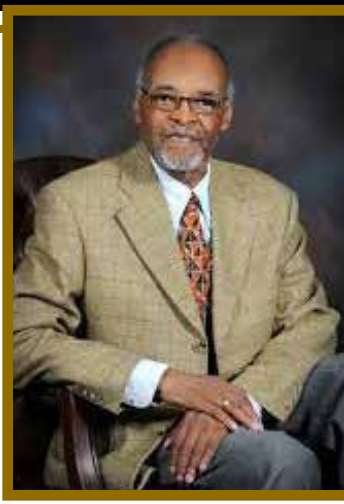
"I think we were tardy in terms of establishing treatment programmes," Mbewu admits. "But we did manage to do great things in the end." Under him, the SAMRC initiated the South African AIDS Vaccine Initiative (SAAVI). It launched initiatives to develop microbicides that killed HIV on contact. Mbewu chaired the task team that developed the treatment plan for HIV/AIDS in South Africa, laying the foundations for the world's largest treatment programme.

Mbewu's career then took an unusual turn. From 2012 to 2017 he was Chief Executive of the Government Printing Works in Pretoria — a state entity that produces official documentation like passports, identity books and matriculation examination papers. Mbewu was in charge of rolling out production of the 'smart ID card' technology in 2013. However, after five years in that role he wanted to return to clinical medicine. Since he couldn't find a senior position in Cape Town, he went back to the United Kingdom where he is doing locum or stand-in jobs at a number of different hospitals. He intends to come back to South Africa some time, but he plans to stay in clinical medicine until his retirement.

Mbewu says he "absolutely feels South African", even though he has spent a large part of his life living abroad. "I think South Africa is a beacon of hope for the African continent and the world – after 350 difficult years of colonialism and apartheid, we have emerged without bloodshed and with a country that is multi-ethnic and multicultural."

Mbewu's time abroad has helped him to see South Africa as a place of potential and promise. In the Brexit-era, the United Kingdom's young people are not positive about the future. "It is amazing to see the optimism and the excitement about the potential in South Africa – you don't see that in the UK. I'm proud to be South African."

| CHABANI MANGANYI |



AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Fellow of the Psychological Society of South Africa
- Humanities Book Award, Academy of Science of South Africa (ASSAf) (2018)
- Lifetime Achievement Award, National Research Foundation (2016)

DEFINING MOMENT

In 1969, while completing his doctorate and simultaneously starting his career in clinical psychology at the University of the Witwatersrand (Wits), Chabani Manganyi's mentors had a hard time finding an internship programme for him. Most psychiatry hospitals in South Africa at that time catered for white patients and trainees only. Since there was no provision for clinical psychology training for blacks anywhere else in the country, Manganyi was admitted as an intern clinical psychologist at the Baragwanath Hospital's neurosurgery unit, even though there were no formal arrangements for the training of black clinical psychologists. Manganyi readily aligned himself with the non-surgical teams in the neurosurgery ward such as the speech therapy team, where he was welcomed without reservation. This inter-disciplinary partnership was highly successful. Four years later, Manganyi was appointed as the first full-time clinical psychologist at Baragwanath Hospital.

WHAT PEOPLE MIGHT NOT KNOW

During his high-school holidays, Manganyi had worked as a gardener at the home of one of the doctors at Elim Hospital on weekends and public holidays. "I watched them at work in the wards in their white coats, stethoscopes hanging around their necks." Little did he know that he would one day be a pioneering doctor at one of the country's biggest and busiest hospitals.

OVERCOMING ALL OBSTACLES

A clinical psychologist, writer, theorist and committed psychologist and intellectual activist during the apartheid years and beyond, Chabani Manganyi oversaw the transformation of the Department of Education when he served as the Director-General from 1994 to 1999. He served as Vice-Principal of the University of Pretoria (UP) from 2003 to 2006. In his latest book, he writes as follows: "I grew up in rural, traditionalist and non-literate Mavambe in Limpopo during the 1940s. As the years went by, I found myself facing an ever-encroaching tide of racial discrimination until the mid-1990s."

Despite obstacles, he managed to attend the then University of the North (now the University of Limpopo) and later, the University of South Africa (Unisa), to become one of the country's first black psychologists. By 1969, he had completed his Master's degree and subsequently pursued research-based studies in psychology. In 1970, he received his doctorate after submitting his thesis entitled *Body Image in Paraplegia*. At that point, he found his career prospects limited in apartheid South Africa, so he went to the United States where he completed a post-doctoral fellowship at the Yale University School of Medicine, where he began writing and publishing a number of journal articles and books.

During the 1970s and early 1980s, Manganyi published a series of monographs, the first of which was *Being-black-in-the-world* (1973), followed by texts on E'skia Mphahlele, Gerard Sekoto and Dumile Feni. In some of the works he incisively examined the effects of institutionalised racism which characterised South Africa at that time, including alienation and distorted individual body relations amidst a quest for freedom. Central to some of the texts were concerns regarding identity development in apartheid South Africa. Some of the early works were the first serious attempts by a South African psychologist to engage with the interface between the individual and society in the context of both symmetrical and asymmetrical relations of power, welcomed by many who were searching for a psychology better able to make sense of the internal and more explicit social realities of the lives of the majority of South Africans.

Significantly, some of the texts identified a number of critical imperatives for a more generative South African psychology. Arguably, one of the most important imperatives was his appeal that mental health services should be made more appropriate and accessible to all South Africans, a call which is still pertinent today.

Manganyi examined the effects of violence on individuals in *Mashangu's Reverie*, published in 1977, in which he explored the place of the Black Consciousness Movement. An antithesis of the dominant and racist cultural practices of the day, it is widely considered to be seminal in the field of psychology. The exploration of the phenomenon of violence is elaborated on in some of his

recent publications. His work has made a substantial contribution to South African psychology, a contribution which has still to be acknowledged.

On his return to South Africa in 1976, Manganyi accepted a professorship at the then University of Transkei in Mthatha, now part of the Walter Sisulu University, where he established the Department of Psychology and served as its first Chair. In 1980 he was appointed Professor and Senior Research Fellow at the University of the Witwatersrand (Wits) African Studies Institute. He spent the politically turbulent 1980s at Wits and established a part time clinical psychology practice in downtown Johannesburg. Referring to that period, he wrote: "In my practice, I concentrated on public interest psychology, specifically responding to the widespread demand at the time for expert evidence during political trials throughout the country and the scourge of escalating public violence (including the practice of 'necklacing')." In 1987, he secured funding for the establishment of the Political Violence and Health Resources Project at Wits. It was during this period that he presented expert evidence in mitigation of sentence in the trials of Robert McBride and Greta Appelgren and several others, including Joseph Lukhele and Mishack Magagula.

WORKING FOR A HIGHER PURPOSE

Between August 1990 and December 1992, Manganyi occupied the position of Vice-Chancellor and Principal at the University of the North (now the University of Limpopo). In 1992, when President Nelson Mandela was installed as Chancellor of the university, Manganyi was installed as Vice-Chancellor, becoming the first former student to occupy the position. His focus during that period was on transforming and democratising university governance whilst strengthening overall institutional capacity. When the democratic government was established in 1994, Manganyi was invited by President Mandela and the Education Minister, Sibusiso Bengu, to accept the office of Director-General of Education, a position he held until he became Advisor to the then Vice-Chancellor of (UP). From 2003 to 2006, Manganyi was one of the Vice-Principals of the University of Pretoria (UP) and during that time he was also chairperson of the Council on Higher Education in Pretoria.

Manganyi's intellectual pursuits have not been limited to the narrow confines of psychology. In 2016 he turned the lens on himself to write a memoir and autobiography entitled *Apartheid and the Making of a Black Psychologist*, a recent winner of the ASSAf's Humanities Book Award in 2018. The autobiography illuminates the history of a country through sensitive, insightful, personalised accounts of the devastating effects of rural poverty, family dislocation, migrant labour and Bantu Education on entire communities. The memoir gains its authority from the author's skills as a psycho-biographer, as well as his restraint as a writer even as he recounts painful recurring episodes of personal and family suffering through the course of his life. Manganyi found even in the most oppressive circumstances – whether as a child being caned for missing school or an aspirant academic turned down for a job – opportunities for learning which advanced his career. He refused to yield to the many obstacles in his path as a black man and a psychologist.

His book is about ordinary black South Africans reaching great heights in their lives and careers. The book provides a retrospective account of time and place in the past, but also offers deep analysis of the issues of our time and into the future. This compelling text provides depth to the current rhetoric about race, racism and the meaning of higher education inasmuch as it is a story about the life of a remarkable psychologist, a human being and an intellectual.

VERONICA MCKAY

AWARDS, HONOURS AND ACHIEVEMENTS

- UNESCO Confucius Award (2016)
- National Ubungcweti GCIS Award for Kha Ri Gude (2009)
- Woman of the Year Award (Education) (2000)

DEFINING MOMENTS

Being appointed Chief Executive Officer of the literacy campaign and being appointed Dean of the University of South Africa, College of Education.

WHAT PEOPLE MIGHT NOT KNOW

As the Dean of the largest College of Education in the country, with 115 000 students, and with her background of having run massive campaigns and developing workbooks for schools, the distribution of which has exceeded 350 million books, she is addicted to scale. She sometimes jokes that it isn't really worth her while to get out of bed for fewer than 20 000 students.

ROLLING OUT LITERACY, EDUCATION AND YOUTH DEVELOPMENT EN MASSE

With work spanning the education sector from preschool to post-schooling, Veronica McKay deals in big numbers. As the Dean of the largest College of Education in the country, at the University of South Africa (Unisa), she oversees more than 115 000 students from undergraduate to doctoral level. "Doing this at a distance is exciting and challenging and requires me to keep one eye on policy and the other on management," she says. "In between I find time for teaching my Master's and Doctoral students, and I still work in developing the new curricula as we prepare to offer new qualifications in line with the Minimum Requirements for Teacher Education Qualifications. I also keep a hand on adult education and oversee the work-integrated learning implementation in the College to ensure that our students get optimal teaching practice experience in one of the 27 000 schools across South Africa."

Despite these achievements, McKay feels her most important contribution was establishing the Department of Basic Education's (DBE) national workbook project, where she played a key role in coordinating and writing school materials for learners from Grade R to Grade 9. To date, the DBE has published and delivered 350 million books developed by her and a team of academics.

McKay started out as a teacher and then moved into academia. Her PhD in sociology focused on "people's education" in South Africa from a humanist perspective. She says she has not actually moved from teaching to research but has blurred the various roles and is fortunate to be in a space that in fact requires a combination of theory, research, pedagogy and practice.

In 2017, in acknowledgment of her substantial contribution to the development of lifelong learning on a global scale, she was made an Honorary Fellow of the UNESCO Institute for Lifelong Learning. She is also a member of the South African UNESCO Commission.

Her passion for lifelong learning goes back to growing up on the mines of Johannesburg. "I could not understand why 'the big men who dug the gold out of the ground' would ask me, as six or seven-year-old, to read an address or a price or a letter or even to work out the change they should receive in a shop. When I did come to understand why, I realised that it was a result of what Professor Bhola refers to as 'the denial of an essential element of the human heritage and the imposition of an intellectual bondage', and I have always tried to bridge the gap through the work and the research that I do. This realisation and her attempts to address it, opened up a very meaningful career that often took her out of the mainstream of the university. Hence her academic career resulted in her working along the lifelong learning continuum, with her praxis interventions aimed at targeting deficits in education, through for example, large-scale educator development, campaigns or the development of school workbooks; and her research focused on informing her work in what has largely been uncharted terrain.

McKay has been at Unisa for 35 years, beginning her academic career as a lecturer in the Department of Sociology where she worked at the intersection of education and sociology, focusing on the sociology of education, gender and also on action-oriented research approaches. With the changes in the country in 1994, the university granted her permission to establish the Institute for Adult Education to provide qualifications for the professionalisation of educators in the broad field of adult education and literacy. Setting up the institute with few precedents required her to draw on theory, pedagogy and insights from research to be able to establish a new university department that

could embrace adult education across sectors and that could span formal and non-formal learning situations.

HELPING MILLIONS BECOME LITERATE

McKay researches education 'at the margins'. She works with those who are vulnerable and marginalised in what UNESCO defines as 'situations of acute and persistent disadvantage in education'. "Much of my work has been at the periphery of society, working with those left behind. In these involvements I was able to carry out reflective praxis focusing on the most pressing needs of the communities in which I worked and exploring ways to bring about social change and inclusion."

"The opportunity to lead two large-scale literacy campaigns, the South African National Literacy Initiative (SANLI) in 2002 – 2003, and the DBE's National *Kha Ri Gude* (Let us learn) Mass Literacy Campaign in 2007 – 2012, jointly enabled five million adults who had previously been denied access to schooling or learning to become literate. In implementing these campaigns, we strove to ensure that learning played a seminal role in building resilience and agency among target groups, offering hope in otherwise hopeless situations. Much of the teaching and learning took place at the nexus of poverty and despair," she says.

Working in informal settlements, prisons and with learners in the streets allowed McKay to merge her theoretical, pedagogic and research knowledge and leadership understanding to work with large teams of up to 40 000 volunteers. Together they were able to explore, through collaborative research endeavours, the range of possibilities for an expanded remit for community learning and for developing social cohesion and resilience at the individual and community levels. As there were no local precedents for large-scale learning campaigns in South Africa, it was necessary to research the situation as it was unfolding on the ground to allow them to continuously improve what they were doing.

"Much of my research has focused on the role of social networks and social capital as being critical for strengthening communal social infrastructure and for developing resilience," she says. She was able to see *ubuntu* in the social cohesion arising from organised learning, in the way learners interacted with one another as co-dependent beings, with compassion and trust and *letsema** as they offered reciprocal support. She has also been involved in many other large-scale projects such as the training programme for Community Development Workers which was implemented by Unisa – reaching some 4 000 community workers who were trained to assist those on the margins of society.

During the period when she was seconded to the DBE from 2007 to 2012, McKay was given another opportunity to engage in praxis at the margins when she conceptualised and coordinated a massive school workbook project. The project was intended to address the challenges of under-performance of learners, particularly those in low socio-economic communities. "The programme has been largely successful," she remarks, "I am presently researching and writing about the reception of the materials and their impact on the improvement in learning outcomes."

* Setswana for a group of people coming together for a common purpose.

PHIL MJWARA

AWARDS, HONOURS AND ACHIEVEMENTS

- Recognition as the best Director-General, Department of Science and Technology, now the Department of Science and Innovation (DSI) (2006 to date)
- Chair of the Group on Earth Observation (until 2017)
- Board member of Square Kilometre Array (SKA) leading the technical team that submitted the bid for the African countries to the International bid committee

DEFINING MOMENT

During his time as a lecturer and early researcher at the University of South Africa (Unisa), Phil Mjwara met Dr Rob Adam who encouraged him to spend some time at the Department of Science and Technology to work on science policy. Since then, he has been involved in making policies geared toward helping researchers and the broader South African community.

WHAT PEOPLE MIGHT NOT KNOW

"I am a failed musician, but I have a great love of music. I tried the trumpet, I tried guitar, tried piano, but never quite got good enough at any of them."

MAKING GOOD USE OF SCIENCE FOR SOUTH AFRICA

"I have come to realise that we can spend a lot of time researching and contributing to science, but we can also spend that time well in creating an environment to benefit researchers." Phil Mjwara likes to use the word 'we' when he talks about his many achievements and the numerous projects he has been involved in. His humility is surpassed only by his great love of science, which started at a very young age.

He grew up in the township of Lamontville, KwaZulu-Natal, fascinated by all things mechanical, especially cars and buses. Now serving as the Director-General of DSI, it is hard to imagine the journey he took to get there. "It is always difficult to sense exactly when I started to love science," he says. "I remember I was about 14 when I learned about a mechanic neighbour who lived downstairs." Seeing the vehicles opened up and taken apart awoke his curiosity and he wanted to know more about how these machines, and the universe, worked.

At high school he had a great affinity for mathematics and science and initially he thought he would become a medical doctor. "I tried to follow the biological subjects, but they didn't work out for me," he laughs. Finishing high school in 1976, he worked at a Shell and BP petroleum refinery in Durban and there he was offered the opportunity to train as an engineer in a chemical, mechanical or electrical specialisation. "They wanted to train us as black engineers; we underwent a course they were offering and my love of science grew even more," Mjwara says. So in 1979 he enrolled at the University of Fort Hare (UFH) in the Eastern Cape, one of the only universities to offer engineering courses to black students during apartheid.

There he did a pre-engineering programme, but he fell in love with physics in his second year which led to him getting a degree in physics instead of the engineering qualification. After completing the BSc, he worked as a senior laboratory assistant at UFH for two years and completed an honours degree in 1984. He became a junior lecturer and then moved to the University of the Witwatersrand (Wits), where he obtained his PhD in 1987 and was then appointed to lecture at the Unisa in 1992. While at Unisa, Mjwara got a taste for science policy that would go on to define the rest of his life and career. "Strangely enough, in life there is always somebody who brings out an expertise in you that you were not aware of," says Mjwara, describing how he met Dr Rob Adam at Unisa, who would later become the Director-General of the then Department of Science and Technology (DST). "At the time I had just started my research career at Unisa, having worked there for two years."

DISCOVERING SCIENCE POLICY

Adam had just started working on science policy in the early days of the DST after 1994 and was looking for good people to work with him. "We had worked together at Unisa, and he asked if I would be keen to be seconded to the department," says Mjwara. The secondment was initially supposed to be for two years, after which he would continue with his research at Unisa, but it stretched into four. "I thought that this was good work for me because while it drew on a scientific capability, I was also working on the broader policy that impacted the very science I wanted to do," he says. "This was yet another point where my love of science grew."

Having had a background in laser physics he applied for the post of director of the National Laser Centre at the Council for Scientific and Industrial Research (CSIR) and got the job in the early 2000s. "I spent four years running the laser centre and I developed a great passion for managing people and managing institutions," he explains. His next promotion was becoming Group Executive responsible for research and development at the CSIR in 2005. "I enjoyed the experience very much because it was a combination of understanding policy, understanding science and being in management."

On advice of the then Minister of DST, Mosibudi Mangena, Mjwara applied for the position of Director-General and was appointed in 2006; he has remained to this day. When he started, he found himself in a department trying to change the priorities of science and technology to fit the needs of the country better. "We had started to worry that while the department had a strong focus on South Africa's ability to do science, we were not strong in our ability to develop technology and identify solutions that the country needed."

Building on work of talented predecessors like Rob Adam, Mjwara established a technology policy portfolio without forgetting the importance of scientific research in general. "I spent a lot of time thinking about how we could strengthen the work that had already been done." When Cabinet adopted the *National Research and Development strategy of 2002*, Mjwara felt that it was not strong enough on technology development and its potential to grow the economy. "We introduced *The Ten-Year Innovation Plan* which placed an even greater emphasis on innovation. This plan proposed setting up the Technology Innovation Agency (TIA) which would accelerate the translation of ideas into products and services. We looked at how other programmes at the DST could be shaped differently to make better use of science, technology and innovation to change people's lives."

Mjwara has been pushing for what he calls advocacy work at the department, where he has been trying to make sure the work they have done for the past 12 years is used to improve the lives of all South Africans. Throughout his career, Mjwara has worked to ensure that good science is done in South Africa, and that the benefits of that science are applied for the benefit of the country and its researchers. "Those are the motivations that moved me into the science and innovation policy space."

"I would like to applaud and express my appreciation of all the people I have worked with," Mjwara says. "I have been very lucky to be a Director-General for so long, and it is thanks to everyone I work with that I have been able to stay for so many years."

VINCENT MORAN

AWARDS, HONOURS AND ACHIEVEMENTS

- Life Fellowship, University of Cape Town (UCT) (1991)
- British Petroleum Scholarship, Visiting Professor in the Department of Zoology, University of Oxford, and Visiting Research Fellowship at Merton College, Oxford (1980 – 1981)
- British Council Scholarship at Silwood Park, Imperial College, London (1974)

DEFINING MOMENT

"In those far-off days, if you were freshly graduated with such an exalted degree as an MSc, you did not apply for jobs, you juggled your various job offers!" Thus, on Thursday 28 of March 1963 he signed a contract, typed on one page of foolscap paper, accepting a temporary lectureship in Entomology at Rhodes University (RU). The post came with the princely salary of R195.00 per month (with no perks at all); he had turned down far more lucrative offers, ostensibly with better career prospects, from industry. "There was no apparent rationale underpinning my choice, except that a stint in academia seemed agreeable. But that almost by-the-way decision was the defining moment in a fulfilling career far beyond any reasonable or pragmatic expectations."

WHAT PEOPLE MIGHT NOT KNOW

Despite 50 years of commitment to research in his field, Moran views himself primarily as an effective administrator, mentor, reviewer and editor, and 'as a person who gets things done through collaboration, rather than as a top-notch scientist'. "I attribute most of what I have achieved not to any special or innovative talents that I might be perceived to have but to persistence and to sustained and mutually beneficial partnerships with top scientists in South Africa and abroad."

THE AMAZING WORLD OF INSECTS AND PLANTS

Vincent "Cliff" Moran is enthusiastic and entertaining in discussing entomology, so it's not difficult to imagine his curiosity, as a 16-year-old, when he observed an older girl swinging her butterfly net back-and-forth in the grass, catching insects for a university project. A quick peek through her field microscope at the extraordinary variety and beauty of form and colour of the many hundreds of insects that she had captured had him instantly intrigued and entranced.

That experience certainly played a role in Moran's choice of biological subjects when he first entered RU in 1956. As an undergraduate student, however, he admits to spending more time idling with his friends or playing competitive squash than diligently attending to his studies. In the end he passed his exams "adequately, but without particular distinction". That is now all a lifetime ago for this ever-modest man, who has been Dean of Science at two of South Africa's most respected universities, and who has travelled the world in pursuit of his passion. He lectured at RU from 1963 to 1978, became Professor of Entomology there in 1979, and then, from 1983 to 1985, Dean of the Science Faculty. In 1986, Moran was appointed permanent full-time Dean of Science at UCT, a post he held until 1999.

Since the sixties, he has co-authored a book on insect pests and published more than a hundred research articles in respected international journals on insect-plant relationships or on biological control of alien invasive plants. He describes himself as "reasonably well-cited" and isn't comfortable with any suggestion he is a "top-notch scientist". Moran says he is rather "meticulous, almost to the point of being obsessive: I like things to be done properly, and I think that attribute really helped me, both as a researcher and as an administrator."

An NRF A-rated scientist for eight years, he is adamant that without the support of "some of the best people in the world, here in South Africa and abroad," his life achievements in his field would have been far more "modestly influential and impactful than they have been". One who he says deserves special mention is Professor Dennis Ewer, from Cambridge University in the United Kingdom. This brilliant teacher and researcher inspired Moran when he came to South Africa and eventually to RU as Head of the Department of Zoology and Entomology. Ewer "lived for science" and would import relevant journals by airmail from Britain at his own expense.

"He taught me what research and publishing was all about and insisted that his students should look outwards and aspire to compete with the top scholars at the big overseas universities," he recalls. Moran followed suit at a time,

during the 1960s and 1970s, when South African science had become isolated, complacent and inward-looking. He took actions at RU and then at UCT to ensure that "our work and that of our postgraduate students was exposed to critical scrutiny by some of the top names in our field, globally." This opened the way to invitations to visit institutions abroad and to attend conferences, securing access for the universities' best postgraduate students, and drawing overseas visitors to South Africa. These initiatives dovetailed with the start, in 1984, of the Foundation for Research Development, now the National Research Foundation(NRF) rating system.

Moran was involved for 25 years with the work of many of the NRF committees. He is justly proud of this involvement, and of his role as a facilitator of research during his years as UCT's Dean of Science: "The UCT Science Faculty has more NRF-rated scientists than any other university in the country, and I remain convinced that it was encouraging increased exposure to and critical comment from those in the big wide world out there that helped in cementing UCT's place as Africa's top-ranked university," he says.

SUPPRESSING INVASIVE ALIENS

Of his work as a researcher that had the most impact, Moran cites his influence in the field of biological control of invasive alien plants in South Africa, using plant-feeding insects to suppress problem plants. "Suppressing alien invasive plants contributes to agricultural endeavours and to conservation efforts. My special interest in the biocontrol of invasive alien trees has helped to reduce the frequency and intensity of damaging wildfires and, most particularly, resulted in huge socio-economic benefits through improving run-off of water from catchments into rivers to help preserve the country's meagre water supplies," he says, explaining that about 7% of the country's water is used up by alien invasive trees.

Moran was also fundamentally influential in how research on the biocontrol of weeds gained momentum in South Africa from the mid-1970s, from low levels of funding, with relatively few research and support staff and students, to what it is today, with 150 or more people involved. "South African researchers are now acknowledged as the international leaders in research and implementation of weed biocontrol."

He is grateful for his privileged life and career, with his research taking him to many places on five continents and allowing him to collaborate with congenial and inspiring colleagues from all over the world. "In particular, I owe much of what I am perceived to have achieved in my career to close interactions with Professor John Hoffmann of UCT, Dr Helmuth Zimmermann and the late Dr David Annecke, both formerly of the Plant Protection Institute in Pretoria, and since the late 1960s, to my friendships and collaborations with the late Professor Sir Richard Southwood of Silwood Park and Oxford, and with Professor Walter Tschinkel of Florida State. All of these people variously made much of what happened in my professional life actually happen," Moran says.

JOHANN MOUTON

AWARDS, HONOURS AND ACHIEVEMENTS

- Award of one of only two Centres of Excellence in the Social Sciences by, National Research Foundation (2014)
- Stals Prize for Inter and Multidisciplinary Research (2000) & Stals Prize for Contribution to Research Methodology in South Africa, from the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (2007)
- *How to Succeed in Master's and Doctoral Studies* (2000) sold more than 30 000 copies and been cited more than 4 500 times

DEFINING MOMENT

This occurred in 1972 when he met his wife in a psychology class. They have been together ever since.

WHAT PEOPLE MIGHT NOT KNOW

"For two years of my life I played in the Potchefstroom Symphony Orchestra. I played drums and cymbals. I then realised how important the director of orchestra is. I see my job at the Centre for Research on Evaluation, Science and Technology as being like an orchestra director – making sure we are all on the same script and going in the same direction."

FROM PLATO TO POLICY: A QUEST FOR BETTER KNOWLEDGE SYSTEMS

"Knowledge is justified true opinion." When Plato uttered those profound words so many years ago, he could not possibly have known what an impact they would have on the Western world of the 21st century. And he certainly wouldn't have thought of the inspiration his words would give to researchers like Johann Mouton, whose life path shifted forever upon reading Plato's treatise on opinion, truth and knowledge, *Thaeatetus*, in his undergraduate philosophy class.

"When I went to Potchefstroom University for Christian Higher Education, now North-West University in 1973, I was going to study theology, even though my aptitude tests had all pointed towards science," says Mouton. "In the second-year philosophy class, we read Plato's treatise on knowledge and how to distinguish between truth and opinion. I fell in love with epistemology and the philosophy of science." Both his master's and doctorate in philosophy at the former Rand Afrikaans University, now University of Johannesburg (UJ) studied the nature of knowledge production.

"I am interested in the nature of knowledge and the differences we can see between scientific knowledge and other types of knowledge," he explains. In South Africa, an important consideration is indigenous sources of knowledge and how it is treated by researchers and the public. "Not to say other sources of knowledge are not important, but what distinguishes scientific knowledge is the principles of reasoning and the methodologies we use," says Mouton. "When we make claims about the world, can we provide sufficiently strong evidence? That depends to a large extent on the methods that underpin these claims. The scientific endeavour is all about the search for truth, even if we don't reach it."

After several years at RAU, in 1983 Mouton was invited to join the Human Sciences Research Council (HSRC) by the then President Johan Garbers, to set up a centre for research methodology to help advance social science methods in South Africa.

NATIONAL INVESTIGATION INTO RESEARCH METHODOLOGY

Mouton says that his biggest contribution during that time was conducting a national investigation into research methodology. The initiative funded and supported more than 80 research methodology projects in social sciences across South Africa and led to a number of unexpected spin-offs. "We produced more than 40 books in less than ten years," he says. "In 1987, the Universities of Limpopo and Venda asked me to start a winter school in research methodology, leading to more than a decade of capacity building there. It was particularly meaningful to me because at that time of high tension, it was unheard of for historically disadvantaged universities to work with the HSRC."

Those winter schools were South Africa's first practical training courses in research methods, teaching researchers practical skills like how to design studies and select a sample population. Mouton's influence even reached undergraduate teaching at the time: "I got universities to redesign undergraduate curricula on research methods."

In the early 1990s, Mouton started to work with international researchers on improving monitoring and evaluation (M&E) methods in South Africa, which were lagging behind international standards. "We invited top international scholars to help us improve our M&E – you can't simply transpose international methods, but we needed their help." Mouton explains that M&E is a critical component of modern society, particularly in the context of development, aid and other humanitarian efforts. It also plays an important role in keeping governments accountable, something that is desperately needed in the modern era. "M&E provides accountability for public and private funds," he points out. "Huge amounts of money is invested in social interventions every year, whether it is in health, education or government service delivery. These organisations need to be accountable to taxpayers, philanthropists or boards of trustees to show how that money was spent."

In 1994, he accepted a position at Stellenbosch University (SU) as Professor of Sociology and established the Centre for Research on Evaluation, Science and Technology (CREST), where he is Director. One of his first tasks was to create two master's programmes: one on Social Science Methods and one on Science and Technology Studies. Both were the first of their kind in the country. "Over those years at CREST, we developed the biggest academic programme in M&E in Africa. We graduated over 600 students from across the African continent. M&E should form part of the democratic ethos of society," he maintains.

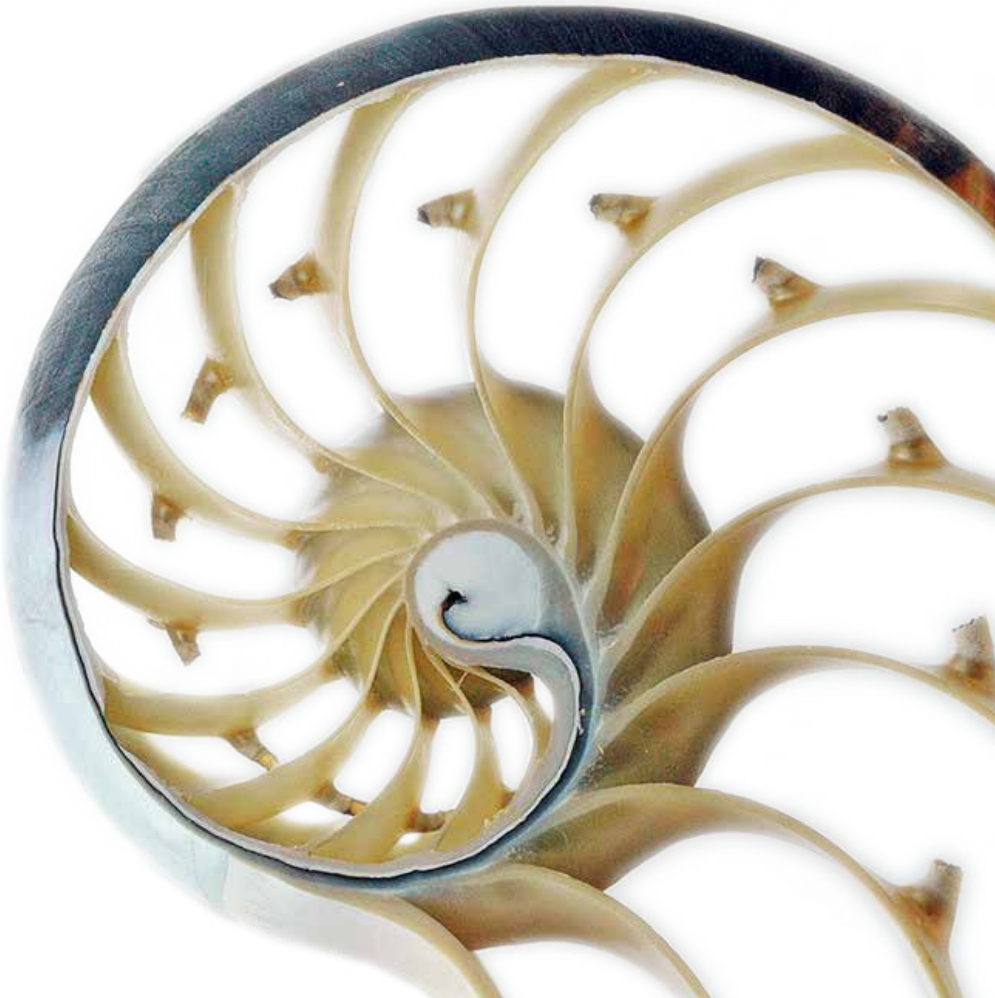
He believes that his work has helped M&E to become institutionalised in South Africa, something he is very proud of. "Awareness of M&E is very high in South Africa, and that is good. Quality is the next concern – our task at CREST now is to help the M&E industry professionalise and establish ways of getting accreditation."

In 2010, Mouton established the African Doctoral Academy at CREST, another proud achievement for him. The academy aims to assist current and prospective doctoral candidates from across the African continent to prepare for their doctoral studies and research careers.

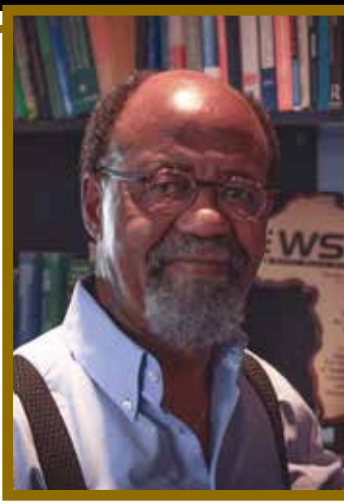
Mouton has not neglected his own research during this time. Over the past 20 years, CREST has conducted more than 60 studies on the state of science and innovation in South Africa, the nature of the PhD, the careers and mobility of scientists and numerous other aspects of the South African science system.

Over this period, Mouton says that CREST has received more than R70 million in funding to support better research in South Africa and the continent. It remains the only centre conducting research on systems of science and research on the continent. In recognition of these achievements, it was made an DST-NRF Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy in 2014.

Forty-four years on from his first reading of Plato, Mouton's passion for knowledge systems and the philosophy of science lives on through his students, his organisations and his legacy of improved research across Africa.



DANIEL NCAYIYANA



AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Fellow, Colleges of Medicine of South Africa (2003)
- Honorary Professor, Obstetrics and Gynaecology, University of Cape Town (UCT) (1994)
- Editor-in-Chief of the *South African Medical Journal*

DEFINING MOMENT

The twenty years that Professor Daniel Ncayiyana was the editor of the *South African Medical Journal* is one of the highlights of his career because he became involved in the world of medicine and medical research in South Africa. "For over 20 years I wrote editorials that influenced medical thinking in South Africa."

WHAT PEOPLE MIGHT NOT KNOW

"I have an obsession with flight and aircraft – I trained as a private pilot and learned to fly single engine planes."

DRIVEN TO CHANGE THE SOUTH AFRICAN MEDICAL LANDSCAPE

"As a young boy I wanted to be a train driver. All the boys in our area did. That's all we knew." Daniel Ncayiyana grew up in the post-war era near Port Shepstone, in what is now the south of KwaZulu-Natal. Those were hard days in a rural area with hardly anyone for a boy to look up to other than the occasional train driver. "Maize was the staple; milk was available in season and the occasional chicken or sheep would be eaten on festive occasions. Otherwise, for protein we trapped birds and collected large locusts and the flying ants that emerged in their thousands – seemingly from nowhere – after rain."

This all changed for Ncayiyana when a doctor started coming once a week to a local clinic set up by foreign missionaries in the area. This was most unusual at the time as no one, including Ncayiyana, had ever seen a black doctor before, or even thought it was possible for a black person to become a doctor. But Ncayiyana was determined to follow in that doctor's footsteps. His first attempt to train as a doctor in the 1960s was cut short during his third year at the then University of Natal Medical School in Durban (now part of the University of KwaZulu-Natal): He was forced to go into exile on account of his anti-apartheid activities. "It was a time when resistance to the apartheid regime was really strong, when the movements were the strongest," he says.

Shortly after he joined the Pan-Africanist Congress, the party was banned and he became active underground as its General Secretary. When police caught wind of his political activities he was arrested and jailed for six months; when he was released he fled the country, going into exile in the Democratic Republic of the Congo. "That was a very significant time in my life story because until my exile I was a medical student heading towards becoming a doctor; suddenly all my dreams were falling apart," he says.

CONTINUING A DREAM

However, all that changed when he received a scholarship to study medicine at the University of Groningen Medical School in the Netherlands, where he graduated as a licensed medical doctor in 1970. "I was able to continue my dream of becoming a doctor, thanks to that scholarship."

He went on to postgraduate training in obstetrics and gynaecology at the New York University School of Medicine and practiced in Seattle as a specialist obstetrician and gynaecologist for 15 years.

"I returned to work in the Transkei in 1986, because at that time it was more or less independent of South Africa. I was banned in South Africa," he says. During his time at the University of Transkei Medical School, now part of the Walter Sisulu University, he pioneered the problem-based learning and community-oriented curriculum which has now been adopted to train health professionals by virtually all universities in South Africa. He was instrumental in establishing the University of Transkei Medical School, today known as the Walter Sisulu Medical School, where he acted as Vice-Chancellor for three years. "I worked in the Transkei until 1990, when President Nelson Mandela came out of prison and we had freedom to move in South Africa."

"My third career change came when I applied to be Editor of the *South African Medical Journal,* and this is perhaps the period in my career that had the most

impact," says Ncayiyana. As editor, he was responsible for selecting the articles that would be published and this meant he became quite influential in the world of medicine and medical research in South Africa.

It was not an easy appointment, however, as the remnants of apartheid still permeated the industry in 1993, a year before South Africa's first democratic elections. "Although I quickly emerged as the most qualified candidate, it took three interviews to appoint me as the first black editor. The excuse for dilly-dallying was that I did not speak Afrikaans (although neither did my British predecessor), but we all privately understood that it was my complexion – and the politics that came with it – that was the problem."

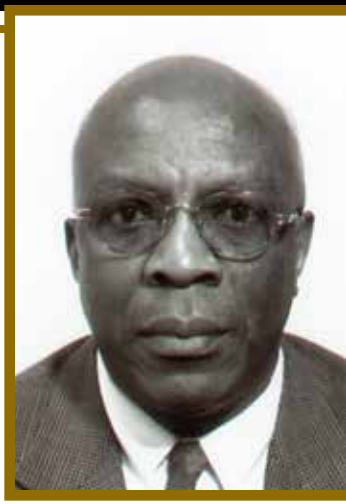
He later became involved in higher education management and governance, even co-authoring a book with Fred Hayward – *Effective Governance: A Guide for Council Members of Universities and Technikons* (1999) – which has become a standard reference for universities in South Africa.

Perhaps the most important contribution he has made in higher education in South Africa was helping to create the Durban University of Technology (DUT). "We merged the Technikon Natal, a previously white institution, with the ML Sultan Technical, which was a black institution, to form the Durban University of Technology." Ncayiyana became the founding Vice-Chancellor of DUT in 2001.

He was an Associate Researcher and Principal Investigator for the HSRC, and chaired the South African Advisory Committee of the Medical Protection Society. He is currently an independent consultant in medical education and training and has served as a consultant to universities in Malawi, Namibia, Nigeria and The Gambia, among others, funded by international agencies including the World Bank, United States Agency for International Development (USAID) and the Ford Foundation.

He may not have ended up driving the trains of his boyhood ideals, but he has certainly driven change, having attained his goal to become a doctor through what he calls "a series of fortuitous and seemingly miraculous events".

MOKUBUNG NKOMO



AWARDS, HONOURS AND ACHIEVEMENTS

- Fellowships from the Yale University (1988 – 1989) and Fulbright Fellowship from the University of the Witwatersrand (1992)
- Editing *Pedagogy of Domination* (1990), a volume that brought together some of the most progressive educationists in South Africa
- Doctorate from the University of Massachusetts (1983)

DEFINING MOMENT

Nkomo identifies his departure from South Africa for the United States in 1966 as the defining moment in his life as it afforded him the opportunity to escape the clutches and debilitating effects of apartheid hegemony.

WHAT PEOPLE MIGHT NOT KNOW

Nkomo is a tanked fish enthusiast. He first grew to love fish when he bought a house with a koi pond; he found it very therapeutic to spend hours watching the magnificent creatures at the end of a long day.

CHAMPION OF EDUCATION

Mokubung Nkomo's hunger for world-class education drove him to leave South Africa in his early twenties; that same passion would eventually draw him back home on a quest to help address past academic injustices. In South Africa and abroad, Nkomo dedicated his academic career to fostering learning, diversity and social cohesion. He held a number of research positions, won several research awards and was active in administration and management at all the campuses he worked on.

EARLY LIFE AND EDUCATION

Nkomo was born in the mining town of Mashishing in Mpumalanga. In 1952, his family moved to Uitkyk, a small mining outpost on the outskirts of Middelburg before settling in the neighbouring township of Mhluzi. His self-educated father worked as a mine store clerk while his mother brewed traditional beer and ran a tavern from their home. Such establishments were illegal at the time so as a boy Nkomo operated as a lookout, perching on top of a mine dump with a whistle to warn his mother of approaching police raids. He attended school in Mhluzi under the shadow of the Bantu Education Act and recalls being acutely aware that "the education black people were offered was sub-standard and grossly inadequate".

In 1963, Nkomo was admitted to St. Christopher's High, a boarding school in Swaziland, where he matriculated. His decision to continue his education in Swaziland prompted questions from the apartheid police's notorious Special Branch, who visited his home a number of times. Ignoring a warning from his father, Nkomo returned home during a mid-term break the following year. He was interrogated, his travel document was confiscated and he was instructed not to leave the country. With his academic future on the line, Nkomo defied the authorities and headed back to Swaziland. He could not legally re-enter, so he crawled under a barbed-wire border fence in the dead of night: "I was determined not to go back to a situation where my dreams would be frustrated, where I would never see the fruition of my desires," he says.

The keen student was offered a scholarship to the United States by the African American Institute but in order to travel, he needed a passport. Help came from an unexpected source: an elderly Swazi woman offered to pass Nkomo off as her son, having lost her own son years before.

Nkomo arrived in the United States in 1966 on a Swazi passport, excited to study towards a degree in economics at Pennsylvania State University but unaware that he would be unable to return to South Africa for three decades. Months after his arrival in the United States, the Swazi authorities discovered what had happened and annulled his passport. Suddenly, he was stateless. Undaunted, Nkomo completed his economics degree and landed a job at the African American Institute. A year later, he decided to switch courses and pursue his master's and doctoral studies in education at the University of Massachusetts.

Despite his ongoing citizenship complications, Nkomo kept in contact with his family, arranging to meet his parents in countries he could travel to like Zimbabwe and Malawi. In 1983, having been granted his doctorate from the University of Massachusetts, Nkomo was appointed an assistant professor of education at the University of North Carolina's Charlotte campus where he

earned his tenure. In 1988, he spent a year at Yale University as a Visiting Fellow. In the early 1990s, as the political environment began to change in South Africa, he returned for a year as a Fulbright Fellow at the University of the Witwatersrand (Wits).

In 1995, Nkomo took on a fresh challenge as Director of the South Africa Partnership Programme at the New School for Social Research, a private university in New York City. Three years later, change beckoned.

He was recruited to take up a position at the Human Sciences Research Council (HSRC) in 1998. Propelled by a deep sense of the injustices of apartheid and a desire to reconnect with his past, he accepted the post of Executive Director of the HSRC Education and Training Programme. "I couldn't get away from this feeling of discomfort while in the United States," he says. "I left because the education back home was bad and I knew that many others still languished in those circumstances. My discomfort could only be eased by involvement in the restoration project."

The late nineties were a time of high flux in state institutions and structures. Having spent more of his life in the United States than in South Africa, Nkomo initially felt lonely and disconnected. However, within a year he was leading the HSRC: "I was appointed as interim President, perhaps by accident, as the institution was fraught with intrigue that only a seasoned operator could manage," Nkomo chuckles.
Nkomo's wife Stella, a New York City native who is herself an accomplished academic, moved to South Africa. In 2002, he joined the Faculty of Education at the University of Pretoria (UP) as an Extraordinary Professor, with a particular focus on social cohesion within the context of education and school integration. He also started the Centre for Diversity and Social Cohesion, hoping to facilitate dialogue: "Serious social cohesion is critical, especially in a country burdened by a divided past; if you don't instill a sense of belonging and common purpose in everyone, you're not going to succeed to the fullest." Only a small grant was made available for the project and Nkomo became disillusioned by its limitations and what he perceived as lacklustre support.

In early 2012, almost a decade after he'd expected to retire, the academic was seconded to join the 'rescue team' at the troubled Tshwane University of Technology (TUT) as a Deputy Vice-Chancellor for Teaching and Learning. The institution was beset by near-constant disruptions that seemed to be endemic and it had been placed under administration. Nkomo is blunt about his role in the daunting task: "Had I known better, I would have stayed away." After two years at TUT, Nkomo left to take on the role of ombudsman at the University of South Africa (Unisa). He retired in 2016, having published and contributed to numerous academic texts and edited several publications, as well as serving on a host of advisory boards and supervising postgraduate students.

Nkomo still believes passionately in the power of education in an increasingly complex world: "Everything is founded on education. If you can get that right, you can be assured your society can stand its ground."

CYRIL O'CONNOR

AWARDS, HONOURS AND ACHIEVEMENTS

- German Society for Oil, Gas and Coal Collegium Medal for contributions to catalysis (1999)
- Brigadier Stokes Memorial Award by the South African Institution of Mining and Metallurgy for distinguished contributions in mineral processing (2010)
- Foreign Member of the United States National Academy of Engineering (2017)
- Lifetime Achievement Award from the Catalysis Society of South Africa

DEFINING MOMENT

When he was elected a foreign member of the United States' National Academy of Engineering, he was the only foreign member from the African continent at the time. "Personally, I greatly valued this recognition."

WHAT PEOPLE MIGHT NOT KNOW

He spent 23 years on the executive of the Western Province Cricket Association, one of only five life members. He was deeply involved in the development of cricket in the townships before unification, as well as in the unification of white and black cricket. "I made friends across colour and religious divides through cricket – I never would have had the chance otherwise," he says.

GOOD RELATIONSHIPS CATALYSE GREAT CHEMISTRY RESEARCH

"If you do world-class research and work on your relationships with industry, companies will keep funding your research. In the end, it comes down to the chemistry of people." Cyril O'Connor of the University of Cape Towns's (UCT) Department of Chemical Engineering believes his academic career flourished through hard work and spending the time and energy needed to build strong relationships with industry and academia around the globe.

This hard work has paid off – he has built two world-class research centres at UCT, both of which have made key contributions to the mining and chemical industries in South Africa and globally. Now a Senior Research Scholar at UCT, after serving as Dean of Engineering and the Built Environment for 12 years, he leads several international societies and was recently inducted into the United States 's National Academy of Engineering.

His research has always aimed to solve problems in two different industrial spaces: mining and the chemical industry. In both cases, he works on making industrial processes more efficient and cost-effective. "After my PhD, I was invited to apply for a position at UCT Chemical Engineering as a lecturer and researcher," says O'Connor. "At the same time, I went for interviews at SASOL and the National Institute of Metallurgy (NIM), now known as Mintek. Both said that if I got the job at UCT, they would want to do some research with me."

Less than a year later, O'Connor had established two research centres – the Centre for Catalysis Research and the Centre for Minerals Research. Both continue to thrive today, each led by former PhD students of O'Connor's, and each currently boasts major global reputation in terms of research output and quality.

The Centre for Minerals Research focuses on flotation and comminution, two of the most important processes used in the beneficiation of minerals. Flotation is a process to separate valuable minerals from ores, while comminution refers to the process of reducing solid materials to a smaller particle size through grinding or other mechanical means. In the area of flotation, O'Connor's group has focused mainly on the beneficiation of ores containing platinum. Given that South Africa has almost 90% of the world's known platinum reserves, this research has made significant contributions to what is South Africa's most important minerals sector.

MONEY WILL FOLLOW IF RESEARCH IS GOOD

The centre works with many global mining companies to develop new processes and improve on existing ones. Contrary to the protective attitudes that many modern research organisations take towards intellectual property, O'Connor believes that carrying out world-class research is much more important than making money from patents. He says that the money will follow if the research is good enough.

O'Connor states that his centres have been funded by some companies for more than 30 years, and that his success comes down to reliably producing

world-class research and adding value to a company. "We don't count our success by how much the industry made using our technology. You know it's working when they keep coming back to fund your research. The key is to build a world-class reputation and keep it that way. Lose your status as a world leader at your peril."

On the catalysis front, O'Connor's work started with SASOL in the 1980s, trying to find ways of improving processes to convert olefins into useful fuels. "At the time, SASOL needed to balance the supply and demand for petrol and diesel in the national liquid fuels pool; they wanted to do this by converting olefins (a by-product of SASOL's oil-from-coal process) into diesel."

Today, SASOL focuses on using olefins to produce polymers, and thanks to O'Connor's work, SASOL is one of the world's largest producers of polymers. O'Connor has strong ties with the Engler-Bunte Institute at the University of Karlsruhe in Germany, home to one of the world's leaders in catalysis research. That relationship demonstrates the value of collaboration well. O'Connor went on a sabbatical to the university in 1992 and began to establish close working relationships there. In turn, several students came out to do research in his group at UCT, and some have stayed on to become senior academics in chemical engineering. Through that long history of working together, the Centre for Catalysis Research is now a world leader in the Fischer-Tropsch process that SASOL has become famous for.

Another research focus in the Centre for Catalysis Research is zeolites, a type of mineral that acts as a natural sponge and filter. Zeolites are widely used in the chemical and petrochemical industries. O'Connor has been involved in the leadership of the International Zeolite Association, an indication of his pioneering work in the field. "Under economic sanctions, we couldn't get samples of the zeolite we needed for catalysis research," he explains. "We figured out how to make our own, and when we could access samples again in the 1990s, we didn't need them anymore."

O'Connor is also a committed and passionate teacher. In fact, he started his academic career with a teacher's diploma, aiming to teach science and mathematics. One of his lecturers asked him why he wasn't at a university and that started him on the path toward academia. "I moved to Cape Town and started teaching. At the same time, I was running a hostel and studying through the University of South Africa (Unisa) towards a BSc with majors in chemistry and mathematics. "I didn't get much sleep," he says with a laugh.

After obtaining the BSc, he got a bursary to study chemistry honours at UCT and his supervisor suggested a PhD in physical chemistry. Then came the offer of a lecturing post in chemical engineering. He continued to lecture at UCT for decades, even when he was Dean and acting Deputy Vice-Chancellor, and believes that it is critical that academic leaders remain active in the classroom. "If you aren't in the classroom, at the coalface, you don't know what's happening in your organisation. I feel strongly that top academic leaders must be active researchers and teachers as well."

Throughout a lauded and successful career, O'Connor has remained humble and committed to the most important part of his work: the people. "I want everyone to know, it wasn't just me, it was a team. Building a team and working with others is much easier and more fulfilling than being a lone ranger."

PHILIP ONYEBUJOH

AWARDS, HONOURS AND ACHIEVEMENTS

- Member of the Academy of Science of South Africa (ASSAf) (2000)
- Foreign Commonwealth Office Scholarship Award, British Council (1988)
- Overseas Research Students Award (Committee of Vice Chancellors, UK), (1989)
- Wellcome Trust Clinical Fellowship, (1992)
- Fellow of the Royal College of Physicians of London (2008)
- Drafting and implementing South Africa's human immunodeficiency virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) treatment guidelines – the country's antiretroviral plan grew to be the largest of its kind in the world (2003)

DEFINING MOMENT

His career was defined by his posting as a young medical doctor to Kano state's (Northern Nigeria) challenging Infectious Diseases Hospital, where he first became fascinated by pathogens and immunology. "When I heard I would be serving there, I broke down in tears in my car. My mother told me to give it a try and believed it was part of God's plan for me … In the end, she was right."

WHAT PEOPLE MIGHT NOT KNOW

He is a voracious reader outside of his field of expertise. He is also a passionate wildlife and portrait photographer.

REWARDING TO SAVE LIVES

Philip Onyebujoh has spent his career on the clinical frontline of the war against some of the world's most infectious and feared illnesses. He has helped to save countless lives, shape world policy and deepen medical understanding of the dreaded pathogens that cause diseases like Tuberculosis (TB), HIV/AIDS, Ebola, Marburg, O'nyong'nyong and Rift Valley fever. Onyebujoh has received several awards and fellowships in recognition of his impact on medical sciences and public health. A prolific writer, he has authored and co-authored several peer-reviewed publications, including World Health Organization guidelines and policy documents.

EARLY LIFE AND CAREER

Onyebujoh was born in Lagos in 1956 and attended school and university in Nigeria, graduating as a medical doctor in 1982. He joined the Ministry of Health in Kano, Nigeria as a medical officer but when he heard he'd be serving at Kano State's notoriously demanding infectious diseases hospital, he was appalled: "It was a horrendous appointment. I was being posted to a hospital that catered for highly infectious diseases and from where doctors would give their left arms to escape. I felt I was being sentenced to work there, not employed." With some encouragement from his mother, Onyebujoh embraced the challenge. In a hospital where many doctors refused to set foot in some wards for fear of infection, he was defiantly hands-on: "I simply did my work as a doctor," he says.

When he stayed late at work one night, treating a gravely ill 6-year-old girl with measles, Onyebujoh had no idea that those few hours would profoundly change his career trajectory. The following day he was told that his patient was the granddaughter of one of Kano State's richest men, who wanted to thank Onyebujoh personally. "He said to me, 'Can I give you something? Money?'" Onyebujoh declined, but the man insisted. "So I said, if you need to spend money, why don't you build us a ward and some facilities at the hospital? He said, 'Done'." In the end, four new wards were donated to the hospital, plus a fully equipped laboratory.

Onyebujoh describes the case as the single most important moment of his career. He experienced for the first time how "fantastically rewarding and fulfilling" it could be to save the life of a dying patient and help them recover fully. The case also pushed him to focus on researching infectious diseases, which he could do in the fully equipped laboratory donated by the grateful grandfather.

PATHOGENS, PRESTIGE AND POLITICS

In 1986, Onyebujoh was appointed Senior Medical Officer and became the youngest ever person to lead the infectious diseases hospital. His quest to develop protocols around the care of infectious patients did not go unnoticed. In 1988, the young doctor was one of just five Nigerian physicians selected by the British Council for a postgraduate research fellowship in the United Kingdom. He attended University College London's School of Hygiene and Tropical Medicine and worked at Middlesex hospital, completing his master's degree in Clinical Tropical Medicine, diploma in public health (DTM&H) and PhD in Clinical Immunology. During that time, Onyebujoh also met and married

his South African wife. In 1993, with his PhD completed, the couple made a brave move: "Going back home to South Africa was an incredibly important thing for my wife, having grown up in exile," he remembers.

Onyebujoh set up the first-ever clinical trials programme for TB and HIV/AIDS at Durban's King George V Hospital under the auspices of the South African Medical Research Council (SAMRC). In 1996, he moved to Pretoria to continue his clinical research while still overseeing the unit in Durban. He was appointed as the SAMRC's first black Director for TB and HIV research and also worked with the Medicines Control Council as deputy chair of its clinical trials group. In 1998, Onyebujoh was asked to join the work being done by the government on HIV/AIDS treatment, as the Chairperson of the nevirapine sub-committee: "The question was whether the drug could be safely used to limit mother-to-child transmission." At the time, the government was under increasing pressure to roll out antiretroviral treatment. Because of insufficient data, and the fact that nevirapine had not been evaluated for use in South Africa, the Presidency and the Department of Health rescheduled the drug to a consultant-only prescription. The move sparked a legal and political battle. In 2001 the Treatment Action Campaign (TAC) took government to court to force it to roll out antiretrovirals nationwide. By that time, Onyebujoh had left South Africa to work for the World Health Organisation (WHO) in Geneva, Switzerland, but in 2002 he was recalled to give evidence in the High Court: "Here I was, a Nigerian who had now become a South African by virtue of the work I was doing," he recalls. "I was in a very tenuous position to say the least." The TAC eventually won its court battle and the Constitutional Court ordered government to begin the national roll-out.

In 2003, Onyebujoh was invited back to South Africa, this time to help implement the country's HIV/AIDS treatment guidelines. After a demanding three months, he "returned to his day-job" at the World Health Organisation WHO, coordinating its TB and HIV research, and watched with pride as South Africa's Antiretroviral programme grew to become the largest on the planet.

Onyebujoh worked for the WHO (in Geneva) for 13 years, coordinating several guideline-informing clinical trials in the African region, until he was posted to Harare in 2013 to head a laboratory-strengthening initiative in 47 member states on the continent for the next four years. He was then seconded to the African Union to help put into operation the new Africa Centre for Disease Control (CDC) as a Senior Technical and Strategy Advisor.

Onyebujoh takes immense pride in his work at the Africa CDC: "This is the first time in our history as Africans that we are implementing and initiating a health institution for our continent, run by our people, who will report to African heads of state. It's a momentous time and I'm happy it has happened in my lifetime."

IQBAL PARKER

AWARDS, HONOURS AND ACHIEVEMENTS

- Oettle Medal of the Cancer Association of South Africa for significant contributions to oesophageal cancer research (2009)
- South African Society for Biochemistry and Molecular Biology Gold Medal for Distinguished contributions to Biochemistry in South Africa (2005)
- National Science and Technology Award for Outstanding Contribution in Science, Engineering and Technology (2003)

DEFINING MOMENT

When Iqbal Parker returned to South Africa after completing a postdoctoral degree abroad, he received several offers from academia and the private sector. In the end, he chose the least financially rewarding – a second postdoctoral at the University of Cape Town (UCT) rather than tenured positions at other institutions. This let him really focus on the research he wanted to pursue and shaped the research trajectory of the rest of his career.

WHAT PEOPLE MIGHT NOT KNOW

"I love being able to fix things; I build furniture and I do all my own plumbing and home maintenance."

COMMITMENT TO OESOPHAGEAL CANCER RESEARCH REAPS ITS REWARDS

Iqbal Parker spent his first year at university commuting by ferry to Salisbury Island in Durban Harbour, where a naval base served as the University College for Indians, now part of the University of KwaZulu-Natal – the designated place of higher learning for Indians in South Africa during apartheid. So unpleasant was the facility and the overall experience that Parker changed academic paths to biochemistry so that he could move to UCT.

This was possible because the University College for Indians didn't offer a biochemistry degree, so he could apply for special permission from the government to study at a white university. Parker is a fighter – instead of complaining or giving in to the inequities of a racist and authoritarian government, he found ways to beat the system. Along the way he fell in love with biochemistry, completing a PhD in 1979 and heading overseas for a postdoctoral degree. "After completing the postdoc in the United States, I returned to UCT," he says. "People have never stopped me from knowing what I want and pursuing that."

What he wanted was to delve into the complex genetics of cancer cells in a quest to better understand this devastating disease. He is particularly interested in oesophageal cancer, which he says is a major problem in South Africa: Black males in South Africa are more susceptible to oesophageal cancers than other population groups, and Parker would like to know why. For a long time, researchers thought that oesophageal cancers were principally caused by environmental factors, but Parker's research has been instrumental in showing that in fact, genetics play a role as well. Perhaps even more importantly, work in his group shows that genetic factors interact with environmental factors like smoking or drinking alcohol to increase susceptibility in individuals and certain population groups.

He says that one of the great successes of this work is the collaborations he has built with institutions like the University of the Witwatersrand (Wits), Walter Sisulu University, Jomo Kenyatta University of Agriculture and Technology in Kenya, and research giants like Kings College London and Cambridge University. He received a grant from the Newton Fund to continue building on these successful partnerships, and to make use of the expertise of the Wellcome Trust Sanger Institute in next generation sequencing (NGS) technology.

NGS has allowed Parker's group to study the genetics of cancer in new ways: Now they can use whole genome sequencing to look at all the genes that might play a role in cancer, rather than picking targets that may be interesting. The research group has 30 whole genome sequences to work with now – a formidable resource in the hunt for answers about the causes and disease patterns of oesophageal cancer. An important discovery that has come out of his work with whole genome sequencing is that viral Deoxyribonucleic acid (DNA) can be found in human genomes and the activity of these genes plays an important role in cancer. One virus stood out in particular – Human Endogenous Retrovirus (HERV113) – a group of genes that is often duplicated or rearranged within the human genome. His group has shown that this behaviour can disrupt gene expression and cause genetic instability that can eventually lead to cancer.

The Sanger Institute's algorithms help Parker and his colleagues detect the most common genes driving these genetic mutations. This information can then be compared with other data on the molecular pathways of cancer progression to help identify potential drug targets.

INTERNATIONAL CENTRE ESTABLISHED

Parker has also played an important part in bringing the International Centre for Genetic Engineering and Biotechnology (ICGEB) to South Africa. Established in 1987 under the auspices of the United Nations, the ICGEB is an international network that promotes research and training in genetic engineering and DNA-based technologies in the developing world. It currently has centres in Italy, India and South Africa. When South Africa became a part of the ICGEB in 2003, Parker was asked to sit on the Board of Governors to represent his country. Later, he would be the first Director of the ICGEB in Cape Town. "The ICGEB were struggling to attract interest in their training activities from African countries so they decided to set up a centre in Africa to improve the situation," says Parker. "South Africa applied to host the centre at UCT, and the Cape Town component of the ICGEB was established in 2007."

The Cape Town centre focuses on cancer and the major infectious diseases impacting the African continent – malaria, HIV and Tuberculosis, as well as several parasitic diseases. The centre has produced a number of world-class students and continues to be a source of high-quality research and international research cooperation.

The Academy of Science of South Africa (ASSAf) is fortunate to count Parker amongst its founding Members. He has served several terms in different leadership positions at the organisation over the last 20 years. "ASSAf's expert committees play an important role by providing valuable independent advice to policymakers in government," he says. Connecting researchers and government is one of the reasons ASSAf exists in the first place.

Parker is now an Emeritus Professor at UCT, as well as a Senior Research Scholar. This latter programme provides a way for retiring research leaders to pass their knowledge and experience on to the next generation of academics coming up through the system.

And he's busier than ever. "When people hear that you are retiring, they think you'll have more time, so they keep giving you more things to do." Nevertheless, he has made some concessions to taking it easier in his retirement – he no longer works six-day weeks, choosing these days to take Saturdays off like the rest of us.

CALIE PISTORIUS

AWARDS, HONOURS AND ACHIEVEMENTS

- The Bill Venter Literary Prize (with Jan Malherbe & Derek McNamara) (1993), for the book, *An Introduction to the Uniform Geometrical Theory of Diffraction* (1990)
- The Presidential Award (P-rating) from the National Research Foundation for research excellence (1992)
- Best PhD dissertation from the Ohio State University, ElectroScience Laboratory (1987)

DEFINING MOMENT

He has enjoyed a defining journey in the company of his wife, Michèle Oliver, a highly regarded expert on constitutional and international law. "She is a continuing source of wisdom, energy and support."

WHAT PEOPLE MIGHT NOT KNOW

Although his entire career and mind-set has had a distinct future focus, he really enjoys reading history and visiting historical sites. He is always mindful that "those who do not learn from history will be condemned to repeat it."

TRANSFORMING A UNIVERSITY FOR A BETTER FUTURE

Calie Pistorius practically grew up on the campus of the University of Pretoria (UP) as he often went to his father's office there at weekends. Years later, he would also become an academic, and in 2001 at the age of 41 he was appointed as the institution's Vice-Chancellor and Principal. Eight years later he also became the Vice-Chancellor of the University of Hull.

Like his father (a former Vice-Rector of UP) and grandfather before him, he was christened Carl Wilhelm Irene, but goes by the nickname of Calie. Born on 9 August 1958, Pistorius matriculated from Menlo Park High School in Pretoria in 1975.

"I like conceptualising something new and then participating in its development up to the point when it works," Pistorius explains his decision to pursue studies in electronic engineering – first a BSc Engineering from UP in 1979 and then an Honours degree in 1981, both received *cum laude*.

After a short period in industry as a design engineer, he returned to work at the consulting company Laboratory for Advanced Engineering located on the UP campus and led by Professor Louis van Biljon. In 1982, Pistorius went to study at the University of California at Los Angeles, but transferred to the Ohio State University at the urging of another mentor, Professor Jan Malherbe. There, he received a Master's degree (1984) and a PhD (1986). Upon returning as an associate professor to the UP Department of Electronic and Computer Engineering in 1987, he joined Professor Malherbe's research group in electromagnetics and continued to consult for the Laboratory for Advanced Engineering.

At the age of 31 Pistorius became the head of the Department of Electronics and Computer Engineering at UP. One of his first tasks was to merge the department with the Department of Electrical Engineering and the Carl and Emily Fuchs Institute for Microelectronics. "I had to learn a lot at great speed," he recalls.

Despite his management duties, Pistorius was keen to further his research. He decided to focus on the management of technological innovation and took a year's sabbatical from mid-1993 to mid-1994 at the Massachusetts Institute of Technology (MIT), where he obtained a master's degree in the management of technology. There he met another of his mentors, Professor Jim Utterback, with whom he still publishes widely. He later became an alumnus of Harvard Business School, having completed the Advanced Management Programme in 2003.

Months after returning from MIT, Pistorius became founding Director of UP's new Institute for Technological Innovation. In 1998 he was appointed as the institution's Director of Information Technology, and in 2000 as Dean of the Faculty of Engineering, the Built Environment and Information Technology.

SERVING AS VICE-CHANCELLOR

While serving as Vice-Chancellor and Principal of UP, he also became chair of the National Advisory Council on Innovation in South Africa, the statutory body advising the Minister of Science and Technology.

At that time, UP was already South Africa's largest residential university. Its institutional transformation process continued as did its pursuit of international academic excellence. Professor Wiseman Nkhuhlu, a former chair of the NEPAD steering committee, became UP's first black Chancellor, and Futhi Mtoba the first black Chair of the Council. A challenge was the integration of the Mamelodi campus of the former Vista University into UP – a move called for by then Minister of Education, Kader Asmal.

After Pistorius was appointed for a second term as Vice-Chancellor in 2005, Asmal noted in a letter to him: "Your re-appointment is a tribute to the care you have taken to renew the university's role in a changing South Africa. Transformation, as the cliché has it, is a process, not an event … Obviously, there will be criticism at the rate of change, but you will be able to deal with this with the fortitude, sensitivity and courage you have displayed up to now."

When his second term was nearing its end, Pistorius was recruited to lead the University of Hull in England. A gesture upon his arrival in September 2009 touched him deeply: "On my first day in office, I looked out of my second storey office window and saw that a gardener had arranged flowers and plants in the shape of the South African flag to welcome me," he remembers.

By the time he stepped down as Hull's Vice-Chancellor in January 2017 to start consulting, many building refurbishment projects and new buildings had been completed at the university, along with organisational and academic restructuring processes and an information technology overhaul. Pistorius rates the reopening of the renovated Brynmor Jones Library as a particularly proud moment. Several cross-disciplinary institutes in, among others, maritime science and creative and cultural research, were established under his watch. And he had even found the time to be a Liveryman of the Worshipful Company of Engineers.

NEW ENDEAVOURS

After 15 years serving as Vice-Chancellor, he has taken on new challenges. His consulting firm DeltaHedron – based in the United Kingdom – focuses on the strategic impact, opportunities and risks presented by emerging technologies. Pistorius also served as a director of Sentamu Academy Learning Trust and is an Extraordinary Professor in industrial engineering at Stellenbosch University (SU).

"Universities play an important role in society – in advancing knowledge, but particularly in inspiring and equipping their students to contribute proactively towards creating a better future, rather than merely participating as spectators in a world given to them by others." That is why he is a registered chartered engineer in the United Kingdom, Member of the Academy of Science of South Africa (ASSAf), Fellow of the Institute of Engineering and Technology, the Royal Society of South Africa, the South African Academy of Engineers and the South African Institute of Electrical Engineers.

BERNARD PRIOR

AWARDS, HONOURS AND ACHIEVEMENTS

- Gold Medal of the South African Society for Microbiology for exceptional service in the field of microbiology in South Africa (2002)
- Elected Member of Academy of Science of South Africa (ASSAf) (1998)
- President of the South African Society for Microbiology (1990 – 1992 & 1998 – 2000)

DEFINING MOMENT

Forced to switch courses in his second year, he chose microbiology and found it to be fascinating.

WHAT PEOPLE MIGHT NOT KNOW

"I am interested in classical music and although I do not have much talent for it, one of my children has become a professional musician and I helped direct her in that field. I also love woodwork."

CITY BOY TURNED MICROBIOLOGIST TURNED WINE TASTER

Naturally inquisitive, Bernard Prior is a renowned scientist in the field of microbiology, who had fallen in love with research during a time when all he had wanted was to be a farmer. "I realised that it is an exciting field to go into because you always have a new horizon to discover, new questions to ask, and the answers might lead to further new questions. I knew that it was something I wanted to do for the rest of my life."

As a Durban-born city boy interested in farm life, Prior had always been happiest when farmers visited his school looking for young volunteers who wanted to experience the farm life. "It was during those times that I learned what it was to be a farmer." The farming bug had firmly taken hold but his parents could not afford to send him to university to study agriculture. For three years he took on odd jobs, including sorting letters at the Post Office, to save up for his university education. Finally, he secured a bursary that would cover the tuition fees of his BSc Agriculture degree and he worked part time as a taxi driver to cover his other costs. "I also found jobs helping on research stations and that stimulated my interest in research."

Prior very nearly missed the road to microbiology research, opting first to study agricultural statistics. "I failed the pre-requisite mathematics course in the second year. But in life you learn that failure is never the end of the road; when one door closes another door will open. I am so glad I failed that course, otherwise I would be in another field that I am not so sure I would be happy in." This fortunate failure charted his course towards microbiology.

"I got lucky," he says, referring to a fully-paid scholarship he received a couple of years later to complete his PhD at the University of Wisconsin in 1972. "I don't think many people get such a wonderful opportunity to study at a top university in the United States. It had a huge influence on the rest of my career and on how I approached research later."

After returning to South Africa, he worked at the National Food Research Institute in Pretoria briefly before being "poached" by the former University of the Orange Free State, now the University of the Free State (UFS) in Bloemfontein. There he spent a quarter of a century, starting as a lecturer and finally becoming head of the Department of Microbiology. "It was a good period in my life: I did the most productive work of my career and was happy where I was," he recalls. That is, until he received a call from a former student of his in 1998 about a position at Stellenbosch University (SU). "I thought it was time for a change."

Prior then became a professor in the Department of Microbiology and Chairman of the Stellenbosch University (SU) School of Biological Sciences until 2005, when he left for a short stay as Visiting Professor at the Louisiana State University in Baton Rouge. "After I came back to South Africa, I was thinking about retirement, but I think that scientists never really want to retire," he says. In fact, he remained an Extraordinary Professor at SU until recently.

WORKING ON YEAST

Prior says his most important work over the years has been on yeast and how it tolerates stresses like temperature, substances and chemicals. He even likens

it to the way humans react to the same stresses. An avid wine taster, Prior has also conducted research into using yeast to change or improve the flavours of different wines. Using his expertise as a microbiologist and his knowledge of agriculture, he has worked to improve the taste and quality of wines by looking at improving their production.

Prior co-authored a research paper in *Wineland*, about the facts and fictions surrounding the effects of glycerol (produced by yeast at different levels depending on stresses) on the taste and quality of wine. The research found that the quality of white wine was related to glycerol levels, but this was not the case in red wine. He also showed that selecting the right yeast strain could yield higher glycerol levels in wine. Prior was a South African representative to the International Yeast Commission for a quarter of a century from 1988.

He also spent 12 years at the International Energy Agency Bioenergy (liquid biofuels) and has been a part of Task 39 – an international group of experts who consult on matters surrounding the commercialising of sustainable biofuels used for transportation. He helped assess the state of biofuels in South Africa, concluding that the local biofuel industry holds huge potential for growth and job creation.

Prior's many publications in national and international journals include *Molecular Microbiology*, *Molecular and Cellular Biology* and *Applied and Environmental Microbiology*. Many organisations have called on the knowledge generated through his research over the years, including the South African Society for Microbiology and congresses focused on biotechnology and bioenergy.

Prior acknowledges that he has had a lot of luck in his life and career; however, he says he was luckiest when he met his wife: "We met on a blind date and we are still together after 50 years."

MAMPHELA RAMPHELE

AWARDS, HONOURS AND ACHIEVEMENTS

- Lifetime Achiever Award from the National Research Foundation (2007)
- The Barnard Medal of Distinction from the Barnard College for Women in Columbia (1991)
- A shared NOMA Award for Publishing in Africa with Francis Wilson (1990) for their book, *Uprooting Poverty: The South African Challenge*

DEFINING MOMENT

Her PhD on the politics of space was an awakening. "I had always known about inequities in South Africa as an activist, but I got close to the humiliating circumstances of migrant hostels in Cape Town during my study of the living spaces of the workers; it brought to light the severe limitations of those spaces on their physical, mental and emotional well-being."

WHAT PEOPLE MIGHT NOT KNOW

"I love my sleep. I don't believe you can be a leader and effectively tackle what the day brings if you don't look after your health. So, I try to sleep for eight hours every night, to eat healthily and to exercise."

SCIENCE GIVES SOUTH AFRICANS DIGNITY

As a medical doctor plunged into the realities of poor South Africans, and as a political activist detained without trial and banished by the apartheid government after the Soweto uprisings in 1976, Ramphele thought she knew about inequality in South Africa. She thought she understood how closely societal factors and the disease burden were tied together.

She says many health issues, some of which persist today, come about because of poverty and the lack of education, which has resulted in people having little understanding of nutrition and reproductive health. "Nobody should be denied the education to know their own body," says Ramphele. "It is humiliating."

In the mid-1970s, in King Williams Town in the Eastern Cape, a young couple who had been struggling to fall pregnant came to see Dr Ramphele for help. "I examined the woman," recalls Ramphele, "and saw she was a virgin." Gently, Ramphele explained the difference between the anus and the vagina to the couple.

Later, in Tzaneen, Limpopo, she encountered children with vomiting and diarrhoea who were dying of kwashiorkor and malnutrition. "Although mothers understood the importance of breast milk, those who had to go to work had no money to buy substitute formula, so their infants were fed inadequate diets by their grandmothers. Under those circumstances, people accepted that you might have six kids, that three would die and you would have three left."

Her PhD in social anthropology in 1991, which led to her book, *A Bed Called Home* (1993), was another big awakening: "I have never been so close to humiliation as when I was working in the migrant labour hostels in Cape Town." She says as many as 12 adult men, who had left their homes and families to find work in an economic system intended to benefit mainly white people as labouring 'boys', all shared a room and slept on cement bunk beds. "I wanted to know what it actually means when home is a bed in full view of everyone else. I asked myself what impact this would have on the minds and emotions of these men; how they felt about themselves and what effect it would have on their social relationships. They had sacrificed their manhood and human dignity to become people without privacy."

Her research showed that the consequences of humiliating working men over multiple generations is a sense of worthlessness. "In my view, this humiliated manhood is at the base of the grotesque gender-based violence we have in South Africa," says Ramphele. "When men are seen as protectors, providers and leaders, but have to leave their women behind to survive without them, they feel worthless at home and at work. This is still the case today. It's unconstitutional!"

MISTRUST OF SCIENCE

Ramphele says that sadly, there was no response to her research from the new South African democratic government at the time, and this is another example of the huge disconnect between research and policy in South Africa. "Many of

the people who came into the new government had not lived in the country for many years, so were distrustful of researchers who had been working here. There was an inherent mistrust of scientific knowledge by politicians, because most researchers were white."

Although she feels that the Academy of Science of South Africa (ASSAf) has gone a long way towards closing the gap between science, society and government, Ramphele stresses that social and other scientists have to build more effective connections between their work and society.

During her tenure as Vice-Chancellor at the University of Cape Town (UCT), Ramphele applied her insight into the importance of personal space to create a conducive learning environment for poor students and first-generation students. "There was not enough protection for those students, so we created residential spaces that could connect them to the academic space." She also promoted a radical transformation of the academic curricula to create better choices for students and says the nine years she spent in leadership roles at the university were the most meaningful of her career. "I came to the job as a non-academic: Although I was doing research, I was not yet established."

But she knew enough to surround herself with strong people who could complement and support her goal of transforming UCT from an 'old-boy's college' to an inclusive South African university that aspired to be a world-class African university. "We made UCT itself better, but we also set standards for the rest of the country." UCT was the first university to have anti-harassment policies on racism, sexism and intolerance of any kind. "Institutions had no idea of the damage they were doing to the scientific endeavour by not making places of research and teaching safe for women. Women have to feel safe to be at their most innovative and creative."

She feels her greatest legacy at UCT is its new library. She drew on the example of the University of Southern California to champion the building of a library that made the most of technology and created conducive working spaces for both students and academics. Because of her guiding role at UCT, and at various other organisations like the World Bank and the Technology Innovation Agency since 2000, many more people have had the opportunity to access knowledge.

In fact, sharing knowledge has been at the core of Ramphele's work since her community health service to poor and uneducated people in King William's Town and Tzaneen. "I believe if we proceed from the assumption that science is universal, then people who are illiterate or uneducated are entitled to access that universal pool of knowledge. We should approach those people with respect, not assume they are stupid; they want to do their best, so instead of alienating them, we should embrace them.

"I learnt that you have to understand where people come from, and that science can give dignity to people depending on how you share your knowledge." In the case of infants with vomiting and diarrhoea, for instance, traditional healers would place herbs on the baby's sunken fontanelle (the soft spot on an infant's skull where the bones have not yet fused). "I said to them, we have the same diagnosis, and oral rehydration therapy will help the herbs do their work," she recalls, referring to the fact that a sunken fontanelle is a symptom of dehydration. She says there are many traditional remedies that have a scientific base. "We need to reconnect indigenous knowledge with science. The idea of Western science is inaccurate because it discounts the contribution of Africa."

Her own connection to science began with her first love, chemistry, but her high-school physical science teacher had advised at the time that as a black woman she had no prospect of becoming a career chemist, so it would be better to pursue a medical degree. Today, she is still grateful for the advice that led her to the former University of Natal (now part of the University of KwaZulu-Natal) where she became part of the circle of black students who founded the Black Consciousness Movement. "That accident put me in the right place at the right time."

DOUG RAWLINGS

AWARDS, HONOURS AND ACHIEVEMENTS

- First National Research Foundation A-rating in 1992 which he held until 2011
- PanLabs Award from the American Society for Industrial Microbiology (1997)
- Gold (2011) and Silver (1992) Medals from the South African Society for Microbiology

DEFINING MOMENT

His decision to pursue microbiology at postgraduate level instead of chemistry. At the time he did not realise that the field of recombinant DNA technology would break initially in the field of microbiology within the next few years and produce so many exciting techniques and rapid advances in fundamental biology.

WHAT PEOPLE MIGHT NOT KNOW

He was so inspired by the community spirit and support during his first, very casual Argus Cycle tour (on his son's school bike!) that he has since completed another 21.

SERVING THE BEAUTY OF SCIENCE

"It saddens me that a lot of people do not perceive the beauty of science. They regard it as utilitarian and so its beauty is lost to them. Science is a cultural expression during which scientists design the question, but never the answer. Yet he who sets the question may be as creative and imaginative as someone in art or literature." Douglas Rawlings, Emeritus Professor in microbiology at Stellenbosch University (SU), put this view forward during a public lecture in 2014 in which he introduced the topic of his Doctor of Science degree. It focuses on the plasmid IncQ2. He has been studying this group of molecules and their ability to replicate in many different bacteria on the side since the 1980s.

He describes attaining a degree as coveted as a DSc as "actually a minor event compared with the journey of over 30 years in getting there." Rawlings is internationally renowned for his research on biomining techniques using micro-organisms. He is a man of faith who gets things done, and many recognise this true leader's ability to develop people to their full potential. A colleague once described him as "a true mensch".

He matriculated from Selborne College in East London in 1968, having been born in the city in 1950. While waiting to start his military conscription, he was working at a shipping agent when his father phoned with news that a place had opened at Rhodes University. Rawlings was placed in a quandary, because he has always liked to honour his commitments. Luckily his boss was understanding, and he started studying towards a BSc in chemistry and microbiology (1971) and a BSc Honours in microbiology (1972). For the PhD (1976), he was supervised by Professor Dave Woods, and developed a way for tanneries to treat their toxic effluent water.

"Molecular microbiology was terribly exciting at the time, and as a postgraduate I watched it develop," remembering how his lecturers inspired him during his formative years in science. While working at the Leather Industries Research Institute and funded by the Water Research Commission to supervise research aimed at building a scaled-up version of his PhD work, he realised that he needed his own niche. After a period as a lecturer at the University of the Witwatersrand (Wits) in 1978, he found it in the significantly stronger mining sector.

Professor Woods invited him to join his department at the University of Cape Town (UCT) in 1982 and it became his academic home for the next 16 years, where he truly fell in love with research. His studies using iron- and sulphur-oxidising bacteria and other micro-organisms as bio-agents to extract metals from ore attracted attention. Gencor and Goldfields acquired the technology and built bio-oxidation plants worldwide like the one constructed in Barberton in 1986. During this time, Rawlings also helped supervise the MSc studies of Professor Philippa Norman. This formed the basis for what became the multimillion-dollar Biox® gold-bioleaching process.

Rawlings was one of the first South Africans to be exposed to the techniques of DNA cloning and the study of gene expression. From his laboratory came some of the first genes to be cloned and the first two genes to be sequenced in South Africa. His 1984 paper in the *Journal of Bacteriology*, is probably the first report of a cloning experiment in South Africa. He also kept on at researching IncQ2, with the last of his 21 research articles or reviews about it appearing in 2012 in the journal *Plasmid*.

INVESTMENT IN PEOPLE

When he moved to Stellenbosch University's (SU) Department of Microbiology in mid-1998 to become its Chair for the next 13 years, he did so with the intention of investing in other people in the next part of his career. The spirit of cooperation and collaboration he experienced while at the helm is something he still treasures. He served various periods as Vice-Dean or Acting Dean of the Faculty of Science, and in 2012 was also SU's Acting Vice-Rector (Research). He has served on various university-wide and national committees, advisory boards, journals and research projects over the past four decades and has overseen 38 postgraduate students. He holds eight patents, authored two books on biomining and 119 journal articles – all of them well-cited. He did duty on the scientific committee of the biennial International Biohydrometallurgy Symposium for a quarter of a century, and as a guest Professor of Central South University in China. He also served as General Secretary and President on the Council of the Royal Society of South Africa and was an academic coordinator of the Claude Leon Foundation postdoctoral bursary scheme. He was also a council member of the South African Society for Microbiology.

Since retiring in 2016, he coordinates SU's staff mentoring programme and serves as alternate research integrity officer – and makes a point of reading the *New Scientist* every week, in search of more beautiful science.

TERENCE ROBINSON

AWARDS, HONOURS AND ACHIEVEMENTS

- Havenga Prize for Life Sciences from the Suid-Afrikaanse Akademie vir Wetenskap en Kuns ((2018)
- Zoological Society of Southern Africa's Gold Medal for contributions to zoology in South Africa (2003)
- British Association Medal of the South African Association for the Advancement of Science (Silver) (1984)

DEFINING MOMENTS

Exposure to early developments in molecular biology and life in academia in the United States made an indelible impression on his early career by highlighting the hugely competitive environments associated with big laboratories and big science. Equally defining was his Wellcome Trust funding in 2003, which led to a three-year collaborative research project that gave him access to resources and skills at Cambridge University.

WHAT PEOPLE MIGHT NOT KNOW

"Many of my PhD students have gone on to achieve acclaim. Among these are four full professors, three of whom are current departmental heads."

DISTINGUISHED CAREER UNRAVELLING GENETIC MYSTERIES

When Terry Robinson chose genetics and zoology as his two majors as an undergraduate student, he recalls being conflicted in his choice of careers – would it be genetics, or zoology? "At that time, the two disciplines were to a large extent distinct (particularly so in South Africa) so he ended up completing a BSc Honours in zoology and then subsequently another one in genetics. "This meant I gained from having both a zoologist and a geneticist as supervisors of my doctoral research," he says.

That was a long time ago, and Robinson's distinguished career in academia has since taken him between South Africa and the United States several times, honing his expertise in the field of evolutionary genetics and aspects of chromosome biology that include molecular cytogenetics, systematics and phylogenomics.

He completed his undergraduate and postgraduate studies at the University of Pretoria (UP), but it was his year as a postdoctoral fellow at the University of Texas MD Anderson Cancer Center in Houston that was really a revelation. Benefiting from the expertise of Dr Tao-Chiuh Hsu, a world authority on cancer and comparative cytogenetics, he recalls this as the first of two defining periods of his career. "This was a time when molecular methods were being introduced into various aspects of evolutionary biology, including comparative cytogenetics," he says. Although he returned to South Africa in 1983, he was lucky enough to resume his international research career a year or two later, initially at the University of Texas Medical Branch in Galveston, and later at the Baylor College of Medicine's renowned Institute for Human Genetics, where he spent a further three years. "Exposure to these big laboratories and big science made an indelible impression on my early career," says Robinson, explaining that the experience emphasised the point that competitive science was increasingly becoming multidisciplinary and international in its execution.

NOT PUBLISHED, NOT DONE

Of the many recollections he has of these formative years, one of the most enduring is that of a plaque in the office of one of his postdoctoral advisors that read: 'Work not published is work not done.' "That motivated so much of what drove us." Robinson has since published more than 170 full-length papers in peer-reviewed scientific journals and book chapters; he held an A2-rating from the National Research Foundation (NRF).

Only once he had addressed his wanderlust and returned home to South Africa did his career really take off. In 1989, he took up a post as professor in the Department of Zoology at his *alma mater* UP, where he started a molecular zoology laboratory. A decade later he relocated to Stellenbosch University (SU), where he served as head of the Zoology Department before becoming Executive Head of the Department of Botany and Zoology and then Vice-Dean of Research in the Faculty of Science. In 2015, he became Emeritus Professor.

"My time at Stellenbosch was really critical. I was a mid-career scientist when a successful Wellcome Trust funding application led to a collaborative research project with Professor Malcolm Ferguson-Smith of the Department of Clinical Veterinary Medicine at Cambridge University. "It was exhilarating to be exposed to technical developments at the forefront of comparative molecular cytogenetics, particularly flow cytometry, at a leading United Kingdom institution," adding that this prompted the publication of what he regards as some of his best work.

Robinson's research studied mammalian genome evolution using evolutionarily important African species, then using this information to reconstruct the history of mammals of differing evolutionary ages. "One focus of my work at that time was the Afrotheria, a mammalian clade thought to be of African origin that arose when the continent was isolated from others through plate tectonics." While the afrotheres show little physical resemblance to one another, comprising as they do the elephant, hyrax, sea cows (dugong and manatees), aardvark, elephant shrews, golden moles and the tenrecs of Madagascar, they are, intriguingly, "strongly united by a phylogenetic history that is based principally on DNA sequences and other genomic data".

"One such data set that developed as a result of my ties with the Ferguson-Smith laboratory at Cambridge involved combining and comparing chromosomes from different species using complex molecular genetics techniques. This permitted the identification of several rare genomic changes that unite the Afrotheria and support for some of the puzzling associations within the superorder," Robinson says.

He has used similar approaches to investigate the evolutionary relationships of the Bovidae (antelope, cattle, sheep and goats) and Leporidae (hares and rabbits). He has also published on aspects of conservation genetics, phylogeography and sex determination in mammals.

His exceptional research achievements, which cemented Robinson's international stature as a research scientist, also saw him serve on the editorial boards of several international journals and committees, including the International Union for Conservation of Nature Species Survival Specialist Groups on Lagomorpha and Afrotheria. At *Heredity*, the official journal of the Genetics Society, Robinson was not only a subject editor, but also edited a special edition on Molecular Cytogenetics: Karyotype evolution, Phylogenomics and Future Prospects.

He also served as one of five NRF assessors for the evaluation of rated researchers in South Africa for seven years from 2007 to 2014.

Robinson is proud of his research achievements. He is equally gratified by the success of his postgraduate students. His exceptional record in student training and professional service has seen many of his PhD students go on to achieve much acclaim. This includes three who are current departmental heads, one a full professor, a senior lecturer, and another who is now a lecturer in Poitiers, France. Several of his postdoctoral fellows hold academic appointments abroad, including in London, Spain, France, the United States and Australia.

That's a legacy he cherishes, says Robinson, especially considering the life-changing contributions that great teachers made to his own career.

| JUSTUS ROUX |

AWARDS, HONOURS AND ACHIEVEMENTS

- Stipendium of the Alexander von Humboldt Foundation for research at the *Institut für Kommunikationsforschung und Phonetik*, Bonn, Germany (1982, 1987, 1994 & 2018)
- Certificate of Acknowledgement of Leadership in International Research from the Vice-Chancellor of North-West University (NWU) (2010)
- Vice-Chancellor's Award for Outstanding Research from University of Stellenbosch (SU) (1999)

DEFINING MOMENT

In 1998, Roux participated in the first International Conference on Language Resources and Evaluation in Granada, Spain, where he realised the pressing need for the development of digital language resources for African languages for various technological applications.

WHAT PEOPLE MIGHT NOT KNOW

"While my culinary skills do not extend beyond making a cottage pie, I do know my way around wine varieties."

BRINGING AFRICAN LANGUAGES TO THE DIGITAL AGE

South Africa is home to eleven official languages, but for a long time only two have had the proper digital treatment by apps, such as Google Translate: English and Afrikaans. Luckily the other nine are now not far behind, thanks in part to Justus Roux, who has been promoting and developing technology and digital resources for African languages for more than 40 years.

Roux graduated with a degree in African languages in the late 1960s at Potchefstroom University (now the North-West University), and then completed a Master's in 1971. After a short period of lecturing at the university, he moved to Stellenbosch and in 1979 completed a DLitt in African languages. "My doctorate focused on Sesotho and was quite interdisciplinary," he says. "It comprised linguistics, experimental work in speech acoustics, speech physiology measuring nasal and oral airflow patterns in speech production, and lip and tongue movements through cine-fluorographic techniques before the advent of video."

"We realised that if you make phonetic descriptions of a language, you can't just do it impressionistically, you have to have some instruments to support your views." Hence his entry into the field of experimental phonetics – the study of how speech sounds are formed, transmitted and perceived as part of communication. "At that time, we didn't have the proper laboratory apparatus to do experimental phonetics," he recalls. Fortunately, colleagues at various universities shared their instruments and knowledge which enabled him and his colleagues to do acoustic and physiological measurements of people speaking Sotho.

Roux's next stop was the University of Bonn in 1982 to learn the latest computer-based techniques in experimental phonetics. In 1987, he moved to the Fraunhofer Institute in Stuttgart to synthesise Xhosa speech for the first time. "These experiences were extremely valuable for me," he says, and he went on to set up an experimental phonetics laboratory at SU.

As the 1980s drew to a close digital technologies became more important, and Roux saw great opportunities for the improvement of research in language and the humanities in general. The 1990s saw the expansion of human language technologies (HLT). These technologies support communication between humans, as well as between humans and machines in natural language. Google Translate and Apple's virtual assistant, Siri, are recent examples of HLT, where interaction can take place through spoken language.

HUMAN LANGUAGE STRATEGY

"South Africa had been lagging behind, but in 2000, I coordinated an advisory panel tasked with creating an HLT strategy for South Africa." This eventually led to government support for various language projects across the country. He further helped launch HLT by leading the African Speech Technology Project, the first major project of its kind. "A consortium of universities successfully developed a prototype automated telephone-based hotel reservation system that worked in five languages: Afrikaans, English, Zulu, Xhosa and Sotho," he says. "This project also served as a learning curve for many prominent South African researchers in this field."

Roux chaired a task team of the Department of Arts and Culture in 2010, set up to create a blueprint for the establishment of a Language Resource Management Agency which led to the founding of a national centre in 2016. Also in 2016, the then Department of Science and Technology, now the Department of Science and Innovation (DSI) introduced the South African Research Infrastructure Roadmap and Roux started lobbying for a national centre for digital language resources, supported by colleagues in the field.

"Usually these roadmaps only support the natural sciences and not the humanities," he says. "We made a presentation to get onto the roadmap so that we could systematically develop digital resources for all official languages, to be used in various language technologies like machine translation and speech recognition."

Roux spearheaded the establishment of the South African Digital Language Resource Centre (SADiLaR) in 2016 and was Director until his retirement at the end of 2017. He believes that SADiLaR will generate data for linguistics research and technology development for all of South Africa's eleven official languages. "SADiLaR provides a vision for developing and supporting a multilingual democracy," he explains. "The technologies are there; what is needed is large sets of digital text and speech data and that is what the centre is geared to deliver."
Roux's other passion is the growing trend of digital humanities (DH) which he has been promoting in the country. He helped establish the Digital Humanities Association for Southern Africa (DHASA), and currently serves as President. Apart from its resource development function, SADiLaR is also committed to promoting and stimulating academic capacity-building in this emerging field where digital technologies and humanities meet. "South Africa's multicultural context creates an interesting opportunity for DH-based research and project development."

Roux's expertise in DH and HLT has been sought after the world over, and he has contributed to many professional bodies over the years, leading South African delegations to annual ISO Technical Committee meetings, presenting at international workshops and participating in international scientific committees. Notably, he has been a member of the Suid-Afrikaanse Akademie vir Wetenskap en Kuns since 1980.

Roux's research contributions have certainly helped to carve a space for African languages to take part in the ongoing digital revolution.

BERIC SKEWS

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Fellow of the Royal Aeronautical Society (2008)
- Three honorary degrees: a DSc (Eng) from the University of the Witwatersrand (2016), a DEng from the University of Pretoria (UP) (2012) and a DIng from the University of Johannesburg (UJ) (2011)
- A-rating from the National Research Foundation that he has held for five consecutive evaluations since 1996

DEFINING MOMENT

Marrying his wife, Joan. She passed away in 2012, after a marriage of 54 years.

WHAT PEOPLE MIGHT NOT KNOW

He is skilled at carpentry, wood carving and marquetry, the art of applying small pieces of veneer to form decorative pictures.

LIFE IS A BLAST

"*The South African academic community has been honoured to embrace within its ranks one of the most illustrious and prolific scientists of his time in the field of aeronautical engineering. An Honorary Fellow of the Royal Aeronautical Society, Beric Skews has achieved what is described as 'the world's highest distinction for aerospace achievement, awarded only for the most outstanding contributions to the aerospace profession'… We acknowledge Skews, one of our own, for the immense contribution that he has made to the academy through teaching and research, but also through sharing and giving of his incredible self – his knowledge and his proficiency – for the benefit of our generation and of those to come.*"

The above extract came from the citation when Skews received an honorary doctorate from the University of the Witwatersrand (Wits) in 2016. It acknowledges Skews' exceptional academic contribution, but also his longstanding working relationship of around six decades with Wits. It began in 1954, when he enrolled to study towards a BSc in mechanical engineering.

"I'm a do-it-yourself type of guy," Skews easily describes himself. Born on 25 April 1936 in eMkhondo (previously known as Piet Retief), he practically grew up in his accountant father's home workshop. Together they spent their free time doing woodwork and taking things apart.

Wits was a natural choice after Skews matriculated from Piet Retief High in 1953 and the institution has since become an extension of himself. He received a BSc (Eng) in 1958, an MSc (Eng) in 1961 and a PhD in 1967. He started at Wits as a junior lecturer in 1959. In the following decade, Skews helped to set up Africa's first aeronautical engineering degree programme, researching and writing the curriculum. Still the only one of its kind in South Africa, the programme feeds graduates to the local aeronautics and defence sectors. Wits has been his professional home for all but a few years when he left to work as an associate professor at McMaster University in Canada in the late 1960s, and as an Eskom Research Manager between 1979 and 1986. He was also a Visiting Professor at Tohoku University in Japan, and a Visiting Fellow at the University of New South Wales.

When he was only 36 years old, Skews was lured back from Canada in 1971 to become Wits' first Professor in aeronautical engineering. Later he would also lead its School for Mechanical Engineering, a position he held twice. In 1990, he also became Director of the University's Flow Research Programme. A special post as Director of the Flow Research Unit in the School of Mechanical, Industrial and Aeronautical Engineering set up in 2002 has allowed Skews to pursue his research well after retirement age. He remains in this position until 2020.

His working life has been a mixture of blast and shock waves, explosions, gas dynamics, supersonic flight and flow mechanics – and the understanding and visualisation of the physics behind such phenomena. To fully understand and visualise such events, he has over the years fine-tuned many high-speed photography techniques in Wits' gas dynamics laboratory. His findings have had relevance for researchers working in the field of supersonic aerodynamics, blast wave protection and attenuation, and to those investigating how metals deform when struck by underwater shock waves.

Skews' stature as a world leader in shock wave dynamics and flow research has been recognised since 1987 with an A-rating from the National Research Foundation. It is an honour that he has retained for five consecutive evaluation periods – the last being granted in 2017 for another five years.

TRAGEDY SPARKS RESEARCH INTEREST

His interest in his subject matter started with the President Steyn gold mine tragedy of 1959. "An underground explosives store accidentally blew up, and hundreds of mine workers died," Skews remembers. Prof Stefan Smoleniec, then head of the Department of Mechanical Engineering at Wits, was asked by the mining authorities to investigate the matter, and Skews was roped in too. His findings would later serve as a basis for his PhD thesis.

He worked out that shock waves can focus and reinforce in a tunnel complex. It explained the deaths of some miners who had been standing some distance away around a corner of a shaft when the blast occurred. Today it's old hat to those in the know, but at the time his findings about curved shock waves were quite revolutionary. He would subsequently also experimentally prove the existence of a four-wave reflection pattern, initially suggested by Guderley in the 1940s and subsequently ignored. In so doing he clarified what was known as the von Neumann paradox for weak shock wave reflection.

Skews is still the only South African to have been named an Honorary Fellow of the Royal Aeronautical Society – an honour bestowed on him in 2008. Internationally it is the highest distinction that anyone working in the aerospace profession can receive. "There are currently 44 living Honorary Fellows out of a total membership of over 22 000," notes Skews. He is also an Honorary Fellow of the Shock Wave Research Society of India, the South African Association for Theoretical and Applied Mechanics, and of the South African Institute of Mechanical Engineers, a Member of Academy of Science of South Africa (ASSAf), the Royal Society of South Africa and the International Shock Wave Institute.

Other awards and three honorary degrees have also come his way. He has twice been the recipient of the John Weston Gold Medal, one from the Aeronautical Society of South Africa in 2018 and one from the Southern Africa Division of the Royal Aeronautical Society in 2002. In 2012, he received a Gold Medal from the Japan High-Speed Imaging Society and the Rem Soloukhin Gold Hands Silver Medal at an International Symposium on Flow Visualisation.

This founding President of the South African Institute of Aerospace Engineering is also a fellow of the Aeronautical Society of South Africa, a Division of the Royal Aeronautical Society. It recognises the many leadership positions that he has held in the country's professional aeronautics bodies, and his efforts to ensure that South Africa retained its professional links internationally during the country's tumultuous political past.

Beric Skews has sat on numerous national industry and research-related advisory and steering committees. He also served on the International Advisory Committee for High Speed Photography and Photonics and the International Advisory Committee on Flow Visualisation, and has been a member of the International Advisory Committee for Shock Waves uninterruptedly since 1991.

In his 82nd year he decided that it was time to take things slightly more slowly – and to only work half-days!

HENDRIK (HENNIE) SNYMAN

AWARDS, HONOURS AND ACHIEVEMENTS

- Science Alumni of Honour Award from the University of Waterloo, Ontario, Canada (2007)
- Honorary Award from Rotary Club Port Elizabeth for his services to transformation of higher education (2001)
- Academic of the Year, Port Elizabeth City Council (1990)

DEFINING MOMENT

Seeing the advertisement for the position of Rector at the Port Elizabeth Technikon.

WHAT PEOPLE MIGHT NOT KNOW

His sister Wilna Snyman is the actress who played matriarch Madel Terreblanche in the soapie, 7de Laan. He is a very ambitious golfer: at best his handicap was 16.

FOR THE YOUTH OF TOMORROW

Hendrik 'Hennie' Snyman was born in 1940 in Bloemfontein. The son of a railway accounts man and a kindergarten teacher, science was not an obvious career choice. However, both Hennie and his twin brother, Jan (who would become a mathematics professor), showed talent in scientific subjects at school, and there was never any doubt what they would study at university.

Despite growing up in an Afrikaans-speaking family, the pair did not enroll at a university where Afrikaans was the language of teaching. "We went to the University of Cape Town (UCT), which was a very good thing," says the retired professor. It meant he experienced first-hand the challenges of learning in a second language. "There were times I couldn't understand the examination questions." As a result, he learned what it is to be an outsider at a university, an issue that is very important in managing diversity at universities in South Africa today.

Those early lessons stood Snyman in good stead later in life as he migrated from academic leadership to institutional leadership – first as the Rector of the Port Elizabeth Technikon, and later overseeing its merger with the formerly white University of Port Elizabeth (UPE) into what is today known as the Nelson Mandela University (NMU). "My greatest pleasure was to see the institution grow, to create a first-choice technological university in Africa."

Snyman graduated with a BSc in mathematics and physics from UCT in 1960. Initially, he and his brother were set on becoming teachers but their tutors kept suggesting they stay on in academia. After his Honours at UCT, Snyman moved to the Council for Scientific and Industrial Research in Pretoria to work on phase changes in inorganic compounds as part of the high-pressure physics group. There, he obtained an MSc in physics from the University of South Africa (Unisa) in 1963, the same year he married his wife, Loëla, whom he had tutored in physics at UCT as she studied to become a physiotherapist. The couple have three sons – Ben, Koos and Hennie Jr – all now living in North America with their families.

For his PhD, Snyman chose to go to Canada, to the University of Waterloo in Ontario to work under the supervision of Frank Boswell. Boswell had been part of the team that had developed the first electron microscope in North America at the University of Toronto. Using the technology, Snyman worked on epitaxy – the growth of a crystal on another crystal – in the case of his PhD, growing gold crystals on silver.

After a postdoctoral at the University of Virginia, Snyman returned to South Africa in 1969 to take up a senior lecturing position at UPE. He focused on thin film physics, what today might be more commonly known as nanotechnology. "We didn't even have a laboratory. I spent a lot of time organising, designing and planning the construction of a physics department."

It was the start of a successful career as a South African physicist. Specialising in solid state physics and electron microscopy, he enjoyed training young scientists and taking up coordinating positions, like the presidency of the Electron Microscopy of South Africa. In 1976, he left South Africa for a year at Cambridge University. By the time he got back the following year, he had been promoted to full professor at UPE. He began working on radiation damage and wrote a paper with his student Jan Neethling on proton implantation of gallium arsenide, which achieved wide acclaim.

In 1985, Snyman was awarded a B-rating by the Foundation for Research Development (now the Nation Research Foundation). But while the work was stimulating, Snyman was uncomfortable with the political realities of the day. "The whole concept of apartheid appalled me," says Snyman. The leadership of UPE was dominated by the conservative Broederbond. As a supporter of the progressive party of the day, Snyman often locked horns with his colleagues over political issues. By 1985, South Africa had declared a state of emergency, and Snyman was feeling disillusioned. "My children were at the point of going to university, and we would pass the convoys of military vehicles on the way to rugby matches." He could not find solace in his research either. "Physics can be very lonely. You know more and more about less and less until you know everything about nothing. I felt there was more to life than looking through the microscope."

It was at this point that Snyman saw an advertisement looking for a rector at Port Elizabeth Technikon, one of the colleges for advanced technical education in South Africa. It was a chance to change tack, to do something new. Snyman took up the post in 1988. "The next 18 years were the happiest of my life." There was less rigidity at the technikons and Snyman set out to desegregate the college. First, simple things like opening the Rector's quarterly 'tea and cake reception' to everyone from the gardeners to the top management. And within a year he had council backing to desegregate the residences.

Snyman took up a seat on the Committee of Technikon Principals. It was obvious to him that the technikons would play an important part in expanding South African higher education with the advent of democracy. But many prospective students saw technikon diplomas as inferior qualifications to university degrees. Snyman served on the executive committee of the technikon principals' committee, including as its chairman twice, while it lobbied to upgrade South Africa's technikons to universities of technology able to issue university qualifications. "The fight for degrees was a tough one because the universities were against us," he recalls. Nevertheless, in the late 1990s the first democratic government endorsed the proposal to turn technikons into universities.

Snyman retired from the Port Elizabeth Technikon in 2005, the year in which it was merged with UPE and Vista University to form the Nelson Mandela Metropolitan University (NNMU, now NMU). He played an instrumental role in the merger and regards his contribution to democratising South African higher education as his life's most important work. He is optimistic about the future of higher education in South Africa: "People forget that we have produced Nobel Prize winners in this country. Many of them went to government schools. If we could offer quality public education for the whites in the past, we can do it for the black youth of tomorrow."

ROLF STUMPF

AWARDS, HONOURS AND ACHIEVEMENTS

- Laureate Award from the University of Pretoria (1998)
- Co-authored the book, *Graphical Exploratory Data Analysis* (1986)
- President of the Human Sciences Research Council

DEFINING MOMENT

When he came to the full realisation of the injustices of the apartheid system. This occurred thanks to work-related interactions with struggle activists during the late 1980s and early 1990s.

WHAT PEOPLE MIGHT NOT KNOW

He is a keen hiker and has hiked the Grand Canyon. He met his wife Adrianne (Adie) while taking a church group on a hike in the Transkei in 1975.

COMFORTABLE IN THE DEEP END

Rolf Stumpf has been described as a man with a head for figures and a heart for people. His sense of being is shaped by his belief in honest relationships, a respect for others and remaining apolitical. This has carried him through the various parts of his career as statistician, lecturer, administrator, university leader and higher education consultant. It is also perhaps why there is little in the line of controversy about him on the Internet or in newspapers. "I'm hopelessly too German and too focused on getting things done to look for the limelight," he says in his no-nonsense way.

Stumpf was born on 6 November 1945 in Vryheid in KwaZulu-Natal. His German parents instilled in him a lifelong passion for education and music. Upon his father's appointment as a school inspector, the family moved to Pietermaritzburg where the trilingual Stumpf matriculated at the Afrikaans-medium Voortrekker High School.

Stumpf came top of his class and after doing his military service attended the University of Pretoria (UP) on a bursary. He combined BA subjects (including English, history and economics) with a few BSc subjects like statistics and mathematics, because he wasn't quite sure what to study. Ultimately, he received a PhD in Statistics (Analysis of Qualitative Data) from the University of South Africa (Unisa) in 1984, after also completing a diploma in theology from the Johannesburg Baptist College in the late 1970s.

Stumpf has never spent more than seven years in any position. He has also never applied for a job of his own accord. He has however often been asked to take up specific positions and was consequently often thrown into the deep end. The first such instance was as a young lecturer at UP in 1968. He was expecting to teach statistics, but instead was put to the test from day one: "I had to present classes on financial accounting, a subject I had never heard of," smiling as he remembers the shock he received. In true character, Stumpf got himself up to speed as soon as possible and made the best of things.

His next challenge came in 1981 when he was asked to develop financial models for the national Department of Education. He wasn't too enthusiastic about working for the nationalist government and made a point of underlining his political independence to his would-be superiors. By the early 1990s, Stumpf had risen to the position of Deputy Director-General and had established a good rapport with ministers, trade union leaders and education leaders from the African National Congress fold. "I immensely enjoyed building bridges between people, and bringing them together."

Stumpf became President of the Human Sciences Research Council in 1993 and subsequently transformed the research culture of an organisation once known to be the National Party's research arm. In a potentially career-limiting move, he even suggested that its board should resign as part of this transformation process. In 1998 Stumpf, his wife Adrianne and three children moved south for him to become Vice-Rector (Operations), and then Vice-Rector (Teaching) at Stellenbosch University (SU). A key contribution was a new information management system for university data.

MERGING PORT ELIZABETH INSTITUTIONS

In the early 2000s, the higher education landscape was dominated by the mergers of the universities and technikons. After narrowly losing to Professor Chris Brink in 2002 to serve as SU's Vice-Chancellor, Stumpf was asked to apply

to lead the then University of Port Elizabeth, now Nelson Mandela University (NMU) and to consolidate it with Vista Port Elizabeth and Port Elizabeth Technikon. And so began his famous 'tea and scones sessions', during which he invited staff to air their views on their experiences of the merger process.

By 2005, the task had been completed and Stumpf became the first Vice-Chancellor and Chief Executive Officer of
NMU and its six campuses around Port Elizabeth and George.

In 2009, Stumpf wrote about the experience in the *Mail & Guardian* newspaper: "The managerial and operational challenges facing merging institutions varied from the sublime to the ridiculous … On the human side, the mergers were difficult if not downright horrible exercises to manage."

He also wrote in an alumni newsletter of the university: "However, the merger gave us an unbelievable opportunity to start over and to re-brand ourselves as a university. It's been a hard, but wonderfully exciting time".

During his tenure, Stumpf also played numerous roles within South Africa's higher education community at large. He chaired the 2007 Higher Education South Africa investigation into student tuition fees.

In 2007, he stepped down from NMU, having slashed the university's long-term debt by two-thirds. He had never intended to stay on because he believed that the person driving a merger should not lead the new institution for too long.

He then started his one-man higher education consultancy – a job he still does with diligence well into his seventies. He has worked for many South African universities and government departments, the World Bank and for institutions in Botswana, Namibia and Lesotho.

After years as a board member of Unisa, the Laurea University for Applied Sciences in Finland and the Council of Higher Education, and as Chair of the Higher Education Quality Committee, Stumpf is trying to scale down. He is still a Research Fellow of Universities South Africa, chair of the National Intellectual Property Management Office Full Research Cost Committee and a member of the Department of Higher Education and Training task team that is developing governance indicators. He serves as board Chair of STADIO investment holding company, which started off as a subsidiary of Curro Holdings and subsequently listed independently on the Johannesburg Stock Exchange.

Stumpf counts himself lucky to have been able to work alongside people from across the political spectrum. "Life is all about the relationships between people, and about having respect for one another," he concludes.

CHRIS SWANEPOEL

AWARDS, HONOURS AND ACHIEVEMENTS

- Heinemann-ALASA Literary Prize for published research in African Literatures (1999)
- Shuter & Shooter Literature Prizes (x6)
- Hiddingh-Curry Award 2018 (Unisa Senate Publications Committee)

DEFINING MOMENTS

Becoming a Professor, Vice-Dean and Vice-Principal were three defining moments in his career. Each came with its own measure of recognition as well as new taxing challenges, underpinning a life of progress and fulfilment.

WHAT PEOPLE MIGHT NOT KNOW

"I cherish a special interest in the recital and performance of Sesotho *dithoko* (praise poetry) which I have often performed. I have sung in semi-professional choruses such as the PACT Opera and SABC Choirs, as well as the *Kleinkantatesangers.* Trained as a baritone, I have given many recitals at lunch-hour concerts, Christmas concerts and weddings."

IMMERSION IN THE MULTILINGUAL REALITY

African languages have interested Chris Swanepoel since the age of four, when he would regularly 'elope' to the grazing fields of the eastern Free State to play with his Sesotho-speaking cattle-herd friends. "Taking Sesotho as a school subject from then Standard 7 was the beginning of a life-long pursuit of a better understanding and love of both the people and the languages of our continent. Africa reverberates in the languages, the folklore and modern literature, history, philosophy and religion of the people – in my case mainly of the Basotho people, but then also of the languages which had a major influence on Sesotho such as IsiZulu and IsiXhosa. I shall forever be grateful for the privilege."

While studying Sesotho at the then University of the Orange Free State, now University of Free State in the early 1960s, Swanepoel was introduced to the literary works of Thomas Mofolo and developed an ever-growing admiration for Mofolo's book *Chaka*, a complex novel written in beautiful Sesotho. "I soon wished that fellow speakers and readers of Afrikaans literature could share my admiration for Mofolo, the depth of his creative mind and the nobility of his prose, albeit through translation," adds Swanepoel. A little more than a decade later this wish was fulfilled with the publication of his first translation of the classic in 1974. *Chaka* was among the top five on the list of the 100 most influential texts published within Africa during the 20th century. It weaves a creative tale which is not strictly bound by historical facts and where the Sesotho and IsiZulu cultures are interwoven. More than 40 years after the first translation into Afrikaans, Unisa Press issued the second translation of the classic work to bring it in line with the sea of changes that South African society has experienced since the early 1990s in all walks of life.

Swanepoel, now an Emeritus Professor at the University of South Africa (Unisa), contends that while there is considerable pressure on Afrikaans as a language of tuition in the higher education sector, there is no constitutional, linguistic or cultural impediment to its existence or curtailment of its further growth. "An entirely new and diverse generation of users is emerging, totally committed to contributing to national reconciliation and the promotion of intercultural exchange and subsequent mutual enrichment."

Literary translation is a key driver of that much-needed intercultural exchange and literary enrichment, he continues. "Here we have an opportunity to follow a fascinating dialogue between official language Afrikaans receiving from official language Sesotho a classic gem that is internationally regarded as among the best of the latter's cultural exports. As a language that developed on African soil, Afrikaans is proudly receiving a contribution from a neighbour in the rainbow of South African languages, Sesotho. In this sense I am confident that the new translation stands a good chance of contributing to what comes to us as a constitutional challenge: building a new multilingual nation. And mutual transfer of this nature between the languages of the land is perhaps an enterprise worth embracing."

A CAREER IN ACADEMIA

Coming from a teaching family and marrying into another one, his first degree naturally led to a second, and then to a third, the so-called research degree

that opened his eyes to further possibilities, especially in a relatively uncharted field at the time such as African language literature. "Research is the bedrock of knowledge and insight and its subsequent application in all walks of life. Perhaps not as financially lucrative as the business professions, academia and research are intellectually just as challenging and spiritually rewarding for a humanities person like me."

Swanepoel has produced numerous articles, conference papers and research articles, the most recent of which was published in an international *Festschrift* in 2018 and focuses on reconstructing aspects of the second Afrikaans translation of *Chaka*, analysing the challenges involved, while at the same time celebrating the depth of Mofolo's creative competence.

Swanepoel has occupied management and executive positions in higher education, including serving as the Unisa Vice-Principal (Academic and Research) from 2001 to 2006 during the time of the mergers. He describes his leadership style as "the pursuit of an understanding of people" and says this supported his becoming a leader as he tried to understand the problems of students, the predicaments of the teaching staff as well as the sensitivities and sensibilities surrounding the new executive leadership dispensation at South African universities in transformation.

"As a WAM*, to be part of such a tectonic metamorphosis was a privilege. A leader is both a supporter and initiator. These attributes were particularly useful during the turbulent times of university and technikon mergers that marked the first years of the new millennium. Unisa's merging with TechnikonSA and incorporation of the distance education branch of the former Vista University, committed one to drive the merger of more than ten faculties into only five. To match and merge the learning programmes of unequal institutions with dissimilar cultures and values required one to balance urgent targets and dynamic initiatives with the greatest possible understanding of the human factor behind every proposal made and every initiative taken."

Highly regarded in his field and always willing to go the extra mile, Swanepoel serves as a rating report writer for the National Research Foundation's language, literature and linguistics evaluation panel. He has been the keynote speaker at many conferences and holds honorary membership of the African Languages Association of Southern Africa.

Looking ahead, he is working on a forthcoming translation of an early Sesotho play by BM Khaketla about King Moshoeshoe and his relationship with the missionaries, as well as a multi-year research project, including fieldwork, looking into the culture and poetry of traditional divination in Sesotho.

* WAM – White Afrikaans male

NTHOANA TAU-MZAMANE

AWARDS, HONOURS AND ACHIEVEMENTS

- University of Vermont Award for research on the Effect of grazing management on light quality within mixed pasture swards (1992)
- University of Georgia Award for research on Legume based technologies for improving and sustaining grain and forage production in humid and semi-arid ecosystems of West Africa (1989)
- Africa Educational Trust Award for research on Nutrient dynamics in grasses under different harvesting and fertilizer treatments (1978)

DEFINING MOMENT

When her father passed away: With family responsibilities weighing on her, Tau-Mzamane decided against pursuing her PhD studies. Through the stories of how the many strong women in her family cared for each other, her mother and aunts persuaded her to continue – and opened her eyes to gender roles in the economy.

WHAT PEOPLE MIGHT NOT KNOW

She was a keen tennis player and is interested in house design.

A LIFE IN AGRICULTURE

Her parents were both teachers and Tau-Mzamane, the eldest of nine surviving children, was born on 10 November 1947 in Ha Koali village in Lesotho. During her primary school years her father became principal of the Holy Family Primary School near Teyateyaneng. In 1964, she matriculated from St Mary's High School in Roma. Those were difficult years in the region because of the increasingly oppressive South African apartheid system. After volunteering as a biology and mathematics teacher at Teyateyaneng Community Secondary School, she enrolled at the University of Botswana, Lesotho and Swaziland. There Tau-Mzamane embarked on the first of many anti-apartheid endeavours as a committee member of the Swiss-based World University Service.

"I later lectured in Nigeria and the United States, sensitising university and other communities about the politics of food, agriculture and natural resources in South Africa and the rest of the Third World". Tau-Mzamane also co-directed the Africa House Programme at the University of Vermont that exposed people to socio-economic and political developments in Africa. She focused on the state of the continent's science and agriculture and the role of women.

Before receiving her BSc in 1970, she married South African refugee and author Mbulelo Vizikhungo Mzamane, who would later become the first post-apartheid Vice-Chancellor of Fort Hare University (UFH). They had three children and they adopted their fourth child upon their return to South Africa in the 1990s. "As the wife of a refugee, there was always a possibility that we would have to leave Lesotho. One needed a qualification that could put food on the table. There was then (as today) a shortage of science teachers, therefore one could work nearly anywhere," she says, explaining why she completed a Postgraduate Certificate in Education in 1972.

After three years as Curator of Lesotho's Herbarium she headed to the University of Wales and completed a Master's degree in science in 1974. Back in Lesotho, a certificate in project planning followed, before the family left for Botswana. She received her PhD from the University of Wales in 1981, while her husband completed his at the University of Sheffield. Although she had to leave her young family behind during her two terms in the United Kingdom, Tau-Mzamane says "it was worth it on so many different fronts."

She has since published on the morphology and chemistry of forage grasses and legumes and how these are affected by fertiliser applications, on grazing management and light quality, and about indigenous knowledge systems and the role of women in Lesotho's agriculture. After four years in Nigeria at the National Animal Production Research Institute and the Ahmadu Bello University, the family moved again, this time to the USA in 1986 where Tau-Mzamane did research and taught at the universities of Georgia (Athens) and Vermont.

Then came the Mandela era and in 1994 she became an agriculture professor at the University of Ford Hare (UFH) and then head and Deputy Director-General of the Limpopo Department of Agriculture, Land and Environment from 1996 to 2000. Tau-Mzamane and her colleagues had to reorganise and consolidate the departments, systems and staff of the former Transvaal, Gazankulu, Venda and Lebowa. "It was one of the most challenging jobs, and I spent many sleepless nights," she admits.

In 2000, Tau-Mzamane became Deputy Director-General of the Department of Arts, Culture, Science and Technology, and a year later she became the first black woman to lead the Agricultural Research Council as President and Chief Executive Officer. She is satisfied that she restored financial stability and accountability within its ranks, expanded its research focus from commercial to small-scale farming, and created reserves to be made available to researchers wanting to address urgent emerging needs for new knowledge. These initiatives were, however, not always kindly accepted by some agricultural media.

A KNACK FOR INSTITUTIONS IN DISTRESS

In 2007, Tau-Mzamane served in the office of the Premier of Limpopo before becoming registrar of Walter Sisulu University from 2008 to 2013. The institution with its four campuses had been established three years earlier when the University of Transkei, the Border Technikon and Eastern Cape Technikon were merged. Again, she had to align policies, governance systems and procedures. "My children say I have a knack of picking up organisations in distress," smiles one of the founding members of the Academy of Science of South Africa (ASSAf).

She has been a member of various professional societies in the United Kingdom, the United States, Nigeria and locally. She served on the boards of the International Institute for Tropical Agriculture, the International Livestock Research Institute, the Council for Scientific and Industrial Research and the National Research Foundation, was an executive member of the National Science and Technology Forum and a member of the National Advisory Council for the then Minister of Science and Technology (now the Department of Science and Innovation).

After two decades of leadership, Tau-Mzamane says she understands the challenges and opportunities of science institutions, along with the broader national and international sectors within which they operate. They nurtured her understanding of financial accountability and how central human capital is to success. In this regard, she has always made a point of providing capacity training opportunities to her senior leadership teams. At the ARC, she fast-tracked a professional development programme for graduates to increase the numbers of black and women researchers.

Tau-Mzamane continues to promote science and maths education, to give talks, to support small-scale agricultural projects and to improve her knowledge of matters relating to policy and urban agriculture. "I thought life would get less interesting as I grow older, but it is not so," says this agricultural scientist and author of science-based stories for children.

PETRO TERBLANCHE

AWARDS, HONOURS AND ACHIEVEMENTS

- Technology Top 100 Award of the South African Medical Research Council for Research Management (2008)
- Council for Scientific and Industrial Research Management Board Top Achiever Award (1997)
- National Association for Clean Air Management Award (1994)

DEFINING MOMENT

The Council for Scientific and Industrial Research (CSIR) entrusting me with change management processes in the integration of AECI laboratories into CSIR BioChemtek in the late 1990s. To integrate two different cultures creating a common vision and to build a team that could change the world was a profound leadership challenge for me. At this early stage of my career in a top leadership position, I realised that as leaders the only thing that really matters is our ability to keep the people with us, not only today but also tomorrow and the day after.

WHAT PEOPLE MIGHT NOT KNOW

I have 90 horses that I care for, my two girls are my life and in my free time I write poetry.

PUTTING SCIENCE TO WORK

"One of the most precious moments of my career was meeting Petrus Vaalbooi, Chairperson of the South African San Council," says Petro Terblanche. "He took my hands and said 'Dr Terblanche, I do not care how much you know, until I know how much you care.' Those words stayed with me."

Terblanche was Executive Director of the Food, Biological and Chemical Technologies Division at the CSIR when the CSIR discovered a potential weight-loss drug from an indigenous plant called *Hoodia*. The San people have been using *Hoodia* for thousands of years to control hunger and thirst, but at the time there was no law to protect indigenous knowledge.

"With my commercial mindset, I wanted to bring a therapeutic approach to market – we had discovered a possible cure for obesity," she explains. "Around that time, the South African San Council was established to track what happened to their knowledge. I was lucky to lead a fantastic team at the CSIR to create a beneficiation model for the first time in South Africa."

This agreement ensures that a proportion of all royalties from drug development and sales is returned to the indigenous people of South Africa as originators of the knowledge used to create the weight-loss drug. Perhaps more importantly, it paved the way for South Africa's progressive biodiversity laws, which will ensure that future development recognises the long-term value of indigenous knowledge. "The Biodiversity Act now includes a clause for benefit sharing," says Terblanche. "If I have to choose science or the fruits of science, I choose the fruits."

The natural world and its inhabitants – both human and animal – have always been close to Terblanche's heart. She recalls her wonder at the world from her youngest days, growing up on a farm north of Pretoria: "I grew up close to nature, and I remember so clearly the smell of fresh earth behind the tractor opening up the soil for planting. Even then I wanted to understand how the world works."

She pursued a BSc at the University of Pretoria, and completed an Honours degree in zoology in 1981, studying the differences in liver enzymes between diurnal and nocturnal rodents. She enjoyed the chance to visit different parts of the Kalahari, but the work didn't hold her attention. "Who cares about liver enzymes in mice? I didn't want to do this with my life, I wanted to do more than just generate knowledge without purpose," she recalls. "I walked out, but I think it was meant to be. I saw an advert calling for a Medical Research Officer at the Department of Medical Oncology."

VENTURING INTO APPLIED RESEARCH

It was the first of several career changes, and her first exposure to applied research. She was responsible for coordinating research for international companies developing cancer therapies. She completed her MSc and DSc studying non-Hodgkin's Lymphoma under Professor Geoffrey Falkson. He was a huge influence in my life, a phenomenal mentor."

Terblanche has always concerned herself with scientific work that makes a difference. Following her cancer studies, she changed tracks once again. "I got restless; I wanted to learn about other fields of science," she says. "I went to do a postdoctoral degree at the School of Public Health at Harvard University. I decided to go into air pollution epidemiology – a totally new field of science."

Returning to South Africa in 1990, she was soon responsible for the acclaimed Vaal Triangle Air Pollution Health Study, intended to be a ten-year study of how industrial pollution and burning coal as a domestic energy source affected children's health. "By year four of the project, I did something unorthodox: I discontinued the study," she says. "Because we had our answers already – if we don't fix coal burning and poverty, we won't affect health. We took that information to the decision-makers and to the community."

Her actions had a direct effect on policy and public health: The findings of this study led to fundamental changes in air pollution legislation in South Africa, and the study itself served as an excellent example of effective translation of science into evidence-based policy. Her contributions to the cause of clean air were recognised by several organisations, including the National Association for Clean Air.

This penchant for science that makes a difference found a natural home at the CSIR, where in 1995 she was appointed the first female Director in the organisation's history. She oversaw applied health and biosciences research for the benefit of South Africa for ten years before moving on to positions of leadership at organisations such as the South African Medical Research Council, the South African Nuclear Energy Corporation and Pelchem, a state-owned fluorochemical production company.

"I am a specialist rather than an academic," she says. "I dig deep until I understand something, and then I make decisions. I want to make a difference, and to me that means making decisions based on evidence." That drive to keep making a difference has seen her move into the bio-entrepreneurship sector in recent years: She has run several technology or research-based companies, and provides guidance and mentorship for young entrepreneurs. "I embrace a culture of abundance – I never say no if young entrepreneurs or scientists approach me." She attributes this generosity to the quality of mentorship she herself received: "At every phase of my career I have had mentors who I could learn from, who shaped my thinking and my contributions. Now, I give back to whoever asks, scientists and entrepreneurs, from all different sectors."

Petro Terblanche is now Chief Executive Officer of Afrigen Biologics, a company working on vaccines and other therapies for African diseases like Tuberculosis (TB) and human immunodeficiency virus (HIV), and a full professor at the North-West University (NWU). But it's all still about the people for her. "I'm privileged to be working with the San people again, to be bringing new products to the market," she says. "I have come full circle: we've changed the model, but we're still using science to make a difference to people's lives."

JENNIFER THOMSON

AWARDS, HONOURS AND ACHIEVEMENTS

- First United Nations Environmental Programme Women in Science Award (2016)
- Honorary Doctorate from Sorbonne University (2005)
- L'Oreal-UNESCO Award for Women in Science for Africa (2004)

DEFINING MOMENT

One murky day in Basel, when Marc van Montagu invited her to work in his laboratory at the University of Ghent.

WHAT PEOPLE MIGHT NOT KNOW

She likes surprising guests and friends with home-made chocolates – many based on her own recipes.

AT THE FOREFRONT OF BIOSCIENCES AND WOMEN'S RIGHTS

Jennifer Thomson has spent more than her fair share of time in hotel rooms across the world – all in the name of African biosciences in general and towards ensuring a stronger footing for women working in science. She's travelled across Africa, been to the World Economic Forum in Davos (twice) and had lunch with Kofi Annan in the United Nations building before addressing ambassadors about the role of genetically modified (GM) crops in food security. Most recently, she's visited India and Italy as President of the Organisation for Women in Science for the Developing World (OWSD).

Thomson was born in Cape Town on 16 June 1942 and grew up in Johannesburg where she was head girl of Hyde Park High School. She showed a knack for teaching and liked plants and animals. In her biographical publication, *Food for Africa: The Life and Work of a Scientist in GM Crops* (2013), she explains how she decided which course of study to follow: "When I discovered that most of my friends were planning to do a BA degree I decided to register for a BSc, just to do something different."

In similar fashion she has since often steered herself quite deliberately towards the road less travelled and in the process, she has championed many causes as researcher, advisor and science communicator.

After receiving the BSc degree in Zoology and General Physiology in 1967 from the University of Cape Town (UCT) with distinction and top of her class in zoology, she intended taking her studies further in this field at Cambridge University. When things did not turn out as hoped, she bravely cycled across Cambridge to ask the head of the genetics department if she could study further in that discipline – despite having a limited knowledge of the subject. She received an MA in genetics in 1970. However, as the organisms she studied grew too slowly she decided to switch to bacterial genetics for her PhD studies at Rhodes University (RU)(obtained in 1973) where she investigated why the hides used in the leather industry were being spoilt. To this end, she received a bursary from Shell SA – at the time the most lucrative award to a PhD in the country.

A Rotary Foundation postdoctoral fellowship made further studies possible at Harvard University. During this time, she and her then husband made a deliberate choice not to have children. Thomson felt it would be the only way she could fully reach her goals. Years later, she would tell a journalist that this choice was one that she would not want any other woman in Africa to have to make.

Her subsequent commitment to furthering the cause of women scientists has seen her sit on national and continent-wide policy committees and task groups. In 1995, it led to the creation of South African Women in Science and Engineering (SAWISE), which she set up along with UCT colleague Lesley Shackleton. Thomson has led the South African National Chapter of OWSD since 2014 and became its worldwide President in 2016, when she also became Co-chair of GenderInSITE.

BIOTECHNOLOGY LEADER

Her career started at the University of the Witwatersrand from 1977 to 1983, and at the Council for Scientific and Industrial Research (CSIR) as Director of its Laboratory for Molecular and Cell Biology from 1984 to 1987. From 1982 to 1983, she was a Visiting Scientist at the Massachusetts Institute of Technology (MIT). Years after her undergraduate studies she returned to UCT in 1988 to become the first woman head of a department in the Science Faculty. Thirty

years later she retired as a professor in the Department of Molecular and Cell Biology, after serving as Vice-Dean of its Faculty of Science and as a senate representative on the UCT council.

She has used her skills in molecular biology to help develop transgenic maize that is resistant to the maize streak virus and potentially tolerant to drought. To start putting the latter feature to the test in greenhouses, her team received a R12 million grant from the Technology Innovation Agency in 2017, but frustratingly the money has yet to be paid.

"I was very lucky to have studied the techniques needed to further my research under the guidance of leading experts of the time," notes Thomson. This included Nobel Prize winner Werner Arber, and Belgian professor in molecular biologist Marc van Montagu who along with others worked out how to introduce foreign genes into plants. The inventor of Southern blots, Ed Southern, even showed her how to use it in DNA analysis!

In the foreword to Thomson's book, former UCT Vice-Chancellor, Dr Mamphela Ramphele wrote that her work "has been transformational in demonstrating the value of biotechnology to food security on a continent suffering from droughts and adverse weather patterns". Thomson also wrote two other popular science books: *Genes for Africa* (2002) and *Seeds for the Future* (2006). In 2015, she edited a National Research Foundation publication celebrating the people involved in South Africa's biotechnology industry.

She has championed the cause of GM crops worldwide, served on numerous advisory bodies and helped draft South African policy about biotechnology. Since 2002, Thomson has served on National Advisory Council on Innovation and was also part of the leadership structures of the Department of Science and Technology's (now the Department of Science and Innovation) Public Understanding of Biotechnology, the National Biotechnology Advisory Committee, African Centre for Gene Technologies and AfricaBio. Thomson served the Academy of Science of South Africa as Vice-President from 1996 to 1998, and as Council member from 2004 to 2006. She was President of the South African Society for Microbiology and served on both the South African Biochemical Society and the South African Genetics Society.

What does she rate as her greatest challenge over the past seventy years? "Being the first woman head of a department in the UCT Science Faculty." In typically passionate Thomson style, she did such a sterling job that instead of rotating the headship as usual every three years, her department voted her in for the next 12 years.

PETER TYSON

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary DSc degrees from the University of Pretoria (UP) (2002) and the University of the Witwatersrand (Wits) (2006) for distinguished and significant scientific research.
- Vice-President of the International Council for Science (2002 – 2005)
- Bill Venter Award for Best Book in the Natural Sciences (1983 – 1986)

DEFINING MOMENT

When the Dean of Science supported him and changed the rules to allow him to continue studying geography, setting his course for a distinguished career as climatologist.

WHAT PEOPLE MIGHT NOT KNOW

He is an accomplished carpenter who spends a good deal of time in his workshop.

SCIENTIST, ADMINISTRATOR AND LEADER OF NOTE

Peter Tyson is a world-renowned and highly respected climatologist who was rated by the National Research Foundation (NRF) as a world leader in his field. He has devoted much of his research career to the complex challenges of identifying and understanding the nature and consequences of climate and climate change, regionally and globally.

Peter Tyson was born and grew up in Johannesburg and attended Parktown Boys' High School. While he did not consider himself to be an exceptional pupil at school, he excelled as an undergraduate student at Wits. Intending to become a science teacher, he planned to major in mathematics and chemistry, with physics and geography as additional first-year subjects. At the end of his first year, however, he came top of the geography class and so decided to continue with Geography II as an additional subject. Unfortunately, Geography II had timetable clashes with his other subjects and so he approached his professor, Stanley Jackson, also the Dean of Science, for help. Jackson agreed that Tyson could register on condition that he taught himself all the practical work as he wouldn't be able to attend the practical classes. This he did (learning at the same time how to work and study on his own) and went on to take Geography III because of his interest in climatology.

While studying for his Honours degree in climatology, Tyson was appointed a lecturer at the then University of Natal in Pietermaritzburg, now part of the University of KwaZulu-Natal (UKZN). He moved to Pietermaritzburg and faced the daunting task of developing and teaching a variety of courses while completing his master's and doctoral degrees in the minimum time allowed through Wits. During this period, he was also married (another defining moment, he says), before moving back to Wits as a senior lecturer. Three years later, aged 29, he was appointed to the position of Professor of Geography and Environmental Studies, succeeding his mentor Stanley Jackson. Tyson was the third professor to hold that position at Wits since the inauguration of the Department of Geography in 1917, and at the time was one of the youngest professors to have been appointed at Wits.

His career moved along two intertwined paths – that of scientist and also senior university administrator and leader. As a scientist he led his department for many years and he also directed and undertook research in the Climatology Research Group at Wits for 25 years, producing an impressive number of publications and conference papers as well as teaching and undertaking research in universities around the world.

As a senior administrator, he served as the Dean of Science, a Deputy Vice-Chancellor (twice), the Vice-Principal and the Acting Principal over a period of 20 years – all the while consistently maintaining his highly productive research, teaching and postgraduate supervision.

Professor Tyson was also involved in several leadership roles at the Council for Scientific and Industrial Research, the Foundation for Research Development (now the NRF), and the Water Research Commission. Internationally, he was involved in the International Council for Science, now the International Science Council (ISC). While Vice-President of ISC, Tyson organised the First International Young Scientists' Conference on Global Change for young scientists under the age of 35. A thousand applications for participation were received for 100 places and a selection panel (including young scientists) identified the

participants. This proved to be a life-changing experience for many of the young scientists. This ISC conference model has since been implemented in a variety of different scientific disciplines and countries for similar international and national conferences to encourage the work of young scientists.

His research interests covered a broad spectrum across the atmospheric sciences and included work on how temperature gradients between the Drakensberg, the Natal Midlands and the sea induce local winds to blow from the mountains to the sea by night and sea to mountains by day, how urbanisation induces climate change and urban heat islands modify the environment of the lower atmosphere, how South African rainfall has varied over the period of meteorological record, and how the climate of southern Africa has changed over the last 26 000 years. A major aspect of his research in the years immediately before his retirement concerned atmospheric chemistry and the transport of dust and pollution over southern Africa and between Africa and Australia and New Zealand.

The research outputs to which his work led are substantial. They include nine books (including *Climatic Change and Variability in southern Africa*, which won the Bill Venter Award for the best book published in the natural sciences from 1983 to 1986), 170 published papers and chapters in books, and presentations at 60 local and 72 international conferences.

Apart from his scientific and university commitments Peter Tyson leads an active family life with his wife Jeannette and their three children – all excellent tennis players. Tennis occupied much time in the Tyson family, as did reading, travelling and doing things together.

ANNÉL VAN ASWEGEN

AWARDS, HONOURS AND ACHIEVEMENTS

- Shortlisted for position of Principal and Vice-Chancellor, Universities of South Africa (1999), Port Elizabeth (2001) and Potchefstroom (2001)
- Elected Member of the Academy of Science of South Africa (ASSAf) (2001)
- Elected Chairperson of the Academic and Professional Staff Association and Deputy Chairperson of the Women's Forum at the University of South Africa (1996)

DEFINING MOMENT

She initially wanted to go into law practice but the allure of academia captured her when she was exposed to the life of research and teaching at the University of South Africa (Unisa) in the 1970s.

WHAT PEOPLE MIGHT NOT KNOW

"I love the music of the 1960s and rock music, and if I could have chosen otherwise, I would love to have been a singer. It is a secret desire of mine, but I have no talent for it!"

CHAMPION OF ACADEMIA AND HUMAN RIGHTS

"I was drawn to law because of my sense that there is a lot of unfairness in society."

Annél van Aswegen is a distinguished academic lawyer who has had many roles in her life and career, all based on addressing the injustices of society and the workplace. "I have always thought that law and education are two of the most powerful tools with which one can ensure justice and fairness towards all." She explains: "What I found particularly rewarding in my working life is the interaction I had with students. I liked the role I could play in developing especially those who had had a difficult route towards studying and getting their degrees. That is why I decided all those years ago not to leave the teaching profession for the more lucrative legal profession."

Van Aswegen has had many highlights in her career, among them her memories of former President Nelson Mandela: "At one time one of my students was Nelson Mandela, still in prison and taking some legal subjects at Unisa, one of which I taught," she remembers fondly. "After he was released, I was one of the three people at Unisa who nominated and motivated for his honorary doctorate at Unisa, which was the first one he got from a South African university," she says. "He was such a wonderful role model for all of our students, all of whom were studying under difficult circumstances."

In her early years, while she was still intending to practice law, circumstances conspired to steer her in a different direction, one that would shape the rest of her life and career. "Many years ago there was still some bias against women in legal practice," she says. She had intended completing her articles after getting her law degree, "but some firms at the time were loath to appoint women, especially if they were married and had or intended to have children.

"Since I had got married immediately after completing my LLB degree, I decided to rather remain at Unisa, where I had started my career as a junior lecturer while studying for my LLB." She found academia rewarding because of its educational aspects, and she chose to continue with it as her career.

As a legal academic, her research interests ranged from the law of contract, delict, damages and family law to human rights and women's rights. She published more than 30 articles in accredited journals and several chapters in books. She regularly used her skills as a lawyer to give talks to women's groups on family law issues, to give interviews on radio and television, and to participate in research projects for the South African Law Commission.

NEW CONSTITUTION ON HORIZON

As her academic career progressed, she chose to focus on overlapping areas of law in her research, doing extensive work on the concurrence of claims in contract and delict. This brought her to that stage in South Africa's history when a new constitution was on the horizon. "My research then looked into how the constitution would influence the practice of private law," she explains.

She chose to fight against the many injustices she saw by getting involved in institutions such as the Centre for Human Rights at the University of Pretoria (UP)

when it was in its infancy in the late 1980s. She also became a member of Lawyers for Human Rights and was Deputy Chair of the Pretoria Branch from 1995 to 1997.

In her time in academia she felt increasingly that university management in the country was not very academic-friendly as it had become bureaucratic and she sought ways to mitigate the problem. "I have always thought that one of the ways of correcting the bias that any big bureaucratic institution will have is by getting people who know the business – academics – to be managers in universities and not only researchers and teachers." After serving as Head of Department of Private Law at Unisa for three years, in 1998 she became Acting Registrar of Professional Services and a member of the executive of Unisa for three years. "I've often wondered how wise a decision that was because it again took me on a path I had not foreseen, since I left my academic career before establishing myself internationally," she says. "But ultimately I have no regrets."
In 2003, she left Unisa after thirty years of service and became the Director of Human Resources at UP, serving in that capacity for ten years. During her time in managerial roles, she served on numerous institutional bodies and committees, often as chairperson, helping to transform higher education after 1994. "I am especially proud of having served as an elected staff representative on the councils of both universities where I was employed."

In 2013 she became the senior manager in the Office of the Principal of UP. When she retired in late 2017, the Vice-Chancellor, Professor Cheryl de la Rey, hosted a retirement function in her honour. The two had grown close over the years they had worked together. At the event, De la Rey pointed out that very few women had occupied the senior positions in which Van Aswegen had served, making her a real pioneer.

Despite resounding success throughout her professional life, she still personally considers her husband and her three children her greatest pride and joy.

ANTON VAN NIEKERK

AWARDS, HONOURS AND ACHIEVEMENTS

- Chancellor's Award for outstanding academic career from the Stellenbosch University (SU) (2016)
- Distinguished Professor at SU (2014)
- Stals Prize for Philosophy from the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (1995)

DEFINING MOMENT

Having intended to complete a theology degree in preparation for ministry in the Dutch Reformed Church, he was enthralled by philosophy after attending just two classes; he enrolled for a philosophy degree and never looked back.

WHAT PEOPLE MIGHT NOT KNOW

"My favourite place to visit is the Kruger National Park. I am absolutely besotted by the Kruger Park and whenever my wife and I get the opportunity, we go there."

LIFE, DEATH AND THE DUTCH REFORMED CHURCH: A PHILOSOPHER'S TALE

Anton van Niekerk, who has dealt with many aspects of the philosophy of life before settling on the finality of death. "My latest book is on death; I have developed an interest in the philosophical significance of the phenomenon of death."

Completing his matric in 1971, Van Niekerk remembers at the time that he wanted to do medicine at university; he was even selected to enrol for an MBChB at SU. His interest at the time shifted when he had what he calls 'a religious experience'. "I decided quite abruptly in my matric year that I would not pursue medicine, but that I would do theology, and that I would prepare myself to go into the ministry of the Dutch Reformed Church," he says. "In those days that was the way in which most people in the Afrikaans-speaking world of South Africa would eventually be confronted by philosophy."

After matric, Van Niekerk did not immediately do his national service in the army as was required in those days in South Africa. Instead, he enrolled for a BA degree in 1972 – the expected route for a prospective Dutch Reformed theologian. "You would have to first to do a normal BA, studying Biblical languages and other social sciences, followed by a Bachelor of Theology degree at the Theological Seminary." From ambitions to become a theologian, temptation came in the form of philosophy which grew to fascinate him. "In the first year we mostly looked at the history of philosophy and logic. Having attended the first two classes, I immediately realised that even though I understood very little, this stuff somehow spoke to me, and so I pursued it."

He went on to major in philosophy as part of his BA, and in addition to his theology degree he simultaneously did an Honours and eventually a Master's in philosophy, attaining all his degrees *cum laude*. Then came the year 1979, which marked the end of the seven years required for him to prepare himself for the ministry, as he had completed his Master's thesis on critical rationalism in the same year. "I was fortunate to be awarded the Chancellor's Medal for the best student on campus for writing that thesis," he says. The next year saw him going into the army as a Chaplain, which meant he did national service for 15 months.

When a vacancy opened for a lecturing post at the Philosophy Department of the SU in 1981, his mentors at the university urged him to apply for it. "I was fortunate to have excellent mentors who eventually became very good personal friends of mine as well. They have been a great inspiration in my life." His mentors included people like Professor Hennie Rossouw who supervised his Master's and Doctoral degrees, Professor Willie Esterhuyse who is a life-long friend, as well as Professor Johan Degenaar who is very well-known in South Africa for his moral, political and religious essays, and vocal opposition to the apartheid regime. "It was a great privilege to work in close proximity to them."

He became a full professor at SU in 1989 at the age of 35. During his tenure as Professor he established a Centre for Applied Ethics within the Philosophy Department in 1990. "Up to the late 1980s, my research interests were mostly the philosophy of the social sciences and the philosophy of religion, with a special emphasis on the issue of the language of religion."

As the decade ended, Van Niekerk saw his interests shift to biomedical ethics, brought on by a serendipitous meeting of minds on the topic. "I found myself increasingly drawn into the world of bioethics. I found it utterly fascinating."

CHANGE IN RESEARCH

His shift in research interest was driven largely by his appreciation of the relevance of philosophically-based moral approaches to the biomedical sciences. "Bioethics proves to us that philosophy, in its guise as ethics, is at the same time one of the most theoretical, yet also practical academic enterprises. It is all about value; the difference between right and wrong, and the complexity of thinking about moral problems and sorting them out," he says.

An academic of many ideas, he has spent his career arguing for right and wrong based on his research, and in one instance this has got him into hot water. "It made me well-known in certain circles for all the wrong reasons," he says ruefully. In 2011, Van Niekerk was assaulted in his office after publishing an article criticising the tendency in some parts of the Afrikaans press to downplay the atrocities of apartheid.

Through this incident, and his many years as an academic, he is thankful for his "marvellous wife" who is a successful businesswoman, as well as his three sons and three grandchildren. He recently published a book titled *Die dood en die sin van die lewe* (Death and the meaning of life) in 2017.

JOHAN VAN ZYL

AWARDS, HONOURS AND ACHIEVEMENTS

- University of Pretoria's (UP) Agriculturalist of the Century (2017)
- Honorary Doctorate from Stellenbosch University (SU) (2016)
- The *Sunday Times* Business Leader of the Year Award (2014)

WHAT PEOPLE MIGHT NOT KNOW

He is a 'closet greeny' who likes nothing better than admiring the stars on his Karoo farm.

AGRICULTURAL LEADER OF NOTE

As a youngster, Johan van Zyl's teacher had him present lengthy weekly book reviews to the handful of pupils attending De Grootboom Primary. The skills of persuasion and conveying an informed opinion that he learnt in this one-man farm school near Lydenburg have served him well ever since: First as a researcher working on issues related to risk management in the farming sector, land reform and market deregulation, and then as a university administrator and business leader.

Born on 1 June 1956, Van Zyl was raised on a citrus farm near Lydenburg in Mpumalanga. He completed his schooling in Volksrust, after which a BSc (Agric) from the UP in 1978 followed. "I was a poor student who preferred rugby to studying," admits the would-be farmer whose co-shares in his father's farms count among his many business ventures. "While doing compulsory military training, I realised my aspirations and what I did *not* want to be." Two postgraduate degrees *cum laude* set Van Zyl's course as an agricultural economist – and a double PhD at that. First came a DSc (Agric) at UP in 1985 and then a doctorate in economics from Vista University in 1990. "I wanted to be taken seriously and therefore needed to position myself strategically," he says, explaining why he persisted in his studies.

After working for the National Maize Producers Organisation and the national Department of Agriculture, Van Zyl started lecturing in the UP Department of Agricultural Economics in 1983. A full professorship followed in 1989. He supervised the research work of 15 PhD and 36 Master's students and published more than 150 scientific papers and chapters in 50 books.

He served as president of the Agricultural Economics Association of South Africa, and the country representative on the International Association of Agricultural Economists. He consulted to governmental departments, local private companies and international entities such as the Food and Agricultural Organization and the World Bank. Lasting business and political relationships were formed during this period. He also delved into the essentials of South African agriculture statistics and feels privileged that much of the research he did alongside colleagues and students was implemented, for instance, as part of new agricultural policy and in rethinking rural development in South Africa and its former homelands.

His research motivated market-based land reforms and the deregulation of agricultural boards to address historic imbalances. From 1987 to 1994, Van Zyl served on government committees such as the Brand Committee of Inquiry into the Marketing of Maize, the Committee for the Development of a Food and Nutrition Strategy for South Africa, and the Committee of Inquiry into the Marketing Act. In 1996, he became an assessor in the Land Claims Court.

Van Zyl helped mastermind the Graduate School of Agricultural and Rural Development that, from 1990 onwards, played a role in transforming UP's student body by introducing the first English courses. One year later he became Dean of the UP Faculty of Agricultural Sciences and could help to reposition it in the international arena through the signing of cooperative agreements with universities in the USA and Belgium.

UNIVERSITY LEADER

A two-year sabbatical in 1994 saw Van Zyl leave for the World Bank in Washington. When a serious bout of malaria after a working visit to Nigeria left him comatose and initially undiagnosed in the United States, it was the impetus for the return to Pretoria of Van Zyl, his wife Cristelle, two sons and a daughter. Van Zyl found his feet again and became Dean of the newly constituted Faculty of Biological and Agricultural Sciences in 1996. Four months later, the 39-year old was named as the youngest person ever to serve as Vice-Chancellor and Principal of UP. "It wasn't the easiest of times, but we were a

young and energetic group working together," remembers this Fellow of the Royal Society of South Africa, the Suid-Afrikaanse Akademie vir Wetenskap en Kuns and one of the founding Members of the Academy of Science of South Africa (ASSAf).

He set the university upon a much stronger financial and research footing, and approved new ventures such as the Forestry and Agricultural Biotechnology Institute (FABI). While Rector, he still participated in research group activities and remained one of the university's most productive researchers.

LIFE AS A BUSINESSMAN

"There's no sense in doing anything that isn't a challenge," says the man who prefers uncharted territory to routine. In 2001 he agreed to become the Chief Executive Officer of the short-term insurance company Santam. Two years later, up against several other applicants, he became the head of insurance company Sanlam. A *Cape Times* business reporter described him then as someone with "a no-nonsense reputation" who "does not get involved in fuzzy intellectual arguments. He listens to what others have to say, but they had better talk sense, for he has a way of cutting down to size anyone who tries to wing it. Once he has listened, he makes his moves, sometimes taking others by surprise".
He has since been hailed as the saving grace of a company that some described as a "lumbering Afrikaans insurance giant". It now has a footing in the financial services industry of more than 30 countries. Stocks prices improved twelve-fold and its market value rose from R14 billion to R170 billion by the time he stepped down in mid-2015 to take up new challenges in the Black Economic Empowerment business investment sector as group Chief Executive Officer of Ubuntu-Botho Investments and Co-Chief Executive Officer of African Rainbow Capital Limited. These ventures, aimed at the economic empowerment of the lower and mid-income markets, are backed by mining and investment leader Patrice Motsepe. As seasoned director, Van Zyl retains his ties with Sanlam after being appointed as Chair in 2017.

Many accolades have acknowledged his quality research, vision and leadership within the higher education and business sectors. Among others he was UP's Young Alumnus of the Year (1991), the *Cape Times*/KPMG Personality of the Year (2006), Media24/*Die Burger* Business Leader of the Year (2012) and the *Sunday Times* Business Leader of the Year (2014). In 2016, Van Zyl received an honorary doctorate from SU, and in 2017 he was named UP's Agriculturalist of the Century.

DAAN VERWOERD

AWARDS, HONOURS AND ACHIEVEMENTS

- MT Steyn Award from the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (2004)
- Honorary Doctorate from the University of Pretoria (UP) (2000)
- Gold Medal of the South African Veterinary Association (1985)

DEFINING MOMENT

Spending time in Germany in order to bring back to South Africa the scientific tool now known as biotechnology. "I think it is extremely important to go to international laboratories because of the contact you have with other scientists, and the increased exposure to new ideas."

WHAT PEOPLE MIGHT NOT KNOW

He is a recognised orchid grower. "My favourite orchid is the Phalaenopsis or moth orchid. I have a small collection; I still grow them and still love them. I try to grow South African orchids too."

SOLVING SOUTH AFRICA'S FIRST MOLECULAR MYSTERIES

In the 1800s, South African sheep farmers observed a strange shortness of breath in their animals, as if they had been in a chase. They called the condition *jaagsiekte* (chasing illness), and over the next century veterinarians noted that it was a type of contagious lung cancer. When Daan Verwoerd came across this piece of history in the 1980s, he realised the cause of the disease was still a mystery. He suspected it could be a virus and made it his mission to prove as much.

"It was known at that time that viruses caused some types of cancers, but only in mice, rats and poultry. I wanted to know if there were models for larger animals, like sheep, that were economically important," recalls Verwoerd, the man who established South Africa's first molecular biology research group at the famous Onderstepoort Veterinary Institute in 1963.

All attempts to isolate the virus in laboratory cell cultures failed, so his group had to use infected sheep for this purpose. Many of the known cancers in smaller animals at the time were caused by a retrovirus (a virus that uses ribonucleic acid, RNA, as genetic material rather than DNA), and Verwoerd's group was able to isolate a retrovirus from the lungs of the infected sheep. They also injected material from the lungs of adult sheep who showed signs of the disease into newborn lambs and other adult sheep.

"We realised the sheep were only susceptible to infection when they were very young – 100% transmission of the disease was observed in newborns. This told us older sheep may be protected by the immune system, which is not yet fully developed in newborns," he explains.

But even in infected adult sheep, his team could not find an immune response in the form of antibodies against the virus – again very strange. The answer came when they were able to sequence the full genome of the retrovirus. "We made the astonishing discovery that 70% of the viral sequence was also found in the genomes of normal sheep," says Verwoerd. This was the first time a full genome sequence was achieved for any organism in South Africa.

"We started testing sheep all over the place, in Europe, Africa and Australia, which didn't even have the disease, but all the material proved the same thing. All sheep cells contain an abbreviated copy of the viral genome." This explained why there was no immune response – the sheep's immune system does not recognise the virus as a foreign invader, because it looks like its own DNA. "This was bad news for the goal of developing a vaccine, and today the recommended advice to farmers is still to isolate newborn lambs for the first couple of months to prevent infection while their immune systems develop," he says.

CHOOSING FOR THE SAKE OF SCIENCE

Being able to solve such mysteries using basic science was the reason Verwoerd chose veterinary science as a young adult. "It wasn't because of a passion for animals or disease; I wasn't really interested in the clinical side or in diagnostics, but in the science behind it. In today's terms, I was interested in what we'd call microbiology or biochemistry."

Verwoerd joined Onderstepoort as a researcher in 1955 after qualifying as a veterinarian at the UP. He soon realised his training was not specific enough for the research he wanted to do, so he completed an MSc in biochemistry

at the same university. During this time one of his seniors had asked for his help in preparing for a talk on the discovery of the DNA double helix. "That started me off on the structure and function of DNA. I realised this really is the future," he says.

Verwoerd left for Germany, to learn what he could from biochemistry institutes that were home to Nobel Prize winners and other pioneers in the field. "I had to do something applicable to veterinary science, so I thought it would be best to focus on viruses," he says. "I needed a practical approach to make this work acceptable to authorities in South Africa." Viruses indeed proved very important in animal diseases in South Africa, and Verwoerd was able to set up his basic science research group to support the clinical expertise at Onderstepoort.

The very first mystery solved by the group was why a vaccine against bluetongue, a disease that had been causing losses in the sheep and wool industry, sometimes worked and other times not. Verwoerd's team successfully isolated the virus, and in doing so were one of the first teams in the word to isolate a virus with double-stranded RNA. "It was known that some viruses had RNA while others had DNA, but at that time RNA viruses were considered to only have a single strand," explains Verwoerd.

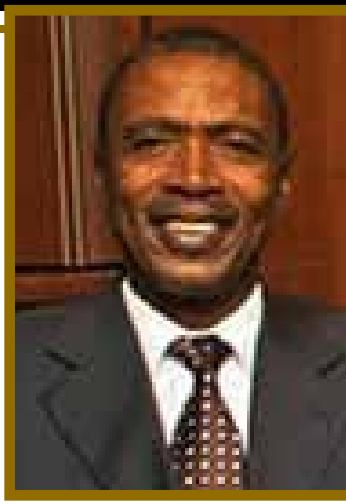
When they looked deeper into the structure of the RNA, they found that each of ten segments coded for a protein – something quite uncommon and unique. But the key to unlocking the mystery of why the primitive vaccine didn't always work was that bluetongue is not caused by a single virus strain but rather by a population of different strains. "The vaccine was for only one strain," explains Verwoerd, "so it would not protect against the other strains. This opened up a totally new approach to vaccines."

Verwoerd's work supported the development of combination vaccines by genetically identifying the various viral strains present, and the very same science was applied to help combat African horse sickness. It was after solving the bluetongue puzzle that Verwoerd tackled the *jaagsiekte* conundrum, all the while working his way up to becoming the Director of Onderstepoort through most of the 1990s. In 1994, he was also one of the founding Members of the Academy of Science of South Africa (ASSAf).

In 2002, he was recalled from a brief retirement to serve where his academic career began: the Faculty of Veterinary Science at UP. "The faculty had to improve its research output under difficult conditions, and they felt they didn't have the expertise," says Verwoerd, "so they asked me if I would join them as research coordinator, to boost research capacity separate from the student training."

Under his leadership the faculty acquired substantial funding, research output went up and new infrastructure was established. "It is difficult to measure, but I do think I made a positive contribution," he humbly admits. But he confidently asserts that he was never worried about the gamble he took to bring molecular biology to South Africa: "I always knew that basic research would yield great results."

| SIBUSISO VIL-NKOMO |



AWARDS, HONOURS AND ACHIEVEMENTS

- Founder's Day Award for Distinguished Leadership from Lincoln University (1998)
- Presidential Citation for Outstanding Achievements from the University of Delaware (1996)
- Alpha Chi Honour Society Award for Academic Excellence from Lincoln University (1986)

DEFINING MOMENT

Being part of the Bilaterals and the Multi-Party Negotiating Process that ultimately saw the establishment of a democratic public service (civil service) for South Africa. "When you pursue your education, you don't know where it will lead you. For me, that education gave me the opportunity to implement and bring to bear what I had learnt to help create the South African Public Service Commission, with its critical public administration oversight role."

WHAT PEOPLE MIGHT NOT KNOW

"I do our home decorating, including choosing the curtains and all the artwork in my home, and my wife knows she just has to appreciate it. I have a real interest in antiques and buy and restore them. I'm also known for regularly rearranging things at home; everything must always be very neat. People often ask about our 'professional interior decorator' but I just laugh because it's all me."

BREAKFAST WITH NELSON MANDELA BROUGHT VIL-NKOMO BACK TO SOUTH AFRICA

When Sibusiso Vil-Nkomo left South Africa he intended to join the military wing of the African National Congress in Botswana at the height of the Soweto uprising; a future in academia and the public service couldn't have seemed more unlikely. But when Ida Wood – a civil rights activist of the Phelps-Stokes Fund – told him at the end of December 1977 to stay out of trouble for the next few months because by January the following year he would be in New York to begin his studies, everything changed.

Fast-forward to 2018 and this leading academic and public sector policy expert is a multi-award-winning international scholar and a doyen of public service administration. Currently a research professor at the Centre for the Advancement of Scholarship at the University of Pretoria (UP), Vil-Nkomo is among several luminaries appointed by President Cyril Ramaphosa to sit on a panel to review the functioning of the country's State Security Agency.

On arrival in the United States, Vil-Nkomo found he would be pursuing his studies at Lincoln University in Pennsylvania and he completed his BA Economics (Public Affairs) *magna cum laude* in 1980. The university is also the *alma mater* of Ghana's first prime minister and President Kwame Nkrumah, and Nnamdi Azikiwe, who became the first democratic President of Nigeria after the end of colonial rule. Vil-Nkomo completed his Masters and PhD degrees at the University of Delaware, and went back to establish the Centre for Public Policy and Diplomacy at Lincoln University. He currently serves on the School of Public Policy and Administration advisory board at the University of Delaware. He has benefited from his exposure during this time to leading professors like institutional economist, Ann Seidman, sociologist Emmanuel Wallerstein, public policy specialist Dan Rich, anti-apartheid activist and poet Denis Brutus, among others.

"The Centre for Public Policy and Diplomacy, funded by the Commonwealth State of Pennsylvania, became very successful. What I didn't know at the time was that all this experience was giving me an excellent grounding in preparation for my return to South Africa to become involved in public service and policy issues," he says.

He has taught at and been associated with several other universities and organisations in the United States, has been a presenter at the Brookings Institution Library and worked at the Library of Congress, the World Bank Library and the International Monetary Fund Library during his tenure as a Fulbright Research Scholar. In his further academic endeavours, he met and befriended Professor Kassahun Checole, a leading owner of Africa World Press and Red Sea Press, based in Trenton, New Jersey.

Vil-Nkomo has published in academic and scientific journals and books, locally and internationally. He has conducted applied research on the public service, organisational development, related technology, ethics, and efficient and effective delivery services. He has also presented papers at local and international scientific conferences and research institutions. In 2015 Vil-Nkomo received the South African Association of Public Administration and Management's highest honour, a Lifetime Achievement Award in recognition of the role his research played in shaping the evolution of the discipline, both as a science and a praxis. He believes in a transdisciplinary approach to teaching and studying public governance that goes beyond the dry definitions of management and leadership. Economics, he says, is important for public servants and policymakers to understand.

LONG JOURNEY TO EFFECTIVE PUBLIC SERVICE

"To develop a vibrant and effective public service is a long journey. It takes several generations to reach a point of satisfaction, while at the same time accepting that public services continue to evolve. So, the generation-to-generation development of proper values and ethics in any public service remains the cornerstone of success," he says.

Vil-Nkomo finally knew he'd been right to tailor his studies in his chosen direction after a pivotal 6 am breakfast with former President Nelson Mandela in 1991 prompted the decision that he and his wife, Renosi Mokate, made to return to South Africa to help build the new democracy. The day had finally come for him to return and apply his knowledge appropriately.
"It was a completely new beginning for me," he says. Vil-Nkomo's contribution to the transformation of the public service in South Africa is indelibly imprinted on the country's post-apartheid history. He was integral in finalising the details of the civil service provisions in the interim constitution of the new government in 1993, and created and administered South Africa's new, integrated civil service. In 1994, President Mandela named him Public Service Commissioner. He went on to become the first black Dean in the history of UP, and also the first black Dean of the Faculty of Economic and Management Sciences.

In his bid to further improve access to education in the field about which he is so passionate, in 2010 Vil-Nkomo also co-founded the Mapungubwe Institute for Strategic Reflection (MISTRA), the board of which he still chairs today. "MISTRA came out of a commitment to the importance of creating a knowledge reservoir that can deal with issues from a transdisciplinary perspective." He was concerned at the gap in the South African landscape, where think tanks were not addressing the reality of the changes that had taken place since 1994. "It was business as usual, unfortunately," he says.

There was further concern about continuity for all the policy initiatives that had emerged in 1994, and how these could be developed into something that could advance the country in a scenario where universities were not necessarily shaping up as 'knowledge reservoirs'. The kind of research he wants to see produced by South African institutions generally, he says, should be based on theory, but should also be usable: "Most importantly, it must lead to implementation."

| DAVID WALKER |

AWARDS, HONOURS AND ACHIEVEMENTS

- The unofficial Greenwald Award from his colleagues for his work contributing to the establishment of the SuperDARN network (2002)
- The De Beers Gold Medal of the South African Institute of Physics (1998)
- The Alexander van Humboldt Fellowship (1977 – 1978)

DEFINING MOMENT

Being introduced by Ray Greenwald to the field of ionospheric radar that formed an important part of his work for the rest of his career.

WHAT PEOPLE MIGHT NOT KNOW

He has written a book about Eastern Cape history in the 1800s, *Pawns in a Larger Game: Life on the Eastern Cape Frontier* (2013).

THE MAN WHO HELPED USHER IN A NEW AGE OF SPACE SCIENCE

The space science field has gone through many changes since its early days in the 1950s, and David Walker is one of the people who help to bring it to what it is today. Starting at a time when not much was known about space beyond the earth's atmosphere, his theoretical insight into the nature of plasma waves and pioneering use of high-frequency radars allowed him to contribute to the study of space weather phenomena. In particular, Walker used the data from these radars to provide complete understanding of the nature of one type of long period pulsations of the magnetosphere. This is considered a seminal piece of research in the field of space physics.

"As our knowledge of the ionosphere and near-Earth space has changed, the way science is pursued has changed too, even the way calculations are made has changed beyond recognition – in fact our science has changed quite a lot. When I started off doing my MSc, I used a slide rule, graph paper and books of logarithmic tables to do all my calculations," he says.

Walker completed his MSc at Rhodes University (RU) which earned him a scholarship in 1962 to study for three years at Cambridge University. His PhD at Cambridge studied radio waves in the ionosphere under the supervision of Dr Kenneth Budden, a Fellow of the Royal Society – "a very good scientist who taught me a lot in terms of science, as well as how to write well and how to be meticulous in my writing".
When he first went to RU in 1955, he had chosen to do physics and chemistry and some pure and applied mathematics, not really knowing "what I was in for". He was encouraged by Professor Jack Gledhill who was a very enthusiastic scientist with a strong research leaning. Walker encountered an appreciation and enthusiasm for science in his high-school years when he chose to study science because of a passionate and capable teacher, even before he knew much about the subject that would later become his career. "It became obvious to me that physics was an interesting thing to do. I was theoretically inclined, so I majored in physics and mathematics and applied mathematics and I went on and did a physics Honours degree and an MSc under Professor Gledhill."

Progress towards the modern picture we see in space science today was held back by the processing power available to Walker and other scientists at the time. "While I was doing my MSc, I needed to do some computer calculations. I spent a long vacation at the Council for Scientific and Industrial Research (CSIR), where they had just established the very first computer in South Africa." At Cambridge he was able to use EDSAC2, then one of the best computers in the world, which worked on electronic valves and took up two floors of a building. "Scientific cooperation has developed enormously. In the 1970s, when I was doing cooperative science, I had to write a letter to somebody who was in the United Kingdom and ask 'have you got data for such and such'; they would print it on paper and send it back to me by mail. Now, you can get it on the World Wide Web in half an hour."

One of those collaborations led to a most important initiative in space science that is still in use all over the world today: While he was at the Max Planck Institute for Aeronomy in Germany, Walker met the American scientist Ray Greenwald who had developed a new very high-frequency radar in Scandinavia.

COLLABORATION IS KEY

Walker was pleased that some of the observations they were getting from the new radar were findings that he was well-positioned to explain. The work he

was involved in from then changed the space science field, and he spent the rest of his working life doing this kind of physics at the University of Natal, now the University of KwaZulu-Natal (UKZN). His collaboration with Greenwald and other colleagues led to the Super Dual Auroral Radar Network (SuperDARN) system, a worldwide network of radars used for space measurements to understand the state of space weather above the ionosphere. When Greenwald produced an improved high-frequency radar in the 1980s, Professor Walker's involvement meant that South Africa played a big part in the early days of SuperDARN.

The South African radar (deployed in 1997 at Sanae, the South African Antarctic base) was one of the earliest radars in the southern hemisphere part of the SuperDARN network and Walker was the first principal investigator on the South African system. He was also one of the 14 co-authors who wrote a paper about the founding of SuperDARN; the paper has been cited over 800 times. Such was the impact of his contribution to the inception and operation of the SuperDARN network that upon his retirement, his colleagues in the SuperDARN community surprised him with an unofficial honour.

"One of the awards I value the most came from friends when I retired in 2002. The SuperDARN community gave me a certificate saying how much my work had been valued in the SuperDARN community – they called it The Greenwald Award."

After retirement, Walker's publication list takes an unconventional turn with the publishing of his book about a history of the Eastern Cape. "It involves the interaction of my ancestors who were all in the Eastern Cape in the 1800s, and there is a lot of Xhosa history and the history of the frontier wars," something he enjoyed writing.

Despite all that has changed in the past 60 years in the way science is conducted, Walker is adamant that collaboration remains as important as ever. In fact, he has noted that collaborations have changed from working with one partner at a time to collaborations that involve whole collections of people all over the world, aided by computing power and connectivity that has improved immeasurably. "I appreciate having had good teachers, good supervisors when I was a student and good colleagues throughout my life, because you can't do science without cooperation and colleagues."

PATRICIA WHITELOCK

AWARDS, HONOURS AND ACHIEVEMENTS

- Gold Medal from the South African Institute of Physics (2018)
- Being asked to coordinate the Strategic Plan for Astronomy (2000)
- Messages from students on the National Astrophysics and Space Science Programme (NASSP) about how the project had changed their lives

DEFINING MOMENT

In 1974 she was observing in Tenerife and was asked to assist John Menzies and a colleague, both from the University of Oxford, who would be using the telescope for the first time. John Menzies was to become her husband.

WHAT NOT MANY PEOPLE KNOW ABOUT ME

"I'm very dyslexic. The hardest thing I did in my life was learning to read."

A LIFE FOR THE STARS

Patricia Whitelock's first science teacher was her father, an engineer who specialised in the construction of power stations. It was a time when the country of Whitelock's birth, the United Kingdom, was investing in nuclear power. "My father talked to me about things like the structure of the atom," says the astronomer, who for the past 40 years has called South Africa her home.

With such a start in life, school science came as something of a disappointment for young Whitelock. "It was so banal," she recalls. Still, in her last years of schooling her science teachers were excellent and her interest in astronomy took root in her early teens. After finishing school, Whitelock attended the University College London, followed by a PhD from the Imperial College of Science and Technology (now Imperial College London). Had times been different, she might have done something more physical with her life. Piloting, say, or helicopter engineering. But back then women didn't do those jobs. "There were limited numbers of jobs open to women. At least women could be scientists."

For her doctoral thesis on ground-based infrared photometry, published in 1967, Whitelock spent six months at a telescope in Tenerife on the Canary Islands. There she met an Australian astronomer based in Oxford and later, Preston who was to become her husband. Keen to forge a life together, and with Whitelock back at the University College London for a postdoctoral position, the two young astronomers discussed their future. Whitelock remembers saying she'd go anywhere in the world where there were good telescopes and clear skies – "But not South Africa."

It was the 1970s and in Whitelock's and many other Britons' minds, South Africa was synonymous with the human rights abuses of the apartheid regime. But on a visit to the country to make astronomical observations in the mid-1970s, Whitelock met local astronomers who were not regime-backers – quite the opposite. "None of them were pro-apartheid and some strongly protested against it. I thought, I could live with these people."

Whitelock relocated to South Africa in 1978, settling at the South African Astronomical Observatory (SAAO) in Cape Town. Her first job was to look after the instrumentation used for optical photometry on its telescopes. She also got into coding for telescope and instrument control. Being based at SAAO, she had excellent access to South Africa's optical telescopes at Sutherland in the Roggeveld Karoo. She became fascinated with what happens to stars when they age and die – a dramatic but poorly understood process.

A DYING STAR

Towards the end of stars' lives their fuel reserves – the hydrogen that is converted into helium in their hearts goes through a process called nuclear fission – start to run out. As this happens, the outer layers of the star fall in, the density increases and another type of nuclear reaction starts turning the helium into carbon and oxygen, the building blocks of life, inside the star. Somewhat later, stars with the mass of our sun or up to ten times more, expand dramatically and begin to pulsate on timescales of hundreds of days; material from the core of the star comes up to the star's surface and eventually escapes into space. This process enables heavier elements, including carbon, to become available to form planets and even create life on planets.

Whitelock was able to observe these stellar pulses with the telescopes at her disposal, creating data sets stretching over decades – long enough to detect

and describe the cycles of dying stars accurately. She also participated in influential observations of the variability of Eta Carinae – a giant star about 100 times the mass of our sun which can only be observed from the southern hemisphere. This star underwent a spectacular brightening in the early 1800s, a phenomenon studied by astronomers who were in South Africa at the time, including British astronomer John Herschel. Whitelock and her colleagues studied this star over many decades using the telescopes stationed at Sutherland, once more cataloguing a steady increase in its luminosity. Observing this star for the next decades or centuries will teach astronomers about what happens to such massive stars as they approach the ends of their lives.

In addition to her research work, Whitelock has also held several administrative appointments at SAAO. She helped to develop its postgraduate training programme, an activity that led to the establishment in 2003 of the NASSP. The programme was designed to address the lack of homegrown South African astronomers, especially black and women scientists. "It was in recognition of the fact that at that time almost all the astronomers in this country were born outside of it," she says. To date, the programme has trained over 270 Honours and 180 Master's graduates. Over half were black, and many were women. More than half of them have gone on to study for a PhD.

Whitelock also held several senior positions at SAAO, including Acting Director for 18 months from 2002 to 2003 and Director from 2011 to 2012. Since 2006 she has combined her work at the observatory with a professorship at the University of Cape Town (UCT). She was the first astronomer to head the South African Institute of Physics, from 2001 to 2003. In this role, she started the "Future of Physics" initiative and chaired the first South African Institute of Physics (SAIP) transformation committee in 2001.

Whitelock has played a vital role in many of South Africa's recent major astronomy investments. Although she was not behind the bid to host the Square Kilometre Array (SKA) radio telescope in South Africa, it was her idea that South Africa should get involved in the international project in the first place. "It was clear to me that if we wanted to be active in radio astronomy, we needed to be part of that," she says. And it was she who persuaded Justin Jonas to lead South Africa's involvement in the project.

At SAAO, Whitelock also participated in a bid to the International Astronomical Union to host the Office of Astronomy for Development (OAD) in South Africa. The bid was successful and Cape Town became the epicentre for work to use astronomy to benefit society in developing countries. The OAD has since established many regional offices, including in Ethiopia and Zambia. The OAD Office won the Edinburgh Medal in 2016.

Whitelock is not keen to retire, even though she has reached retirement age. She currently holds a five-year consultant astronomy post at SAAO and plans to keep doing research in astronomy for the foreseeable future. She wouldn't have it any other way – solving astronomical challenges is what she loves to do. "It keeps me out of trouble."

DAVID WOODS

AWARDS, HONOURS AND ACHIEVEMENTS

- Honorary Doctorate from University of Oxford (2003)
- Distinguished Teacher Award to spend a year in Baylor University, Texas (1992 – 1993)
- Rhodes Scholarship (1963 – 1966)

SIGNIFICANT MOMENT

When Jacques Monod, a Nobel Prize winner in medicine for his discovery of gene regulation of enzyme and virus synthesis, told him he was right (and that he, Monod, was wrong). This was about collagen, a very large protein, switching on genes in the nucleus without entering the cell but rather by interacting with its surface.

WHAT PEOPLE MIGHT NOT KNOW

"During my time in Norway, my colleagues would take my leftover laboratory alcohol and make moonshine. It made me very popular, since alcohol is very expensive in Norway."

A LIFE PUNCTUATED BY MOLECULAR MICROBIOLOGY

David Woods learnt the power of generosity and goodwill early in life. After his father, a schoolmaster at Michaelhouse private school in what was then Natal Province, died when Woods was only ten years old, the 'Old Boys' donated enough money to pay his and his brothers' school fees until they matriculated. For university, Woods followed in his father's footsteps and went to Rhodes University (RU), where he majored in botany and zoology. Here, he attended a course given by Brigid Galloway and learnt about the structure of DNA, discovered less than a decade before. "In South Africa I don't think anyone else was teaching it at the time. She was very far-sighted. It inspired me."

In 1963, Woods won a RU Scholarship to go to Oxford University to study for a postgraduate qualification. He studied molecular microbiology and was fortunate enough to attend lectures by Francis Crick, one of the co-discoverers of the DNA molecule. His PhD thesis, *Studies on the Nature of the Killer Factor in Yeast*, focused on a problem of the beer-brewing industry. Sometimes so-called 'killer yeast' would come into the brew and stop the fermentation process. It turned out that the process was caused by RNA molecules encoding a toxin that killed other more sensitive yeast strains. The ability to determine whether a brewing strain of yeast was a 'killer' or a sensitive strain assisted the brewing industry.

Halfway through Woods' PhD his supervisor, Allan Bevan, moved to Queen Mary College at the University of London. Woods enjoyed the intellectual freedom the move provided. "It taught me leadership. Many supervisors supervise too closely, but then you just produce a technician," he says. After his PhD, Woods joined Bevan at Queen Mary for a year, and was about to depart for Rochester University when he was approached by Edgar Twyman from Rhodes with an invitation for him to return for a senior lectureship, and to develop microbiology at the university. It was a good offer and Woods returned to South Africa in 1967.

Back home, Woods worked with the leather industry to solve a major logistical challenge. The abattoirs that provided the hides for tanning were located near large population centres. But the tanning process produced such unpleasant effluent that it was done in far-away small towns, and transportation was a problem as the hides would often rot *en route*. Woods and his colleagues discovered a bacterium that produced collagenase, an enzyme that destroyed the collagen in the hides. His team also pioneered the study of the genetics of anaerobic bacteria which are bacteria that require oxygen-free environments.

Woods travelled for fellowships in Norway and France. In the mid-1970s, at the *Institut Pasteur* in Paris, Woods met Jacques Monod, a Frenchman who had won the 1965 Nobel Prize in medicine jointly with François Jacob and Andre Lwoff for their work on gene regulation. Woods was at the bench, working on the regulation of the gene that produces collagenase. Monod had shown that small molecules get into cells and interact with the DNA that turns on the gene. However, collagen is a huge protein, a triple helix, and is unable to enter a cell. Woods and his colleagues showed that gelatin, the first degradation product of collagen, and the amino acids from collagen, did not turn on the collagen gene. The entire collagen 3D structure was required and it interacted with the cell surface to turn on the collagenase gene.

MEMORABLE INTERACTION

This led to a most memorable interaction. "Monod had heard about our results and asked me to come and see him. I spent a day with him, during which we argued about it. He would not accept that this signalling could work from outside the cell." At the end of the day, Monod said he would think about it overnight. "The following morning, when I walked into his office, he said 'You're right, I'm wrong.' And he had brought cake." For a young scientist in his mid-30s, it was an honour but also a lesson in humility.

After six months at the *Institut Pasteur,* Woods travelled to Trondheim University in Norway for a year-long research fellowship. The reason was Helge Larsen who worked on salted fish and was a world leader on bacteria that require high concentrations of salt – hence the connection with salted hides. But culinarily Trondheim was a stark contrast to French cuisine. "When we got there, we were asked 'Do you like fish?' When we said yes, they said 'that's good because for four days of the week, you'll eat fish and potatoes, and for the other three days, you'll eat potatoes and fish' – and we did!"

After returning to South Africa, Woods spent another 13 years at RU. Then, in 1980, Woods's department moved lock, stock and barrel to the University of Cape Town (UCT), which had made him and his colleagues an offer they couldn't refuse. After a productive eight years at UCT, Woods became Deputy Vice-Chancellor for Research from 1988 to 1996, all the while keeping his research group going. Then, in 1996 Woods was once again approached by RU, this time to apply for its soon-to-be vacant Vice-Chancellorship. Woods applied and was selected. "I wanted to build up research at Rhodes." This he continued to do until his retirement in 2006.

During his career Woods has produced more than 200 research papers and supervised 42 PhD students. He was Chairman of the Bacteriology and Applied Microbiology Division of the International Union of Microbiological Sciences from 1995 to 1999. He is a Fellow of the American Academy of Microbiology and the Royal Society of South Africa, and a Member of the Academy of Science of South Africa. He has served on several boards and as a consultant for industry, and in 1984 he was awarded an A-rating by the former South African Foundation of Research Development (now the National Research Foundation). In 2003, he was awarded an honorary doctorate by Oxford University, and in 2007 he received another from UR. Today he lives with his wife in Kenton-on-Sea in the Eastern Cape.

2020

Legends of South African Science II

Academy of Science of South Africa (ASSAf)

Academy of Science of South Africa (ASSAf)