



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Innovation at UCT 2016

WAVES,
SURFING &
INNOVATION



“Watching surfers gracefully yet boldly ride monster waves is breathtaking. You see first-hand how seemingly at ease they are before and after the ride. Onshore there are plenty of high fives but there's also a cool nonchalance about them. It almost makes you think, ‘I could do that’. Until you try it. When you emerge half-drowned, board-scraped, bruised and beaten it becomes clear... this is no amateur sport. It requires endless practice and patience. Innovation is like that too. Done well, it seems simple. But underneath the simplicity is an incredible amount of hard work, smart experiments, and spills that require us to get back up on that board and go again.”

- Deborah Chase Hopkins,
10 Reasons Why Innovation is Like Surfing

Note from the Director



It is again an honour and privilege to share the accomplishments of the University of Cape Town on the innovation front. Every year when we start preparing for this publication I wonder whether we will have enough exciting material to showcase and report, on and every year I am left surprised at what has been accomplished.

These accomplishments are not possible without financial support. In this regard UCT is still fortunate, with research income from external sources reaching R1.44 billion and the value of research contracts entered into at R1.45 billion. The Technology Innovation Agency (TIA) Seed Fund, established two years ago, is proving to be a huge success in maturing early stage technologies. Six of our seed projects that were funded have already reached such a “technology readiness level” that we have been able to prepare follow-up funding applications to TIA’s Technology Development fund. In addition, another eight projects received funding in 2015, totalling R3.95 million. The ongoing financial support from NIPMO for additional staff and strategic projects in RC&I is also contributing immensely to our ability to move our technologies forward, to market them and introducing new initiatives to facilitate decision making.

Maurício Manhães, a service and design researcher, considers the sport of surfing as perfect metaphor to understand the innovation phenomenon. According to him, “Surfing presents a perfect analogy for keeping ahead of change because, like work and life, this sport occurs in an environment that is in flux, constantly changing. Just as in surfing, if you aren’t out in front of the change wave you’re facing, it’ll pass you by, leaving you struggling in the backwash.”

With this report we provide you with an account of our technology transfer activities with performance metrics and stories that demonstrate the innovative abilities of the UCT community. We as the RC&I team are proud to have a role (waxing the surfboards) in the process of converting the ideas and inventions of our academics and students (the surfers) to the innovations of the future.

- Piet Barnard

Dashboard

Research

2306

Research Contracts Signed

— 2014: 2113

R1.45bn

Total Research Income

— 2014: R1.233 bn

R564m

Value Local Research Contracts Signed

— 2014: R496 m

R1.44bn

Research Contracts Value

— 2014: R1.18 bn

R880m

Value Foreign Research Contracts Signed

— 2014: R684 m

1623.61

Publications 2014 figure

— 2013: 1549.12

IP Protection

42

Invention Disclosures

— 2014: 41

56

Patent Applications Filed

— 2014: 88

15

Patents Granted

— 2014: 16

Innovation

13*

License Agreements (Outbound)

— 2014: 19

R3.73m

License Income

— 2014: R1.32m

29

Materials Transfer Agreements (Outbound)

— 2014: 39

R86.6m

Estimated Value of Equity in Spin-offs

— 2014: R16.52m

2

Spin-off Companies

— 2014: 3

R3.8m

Total Income from IP

— 2014

*Includes Option and Assignment Agreements

UCT Spin-off Companies

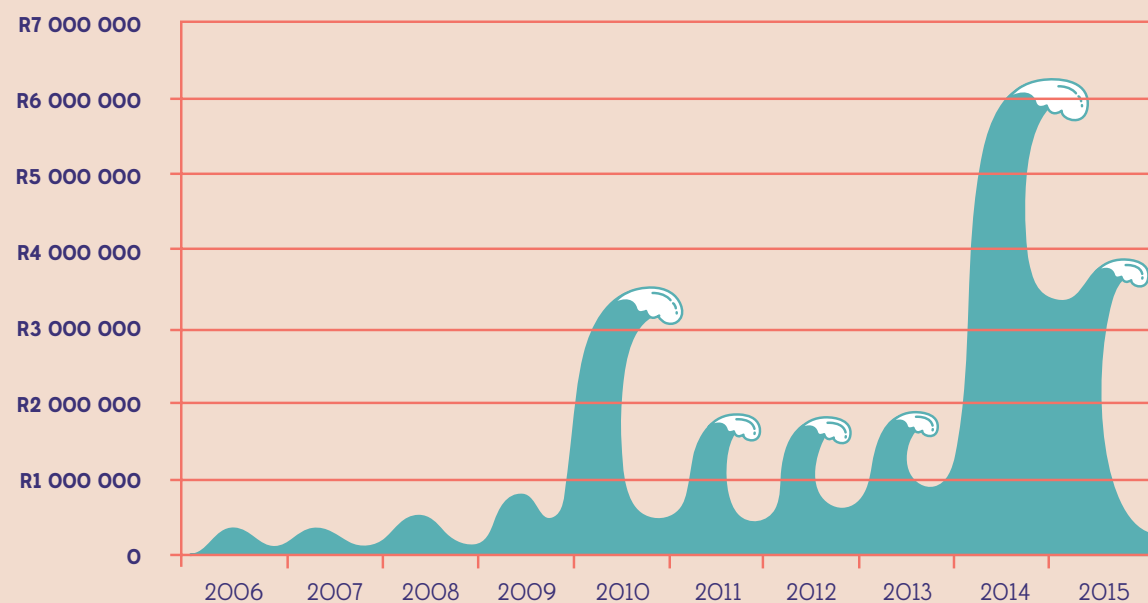
Annual UCT Patent Portfolio Statistics

	2010	2011	2012*	2013	2014‡	2015
Disclosures	31	36	36	38	41	42
Total Patent Applications Filed – all stages	57	68	56	25	88	56
National Phase Patents Granted (incl. European validation)	36	29	26	31	16	15
Application Details						
Provisional	15	14	13	14	12	14
PCT	8	9	8	8	8	13
National (including Divisionals, excluding Regional)	29	38	31	3	58	27
Regional	5	7	4	0	7	2

* A large portfolio was transferred to spin-off company PST Sensors in February 2012.

‡ The ACE portfolio was only transferred to spin-off company AngioDesign at the end of 2014, so the patent family has been included in the 2014 stats.

IP Commercialisation Revenues



UCT Spin-off Companies

Key

Status

- Not Operational
- Operational
- E** UCT Equity

2004

- Isiqu Orthopedics (Pty) Ltd
- Cell-Life



2006

- Cape Carotene (Pty) Ltd
- Hot Platinum (Pty) Ltd




2007

- Nurture Restore Innovate



2009

- E** ● CapeRay Medical (Pty) Ltd



2010

- E** ● Strait Access Technologies (Pty) Ltd



2011

- E** ● PST Sensors (Pty) Ltd
- Seraptix CC
- E** ● Antrum Biotech (Pty) Ltd





2012

- Tuluntulu (Pty) Ltd



2013

- E** ● Elemental Numerics (Pty) Ltd



2014

- AngioDesign (UK) Ltd
- E** ● HyPlat (Pty) Ltd
- E** ● DroneSAR (Pty) Ltd




2015

- Lumkani
- Attri Orthopedics (Pty) Ltd




New Spin-off Companies Recognised in 2015

Attri Orthopedics

Attri Orthopedics (Pty) Ltd (Advanced Tumour & Trauma Reconstruction Implants) was established by serial-inventor Dr George Vicatos (Mechanical Engineering) to commercialise a number of inventions that he is either inventor, or co-inventor of. A major focus is the design of orthopaedic implants destined exclusively for people who have suffered loss of bone tissue due to surgery.



Lumkani

Lumkani is commercialising an early-warning system to reduce the damage and destruction caused by the spread of shack fires in urban informal settlements. Many cooking, lighting and heating methods used by people living in informal settlements produce smoke. For this reason Lumkani detectors use rate-of-rise of temperature technology to accurately measure the incidence of dangerous fires and limit the occurrence of false alarms. Density is a challenge in all urban informal settlements share and is a major risk factor that enables the rapid spread of fires. In order to provide sufficient early-warning, a communal alert is required. Lumkani's detectors are networked within a 60-metre radius so



that in the event of a fire all devices in this range will ring together, enabling a community-wide response to the danger. This buys time for communities to become proactive in rapidly spreading fire risk situations. Lumkani has already distributed detectors to over 7 000 households.

Awards

National Science and Technology Forum (NTSF) Awards



Khilona Radia, CEO of Antrum Biotech, proudly displays their IRISA product that received recognition at the NTSF Awards

One of UCT's spin-off companies, Antrum Biotech, was honoured with the award for "research leading to innovation by a team or individual in an SMME" at the 17th Annual National Science and Technology Forum (NTSF) Awards. The award recognised their research and innovation achievements in health sciences, specifically for their development of an accurate, rapid test for extra pulmonary TB, called IRISA-TB.

Professor Keertan Dheda, the inventor of the technology Antrum Biotech is commercialising, is widely acknowledged for his contributions to the understanding of the pathogenesis, diagnosis, management and control of drug-resistant TB. He was also an NTSF-BHP Billiton awardee in 2014 for his support of the fields of science, engineering and technology through research and its outputs over the last five to ten years.

Chivas Regal Venture Campaign



The Lumkani team receive their \$50 000 prize

UCT spin-off company Lumkani, was the winner of the Chivas Regal's inaugural 'Win The Right Way' campaign. Lumkani received \$50 000 in funding and participated, along with twenty other social entrepreneurs from around the world, in a mentorship programme in Silicon Valley, California. Participants received global exposure for their company and an opportunity to pitch for a portion of \$1 million in funding.

Lumkani is commercialising an early-warning system to reduce the damage and destruction caused by the spread of shack fires in urban informal settlements.

Water Rocket World Record



The Industrial CFD group after achieving their 830 m world record

A team from the Industrial Computational Fluid Dynamics (CFD) Research Group has successfully broken the longstanding Class A water rocket world altitude record by a massive 33%, achieving a height of 830 m. The record was formally ratified on 7 October 2015, after international peer review by the Water Rocket Achievement World Record Association. The previous record of 623 m was set in 2007 by US Water Rockets. "The competition is truly multidisciplinary in nature and requires pushing state-of-the-art technology in areas ranging from mechanical design and lean manufacture to computer-based mathematical modelling. It is like the Olympics of water rocketry and pits us against the best and brightest in the world. Clearly, we are now the undisputed best of the best," says Professor Arnaud Malan, Department of Science and Technology South African Research Chair in Industrial Computational Fluid Dynamics, who led the research group.

As with most academic (rather than commercial) projects, this was done on a shoestring budget: the rocket was built from off-the-shelf components using standard tooling. The result was a featherweight record-breaking rocket, named Ascension III.

The record was the end of a long journey for the research group – driven by Stuart Swan and Prof Malan, with assistance from Donovan Changfoot and William Liw Tat Man. The technology has been patented and useful applications that may include ones in the aerospace sector, are being developed.

Innovation Bridge



UCT's innovation showcase at the Department of Science and Technology's first ever Innovation Bridge

RC&I participated in the Department of Science and Technology's first ever Innovation Bridge event at the CSIR Conference Centre in Pretoria. The event was designed to showcase technologies emerging from South African universities to potential commercial partners, funders and stakeholders.

The Innovation Bridge was well-attended and received considerable media attention, especially during the visit by Minister Naledi Pandor. Funding received from DST enabled the universities to create professional exhibitions and RC&I also launched a new publication "Innovation Opportunities" which highlights UCT technologies that are available for licensing, investment opportunities in existing companies as well as UCT products and entrepreneurship opportunities.

Many useful leads were obtained and a great deal of interest was shown in the three UCT technologies profiled on the stand – HyPlat hydrogen fuel cells, Elemental CFD software and the Lumkani fire detector. Lumkani won both the best pitch given by Paul Mesarcik and the innovation most likely to have impact on inclusive development.

New Provisionals

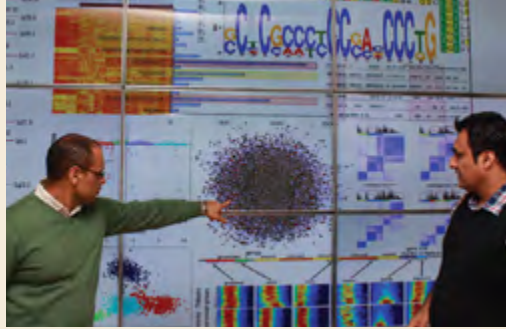
"We keep out in front of the wave and create the future. If you wait for the wave before you move, you're already too late."

- Robert Kriegel quoting an Apple executive



Cancer Classification

Prof Kevin Naidoo and Dr Jahanshah Ashkani



Prof Naidoo's research team used computational tools and data analytics to assess tumour sample of a number of patients. Specifically they studied the expression profiles of genes coding for proteins that modify complex carbohydrates on the surface of cells. The results showed that some of these proteins were upregulated during cancer and effectively created a signature that was unique to each type of cancer.

Based on this, Prof Naidoo has created a technology directed at early diagnosis of cancer via analysis of blood samples. This would be a major advantage as early detection would greatly assist in combatting mortality due to cancer. If cancer is detected early it often can be easily and successfully treated by removal of the tumour or via specific chemotherapies.

Early detection through screening and determination of the cancer type in patients is quintessential to increase the chances of successful cancer treatment. Current methods are not very sensitive and in many instances leads to delayed detection of cancer.

Risk of Developing Tuberculosis

Assoc. Prof Thomas Scriba, Dr Adam Penn-Nicholson, and Prof Willem Hanekom



Therefore being able to predict – with high sensitivity and specificity – whether a given TB patient will transition from latent to active TB will make an enormous contribution to the development of more effective TB vaccines and/or the prophylactic treatment of at risk patients.

A team at the South African TB Vaccine Initiative (SATVI) at UCT carefully constructed a set of patient samples that was analysed for various biomarkers. In collaboration with SomaLogic and the Centre for Infectious Disease Research (CIDR), who are experts in mathematical modelling, they have developed a 'signature of risk', which can be used to predict whether latent TB infection will develop into an active form. A number of provisional patents have been filed on the biomarker sets in two broad categories: transcriptomics and proteomics.

Latent tuberculosis infection means a patient is infected, but the bacteria that remain in the body are in an inactive state and cause no symptoms. However, there is a risk though that a person can become ill with active TB later on.

Radar to Detect Changes in an Environment

Dr Amit Mishra

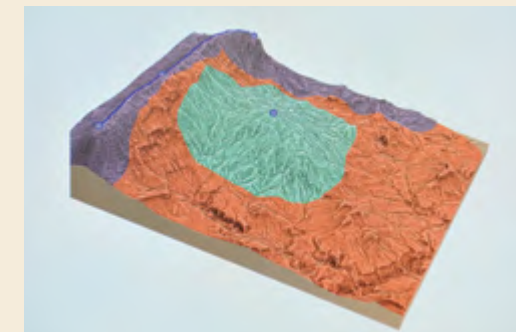


Иван Гриценко

The invention, named "CommSense", invented by Dr Amit Mishra (Electrical Engineering), is a radar system that utilises established communication systems (cell phone or Wi-Fi) to monitor changes in an environment, such as traffic conditions, floods, fire, insurgent activity, and agricultural settings. Unlike conventional radar and commensal radar systems, which typically perform correlation to detect and range targets, this invention utilises a reference signal in a received communication signal to estimate the channel (or equalise the channel) and thereby monitor changes in the environment. This system will be particularly useful in remote areas, where it is not always possible to physically monitor an environment.

Creating Realistic Virtual Terrain for Gaming, Movies and Virtual Reality

Assoc. Prof James Gain, Dr Bruce Merry, and Assoc. Prof Patrick Marais



The designer starts with a working terrain with target dimensions and an associated height, chooses a template terrain (such as bare terrain, a canyon, a mountain, vegetation, a river, or rolling hills) with an associated height dimension, and then modifies the working terrain by "height matching" it to the template terrain. The designer can apply user-defined constraints to further modify the working terrain and produce a final landscape with the desired features. The computer algorithms achieve seamless integration of the various terrains for a more realistic image.

Computer generated or "synthetic" 3D terrain has various applications, such as in computer games, landscape design, flight simulators, emergency response training, battleground simulations, film animation and special effects.

Associate Professors James Gain, Patrick Marais and Dr Bruce Merry (Computer Sciences), invented an improved method for creating a realistic-looking virtual 3D terrain on a computer. The system, termed Realistic Terrain Synthesis (RTS), is comprised of a collection of algorithms and constraint design tools to create realistic looking height-field terrain. It synthesises new terrains in real-time, subject to the constraints sketched or selected by the designer, utilising real terrain examples drawn from a database of Digital Elevation Maps (DEMs).

Existing terrain generation software tends to produce unrealistic terrain, or uses computationally complex simulation processes to create realistic-looking terrain. These processes, being slow, do not support quick iterative design cycles, and are expensive. The RTS system fills a niche since there are no current terrain generation software systems, which combine its speed, ease of use, and user control.

Measuring Intracranial Pressure

Dr Llewellyn Padayachy and Prof Graham Fieggen



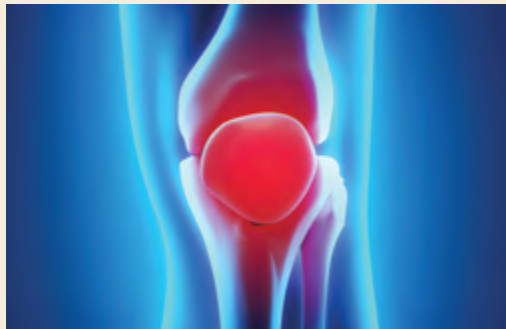
Monitoring Intracranial Pressure (ICP) during neurosurgery or medical care is especially critical for patients suffering from head injuries or stroke. Elevated levels of ICP may result in tissue damage, or even death if left untreated, which makes rapid detection very important.

Invasive methods, such as the placement of micro-sensors inside the brain, are currently still the gold standards. However, with these methods there is always a risk of infection and brain haemorrhage. Various non-invasive methods have been developed, but none have successfully replaced the invasive methods.

Dr Llewellyn Padayachy and Prof Graham Fieggen, in collaboration with inventors from an independent Norwegian research organisation, Sintef, have invented a new non-invasive method for measuring ICP. The system consists of two devices, one configured to detect the optic nerve sheath (ONS) in a subject, and the second configured to obtain information of the pulsatile dynamics of the ONS. The system is further configured, based on the pulsatile dynamics, to calculate the parameter of deformability in order to assess the subject's intracranial pressure.

Drill Guide to Aid Knee Surgery

Dr Sudesh Sivasaru



This invention by Dr Sudesh Sivasaru (Human Biology) and Dr Sarthak Patnaik (a sports and arthroscopic surgeon from India) is a surgical tool to help an orthopaedic or sports surgeon drill tunnels in the patella of a patient's knee during medial patella femoral ligament (MPFL) reconstruction surgery.

During MPFL replacement surgery, the insertion of the replacement ligament must be very precise, the drilled tunnels must be at the correct angles for the reconstructed ligament to function optimally.

For double bundle MPFL replacement surgery (the best practice surgical technique), the tunnels must be absolutely parallel, otherwise the ligament could rip off the patella, or break the ligament off. This is very difficult, as the surgeon will need to estimate the correct angle of drill entry into the patella with his eye ("ballparking"). This often requires a number of intra-operative X-ray scans to ensure that drilling is correct.

The "Patellofixator Rig" is designed to reduce surgeons' apprehension to drill tunnels, and also reduce their exposure to intra-operative radiation. In use, the device is placed on top of either one of the knees, above the skin, to form a tight grip around the patella. Holes in the sides of the device allow for the drill to be guided accurately.

A disposable commercial device is currently being developed with a number of accessories such as a scale and a tool to help determine the optimal point of attachment for the ligament.

Tracking Patient Orientation During MRI Scans

Mr Adam van Niekerk



This invention is a device capable of tracking the movement of a patient during long MRI scans. The device is attached to the patient, and the orientation thereof provides an indication of the movement of the patient. These measurements can then be used to correct for scanning errors introduced by movement using conventional motion correction equipment,

ultimately improving the image quality and accuracy produced by the MRI Scanner.

The unique MRI environment allows for orientation to be measured from vector observations within the scanner bore at a single point, i.e. by recording angular rate vector, acceleration vector and magnetic field vector. The observation that the earth's gravitational field and the main magnetic field of the MRI scanner is almost perfectly orthogonal has led to this simple and cost effective device.

The hardware differs from similar devices in other applications in that special printed circuit board layouts are required to protect the device from transient fields generated by the MRI scanner gradients and radio frequency coils (short tracks are used where possible, to prevent them acting like an antenna, and longer tracks are shielded).

Fire Detection in Informal Settlements

Mr Samuel Ginsberg, Mr Paul Mesarcik, Mr David Gluckman, Mr Francois Petousis, Mr Max Basler, and Ms Emily Vining



Numerous field trials have shown that it works very well. Conventional smoke detectors are unsuitable for informal settlements due to the use of paraffin lamps, cooking on open fires and candles.

The patent application covers the fire alarm and LED detector, a meshed network of fire alarms in communication with one another, and a network control device for sending control messages (the "sniffer" device).

Lumkani is an early warning fire detector for use primarily in informal settlements. Shacks burn exceptionally rapidly and warning of neighbours is important to contain the spread of fires. The detector measures the rate of rise of temperature within the shack, and if it is above a certain threshold, the alarm and surrounding alarms are triggered. The sound has been specifically selected to wake people sleeping deeply.

New Bluetongue Virus Vaccine

Prof Edward Rybicki, Dr Ann Meyers, and Dr Albertha van Zyl



Bluetongue virus is a viral disease affecting sheep, cattle, goats and other ruminants, and it is widespread around the globe. However, until recently there was limited spread in Europe. Generally, there is no treatment for infected animals and prevention of

infection by vaccination is the best way to combat vector-borne diseases.

Scientists from the Department of Molecular and Cellular Biology, Prof Ed Rybicki, Dr Ann Meyers and Dr. Albertha van Zyl have developed two bluetongue virus (BTV) candidate vaccines.

In contrast to the currently marketed attenuated and inactivated vaccines, the UCT vaccine candidates are plant-produced particulate vaccines which can be used in animals to protect them against more than one virus serotype. In addition, because it is particulate in nature, it stimulates a strong immune response. A further advantage lies in the simplicity and low safety requirements for production, as well as the cost effectiveness of the production method.

New Anti-Malarial Drug

Prof Kelly Chibale, Dr Leslie Street, Dr Tanya Paquet, and Dr Diego Gonzalez Cabrera



Currently, more than 400 000 people per year die due to malaria despite various treatments being available. In addition, drug resistance is starting to occur against even the latest WHO recommended drugs. Novel therapies for the treatment of malaria are thus socially and economically significant.

The UCT inventors together with collaborators from Medicines for Malaria Venture (MMV) have developed a novel synthetic small molecule, MMV674594, with potent *in vitro* activity against both drug sensitive and drug resistant Plasmodium parasites. The good efficacy and pharmacokinetic profile of MMV674594 means it has the potential to be used as part of novel combination therapy for the treatment of malaria.

Water Rocket

Mr Stuart Swan and Prof Arnaud Malan



A team from UCT's Industrial Computational Fluid Dynamics (CFD) Research Group (Stuart Swan, Prof Arnaud Malan and William Liw Tat Man) have created a composite pressure vessel designed for a high-powered water rocket which is lightweight, low cost and easily manufactured, while still having a pressure capacity of 10 MPa. The team's novel design overcomes the shortcomings of many lightweight materials in high pressure environments, thus opening up opportunities for applications in aerospace and spacecraft.

Using the vessel the team were able to construct a featherweight water rocket. This enabled them to break the longstanding Class A water rocket world record that is discussed elsewhere in this publication.

Social Innovation of the Year

Abalobi: "From Hook to Cook"

With the increasing affordability of mobile devices and rapid development of internet systems and mobile apps, this ubiquitous form of communication is increasingly being used to develop sophisticated monitoring systems to address some of the world's more pressing economic, social and ecological challenges. Examples abound of development projects around the world that are making use of cellphones to empower local communities to monitor issues as diverse as natural resource use, community health and water quality, as well as to empower these same communities with marketing and management tools.

Dr Serge Raemaekers headed a team that developed an integrated catch management system for small-scale fisheries. The system, Abalobi, aims to empower marginalised small-scale fishers whilst at the same time satisfying the legislative requirements and improving fisherman safety and connectivity. The pending implementation of the gazetted Small-Scale Fisheries Policy in South Africa has provided an impetus for similarly novel approaches to small-scale fisheries governance, and an opportunity exists to leapfrog the traditionally marginalised small-scale fisheries sector into the forefront of fisheries management through the use of modern, mobile and cloud-based information technology.

The new Small-Scale Fisheries Policy is seen as a bold step towards recognising small-scale fishers' traditional rights and seeks to implement novel co-management approaches, decentralise resource allocation, and involve fishers in resource monitoring and compliance. At the same time, the policy aims to enable fishers to play a more empowered role throughout the value chain. This new policy environment, which will impact more than 100 000 households involved in the small-scale fisheries sector along the South African coast, provides an exciting opportunity to develop innovative information and communication systems.

Abalobi aims to enable the marginalised fishing communities to be integrated into larger information and resource networks, from fishery monitoring and maritime safety to local development as well as rapid and wide access to market opportunities.

An additional mobile app is currently being funded as a TIA Seed Fund project to enable the fishermen to interact directly with restaurants in order to sell their catch.



TB Innovation

South Africa ranks third after India and China in terms of tuberculosis infection, with 1% of our population developing active TB each year and an increase of 400% over the last 15 years. UCT researchers have responded to this scourge by inventing new diagnostics, predictors of disease progression, medications and systems to monitor the spread of the disease. Many clinical trials are also conducted by UCT researchers.



TB Test Strip

Up to now there was no reliable rapid point-of-care diagnostic test for the diagnosis of TB in pleural effusions, and these have remained a challenge for many decades. A Th1 cytokine-based rapid point of care diagnostic tool for tuberculosis of the pleural space and other body compartments (pericardial space, abdominal cavity, sub-arachnoid space and potentially peripheral blood) using immunochromatographic strip test technology, was developed. The product (InterGam assay) being commercialised by spin-off company Antrum Biotech, is novel and has significant advantages over existing tools.

Prof Keertan Dheda

Prof Jonathan Blackburn, Prof Keertan Dheda, and Dr Brandy Young-Gqamana



TB Biomarkers in Urine

This invention relates to biomarkers for determining the presence of TB in patients, and for distinguishing between active and latent TB. Research at UCT has uncovered biomarkers comprising specific proteins from Mycobacterium tuberculosis. It was determined that some of these proteins are related to human response. These are found in the urine of the infected patients and could potentially form the basis of new and improved point-of-care diagnostic tests for TB, which may have major ramifications for disease control.



TB Risk

Latent tuberculosis infection means a patient is infected but the bacteria remain in the body in an inactive state and cause no symptoms. There is a risk that a person can become ill with active TB later on. Therefore being able to predict – with high sensitivity and specificity – whether a given TB patient will transition from latent to active TB, will make an enormous contribution to the development of more effective TB vaccines and/or treat patients prophylactically. A “signature of risk” test was developed that can be used to predict whether latent TB infection will develop into an active form.

Assoc. Prof Thomas Scriba, Dr Adam Penn-Nicholson, and Prof Willem Hanekom



Phenothiazine Anti-TB Drug

The major challenge of the current anti-TB drug regimens are antibiotic resistance, toxicity and interactions with other medication (e.g. in HIV patients). Drugs that are cost-effective with fewer side effects and short and simple regimens are urgently required. Phenothiazine based molecules have been identified as a potential solution. Phenothiazine, a psychotropic drug (i.e. drugs with neuroleptic attributes), which causes side effects and there is a reluctance to use it as such. It was shown that it is possible to separate the anti-TB activity from the psychotropic activity by remodelling the structure of phenothiazine and its derivatives to reduce their ability to cross the blood-brain barrier. This is possible through: (i) increasing the polarity at the terminal alkyl side chain moiety; (ii) variation of alkyl chain length; (iii) expansion of the ring system; (iv) introduction of heteroatoms into the aromatic ring; (v) variation of ring substituents.

Dr Anwar Jardine and Assoc. Prof Mazam Jacobs



Superspreader Mask

Approximately 650 000 TB patients have Drug Resistant TB (DR-TB), which is untreatable. Anti-microbial resistance occurs when the organism develops the ability to evade an antimicrobial drug that was originally effective for treatment of infections caused by it. In the case of DR-TB patients, there is a group of patients referred to as “superspreaders” who are highly infectious. In principle, superspreaders should be isolated from society, but in practice many superspreaders continue their day-to-day activities. Researchers at UCT have developed a smart mask that is able to estimate and limit disease transmission, monitor cough frequency, and determine the infectious risk to a group, community or region from a patient suffering from TB or other highly infectious diseases. Research at UCT showed that the number of DR-TB patients and superspreaders is small (2% of total caseload), however, these patients use more than 45% of South Africa’s total R1.6 billion TB budget.

Dr Grant Theron, Dr Lester John, Prof Keertan Dheda, and Dr Suresh Sivarasu



Thoracoscope

Operating on patients with Pulmonary TB is often problematic because of blood loss from the thoracic wall and the inability to visualise the areas from where the blood loss occurs. Dr Serita Barnard’s angulated rigid endoscope for viewing the inner thoracic wall during a thoracotomy is able to locate bleeding points. It can be operated with one hand, so a clear image is attained without the need to adjust the overhead theatre lights. It is also able to provide a real-time image of the area directly under the entrance wound, right up to the apex of the thoracic cavity and down to the costo-phrenic angles. In addition, the scope does not require any training to operate, is cheap and can easily be gas-sterilised.

Dr Serita Barnard

Seed Projects

UCT PreSeed Fund

UCT's PreSeed Fund (R500 000 per annum awarded by the URC) supports projects in the early innovation space so that on completion, IP can either be commercialised, or projects are better positioned to attract next-stage funding.

There are two levels of funding 'Explorer' (< R20k) and 'Concept' (< R100k). The Explorer Fund received 9 applications of which 6 projects were funded to the amount of R85 090. The Concept Fund received 7 proposals for funding of which only 4 could be accommodated, mainly due to budget constraints.

UCT TIA Seed Fund

The UCT TIA Seed Fund is an instrument of the Technology Innovation Agency (TIA) which provides funds of up to R500 000 for early stage innovation projects (typically between technology ready level (TRL) 3 to 4. The aim with this fund is to mature high risk, low maturity technologies to enable the innovations to reach the next round of innovation or commercial funding.

The funding is certainly having the desired effect and projects coming out of the Seed Fund are well positioned for follow-on funding from TIA or other sources. Six 'two-pager' proposals were presented to TIA to establish their interest in follow-on funding and of these, only one has been rejected.

During 2015 a total of 27 applications, to the value of R12.52 million, were considered by the UCT Steering Committee of which 11 were considered meritable. TIA was able to support 8 projects to the value of R3.95 million.

<p><u>Calls for Applicants</u></p> <p>2 _____ 2014 2 _____ 2015 4 _____ Total</p>	<p><u>Max Investments Per Project</u></p> <p>R500 000 _____ 2014 R500 000 _____ 2015 N/A _____ Total</p>	<p><u>Total Applications Received</u></p> <p>26 _____ 2014 27 _____ 2015 53 _____ Total</p>
<p><u>Total Value of Applicants Received</u></p> <p>R10 782 000 _____ 2014 R12 515 750 _____ 2015 R23 297 750 _____ Total</p>	<p><u>Applications Approved by Steering Committee</u></p> <p>9 _____ 2014 11 _____ 2015 20 _____ Total</p>	<p><u>Value of Applications Approved by Steering Committee</u></p> <p>R4 152 447 _____ 2014 R5 203 000 _____ 2015 R9 355 447 _____ Total</p>
<p><u>Applicants Awarded Funding by TIA</u></p> <p>9 _____ 2014 8 _____ 2015 17 _____ Total</p>	<p><u>Value of Applications Awarded Funding</u></p> <p>R4 152 447 _____ 2014 R3 949 000 _____ 2015 R8 101 447 _____ Total</p>	<p><u>Awarded Projects Completed</u></p> <p>5 _____ 2014 1 _____ 2015 6 _____ Total</p>

Blue Food Colourant from Algae



Phycocyanin is a blue pigment that can be extracted from *Spirulina* algae. Phycocyanin is one of very few natural blue pigments that are approved for use in the food and cosmetic industries, so it is in demand. In addition to its striking blue colour, phycocyanin has beneficial nutritional qualities such as immune enhancement, anti-inflammatory and antioxidant

properties. It also has fluorescent properties and is used in immunodiagnostic and analytical applications.

The Centre for Bioprocess Engineering Research (CeBER) has already demonstrated that it is capable of producing high quality *Spirulina* at production scale. Phycocyanin produced by them at laboratory scale was analysed by a large international food colourant company and was considered to be of exceptional quality.

The UCT TIA Seed Fund has enabled them to improve the lab-scale manufacture of phycocyanin – very innovatively - and to scale up in such a way that they can produce high quality phycocyanin competitively.

The next stage of the project will focus on scaling up the process to a full commercial scale operation for which funding is currently sought.

UCT Greenhouse: Multi-stakeholder platform



The lack of a reasonably sized, high quality, well equipped greenhouse facility at UCT has been a dream of both the Biopharming Research Unit (BRU), and the Centre for Bioprocessing and Engineering Research (CeBER).

BRU's major focus is the expression of pharmaceutically relevant proteins in tobacco plants, and they needed a facility to accommodate some of projects that they are currently working on. These include the production of pandemic and potentially pandemic influenza

vaccines, candidate vaccines against bluetongue virus of ruminants, and chimaeric papillomavirus vaccines.

A focus of CeBER is on algal cultivation, harvesting and processing for the production of carotenoids, nutraceuticals, lipids and energy products, and to cultivate algae at semi-commercial scale a 50 000 litre raceway was needed.

BRU and CeBER have, as part of two separate applications to TIA, made provision for a contribution towards the establishment of a facility to accommodate both units' needs. The rest is history - a 105 m² facility on upper-campus.

RC&I's Francois Oosthuizen did exceptionally well as project manager, having had to accommodate and meet all the requirements of the different stakeholders: researchers, institutional planning, architecture, heritage and municipal building regulations and service providers.

Power Injection/Extraction to Optimise Electricity Distribution



Professors Trevor Gaunt and Michel Malengret developed an algorithm that if applied to an inverter, enables power to either be injected into the network optimally, or withdrawn. This will become increasingly important as 'green' technologies such as wind farms and solar panels are connected to the grid. It can be applied to a single phase or multi-wire power network so that the power reaches its destination where it is consumed with minimal losses. This increases the efficacy of utility networks.

Practically, the algorithm is implemented through software installed on invertors and the efficiencies, increased

capacity, and importantly network stabilisation that result, will be of interest to utility providers who control power networks.

The "Power Injection" TIA Seed Fund project had the goal of integrating the UCT technology into an existing South African commercial inverter (70 kW MLT Drives grid tie three-phase inverter) to demonstrate the impact of the technology.

Test work was conducted in collaboration with industry partner MLT Drives both at their facility and the UCT High Power Laboratory (100 kW network with actual varying loads), which is a sufficiently large network for realistic assessment.

The technology was implemented on 24 kW invertors and tested in a live network. Depending on the imbalance that is corrected, the saving can range from 4% to as high as 20%. The technology has been demonstrated to industry partners, some of whom will hopefully participate in the large-scale trials on real networks.

Implant to Combat Sleep Apnoea



skin. Moreover, the machine is bulky, making it difficult to travel with, and noisy, affecting bed partners.

A number of tongue implants have been developed to prevent the tongue from collapsing during sleep. None of these implants provide a permanent solution to OSA, and there is a risk that they may tear out. Dr Rushdi Hendricks and Assoc. Professor Deon Bezuidenhout have developed a vastly improved implantable tongue anchorage device, which has recently been patented.

As part of this project, devices were implanted into sheep to test the characteristics, strength, safety and efficacy of the implant. The project consisted of an initial 'pilot study' using six animals, followed by an extended study on sixteen animals. The outcome of the project was extremely favourable and results showed that the implant is supported well within the tongue.

Approval was received to submit an application for TIA Technology Development funding to conduct a human clinical trial - a critical step before the product can enter the market.

Obstructive Sleep Apnoea (OSA) is a serious condition characterized by blockage of the upper airway during sleep as a result of a collapsed tongue in the throat. Patients suffering from OSA have interrupted sleep, resulting in day-time sleepiness and moodiness. Moreover, OSA has been linked to a number of other ailments, including cardiovascular, cerebrovascular, endocrine/metabolic complications and premature death. Continuous Positive Airway Pressure (CPAP) treatment remains the gold standard for OSA because of its effectiveness in the elimination of apnoea. CPAP adherence is low (~40%) due to a number of side effects, including dry nasal passages, bloating, dry eyes, and dry

Inventor Focus



MICHAEL HAMMOND

Adam Van Niekerk

Meet Adam van Niekerk, biomedical engineer, PhD student and the inventor of a device that corrects for accidental motion during MRI scans.

Gravity, as a force to defy and as an inspiration, has been central to Van Niekerk's interest in engineering and his fledgling career as an inventor. In fact, as a child Van Niekerk knew what it felt like to leap over tall buildings in a single bound. Back then, a 10-year-old Van Niekerk often volunteered as the pint-sized pilot for the projects he dreamed up with his older brother and father, both of whom are engineers.

"At that time my father was working for the Hamilton Airship company on a helium airship that the South African military was creating," remembers Van Niekerk. "At the end of the project my dad had some helium and sail cloth left over and so of course we decided to build our own balloon. Since I was the smallest and the lightest, I got to be the guinea pig. I could basically moon walk over the house and the blue gum trees that surrounded it. It was really fun until a wind came up and then I almost turned into a kite."

"There are a lot of kids that need to have an MRI, but it is a pretty unpleasant experience for them, so knowing that I might be able to help is a really good feeling"

After completing his undergraduate studies he became interested in human anatomy and decided to pursue an MSc in biomedical engineering.

"At the beginning of the course we had some introductory lectures, one of which was about radiology. I was immediately fascinated with MRI brain scanning which allows for the most amazing contrasts to be gathered. However, MRI scans are very easily impacted by even small movements. It was then that I realised that between the strong magnetic field of the scanner itself and gravity, I had two unchanging vectors that could be used to calculate movement."

The other piece of the puzzle fell into place when Van Niekerk realised that new, but already existing technology, such as the angular rate sensors and accelerometers found in most cell phones, were created from tiny components that were made out of silica and were therefore suitable to be used within the powerful magnetic field of an MRI scanner. This formed the basis of his invention.

Not only will Van Niekerk's device allow for more accurate scanning of patients who find it difficult to remain still, such as children, but the device may also have other applications. "There are a lot of kids that need to have an MRI, but it is a pretty unpleasant experience for them, so knowing that I might be able to help is a really good feeling," Van Niekerk says.

At the end of last year Van Niekerk converted his MSc to a PhD, which he hopes to complete by mid-2017. He is also looking into the viability of commercialising his device. "It's great to be able to do these things at the same time," he says, "but in the future all I really want is a workshop and some problems that need solving."



Stuart Swan

A willingness to experiment led mechanical engineering student, Stuart Swan, to help break a world record and patent a new sealing solution for pressure vessels.

On 26 August 2015 at 9:37am, the Ascension III water rocket soared into the sky for the first time. It measured 2.68 meters in length, weighed less than 1.5 kg and reached a speed of 550 km/h in 0.5 seconds. Most importantly, it shot to an altitude of 835 meters, beating the previous world record by 217 meters.

“I remember when we approached Professor Malan with our idea, right at the start and even though at that point we only had 3 months to attempt to break the record for 2013, he fully supported us. But I remember he gave us one condition: no quitting allowed. I think the fact that we were very persistent is what led to the success of the project.”

The team who built the rocket had worked for three years to get to that point and they had suffered their fair share of setbacks along the way. Mechanical engineering student Stuart Swan, who worked with Professor Arnaud Malan and fellow students Donovan Changfoot and William Liw Tat Man, remembers having to go back to the drawing board on at least three separate occasions.

On one occasion, Swan had designed a new launchpad made to withstand about 550 kg of thrust, the rocket didn't even take off. This led to other innovations being made, including a fail-safe recovery system and a spring-loaded mechanism for the release of the

parachute.

“It took us a little while to find a solution that was lightweight, that we could realistically manufacture ourselves and that was also cost effective, but in the end we found a way of using existing materials but applying them in a new way. It worked!”

“I remember when we approached Professor Malan with our idea, right at the start and even though at that point we only had 3 months to attempt to break the record for 2013, he fully supported us. But I remember he gave us one condition: no quitting allowed. I think the fact that we were very persistent is what led to the success of the project.”

Now their design and sealing system for pressure vessels is being patented with hopes that it will have applications for everything from scuba diving tanks to hydrogen powered cars and even within the aeronautical industry.

So what does Swan hope for the future? “Right now I'm still working with Professor Malan, I'm also working on the design of a device used for diagnosing TB, and I am working on a project with my dad. My wife and I have our own design company that we are hoping can be an umbrella platform for a lot of different ideas,” he replies. “Most of all I would like to be able to carry on making stuff, and making sure that the stuff I make also has a social good, ideally one that can be used to empower others.”



Lutete Khonde

Growing up in the DRC, Lutete Khonde had no idea that a decade later he would find himself in Cape Town, dedicating his PhD research to finding new ways of making ergothioneine.

Ergothioneine was first discovered in 1909. It has only been in the last few decades, however, that interest in the use of this amino acid within the human body has grown. Ergothioneine is now being studied all over the world for its antioxidant powers, role in ageing and ability to increase athletic performance. Its relationship to tuberculosis as a protectant of Mycobacterium tuberculosis against oxidative stress is of interest and could lead to a novel way of designing anti-TB drugs.

“When I announced I was doing chemistry at university my family was quite shocked,” Khonde recalls, “My father is a judge and no one else in my family showed an interest in science. I remember my mother asking me, ‘Lutete, what do you do with chemistry?’” He was therefore happy to announce, two weeks before he graduated with distinction from the University of Kinshasa, that he had been offered a job with the international beer brewing company, Heineken. After two years working for the company, he grew bored. When his father suggested he accompany him on a trip to South Africa in 2010, Khonde agreed, and ended up applying to UCT for his Master's degree.

Two years later, with his MSc in Chemistry in hand, Khonde again decided to stay in Cape Town to further his studies. “For my Master's I worked on creating a platform for the synthesis of key enzyme substrates involved in the biosynthesis of thiols in Mycobacterium tuberculosis,” Khonde explains, “For my PhD, however, my supervisor Dr Anwar Jardine and I decided to look at the synthesis of ergothioneine since up until that point it was very difficult both to extract it from natural sources, such as bacteria and mushrooms, or to synthesise it in a lab.”

“I believe that if you are going to do a PhD, which requires a lot of time and hard work, then it must have an impact. Your work must mean something in the world.”

Khonde discovered that there were three existing patents related to the synthesis of ergothioneine, but all three were almost impossible to reproduce. Instead, he created a new way of synthesising this super antioxidant in a lab, one that was simpler, faster, and cheaper with a much greater yield than previous processes. “Finally my mom knows what you can use chemistry for,” Khonde says. His process has now been patented and he is working with colleagues in the Department of Chemistry to find ways to bring the process to market.

“I believe that if you are going to do a PhD, which requires a lot of time and hard work, then it must have an impact. Your work must mean something in the world,” he says. In the future Khonde plans to remain in academia, where he thinks it is possible to balance the need to publish papers and get citations with a love of teaching and a desire to invent new ways of doing things that have practical uses.

“I think it is possible to strike a balance between these different motivations,” Khonde says, “If you listen to your own voice, find your vocation and work really hard then anything is possible.”



Sudesh Sivasaru

Dr Sudesh Sivasaru ascribes his prolific output as an inventor to persistence, pragmatism and a clinician centred approach.

Dr Sudesh Sivasaru's path to becoming a prolific inventor of biomedical devices has had its twists and turns. As a child he was mesmerised by the locomotives that thundered down the railways in his hometown near Chennai in India. So, while it was not surprising that he elected to study engineering at an undergraduate level, his choice of business as a subject for his graduate studies was unexpected. Sivasaru was about to take up a place in a prestigious business studies programme abroad, when he had a car accident that led to six months of rehabilitation and him having to give up his place in the programme.

"I didn't know it at the time but it was really a blessing in disguise. It led me to taking a course in biomedical engineering and specifically a class in rehabilitation engineering. The man that taught that class, Professor Lazar Mathew, became my PhD supervisor and is still my mentor today," Sivasaru says.

Sivasaru was trying to figure out why his first invention, a type of knee prosthesis, had not made it to the market. He realised that up to that point he had considered the patient to be the central "client" in the innovation process but that in fact it should be the clinician. The patient remained the end user but the clinician was the one who had to buy the device or at the very least sign off on its use. According to Sivasaru, this had a revolutionary effect on the user-friendliness and effectiveness of his devices.

In the five years since Sivasaru arrived at UCT he has invented numerous devices with applications ranging

"As an academic I am expected to publish high impact papers but as an engineer I want to make things, especially things that work and have real world applications. I think we must move towards translatable research."

from stroke rehabilitation, through to asthma therapy and devices directed at children to devices to aid orthopaedic surgeons resolving issues with knee joints. These devices have received a number of national and international awards.

"UCT has great support services to researchers," Sivasaru says, "but still a limited range of spin-off companies." Sivasaru believes this is due to a lack of attention towards product related research.

"As an academic I am expected to publish high impact papers but as an engineer I want to make things, especially things that work and have real world applications. I think we must move towards translatable research. There is a lot of emphasis on publication driven research and citations, but I believe that we can make a difference in the world we live, only if we start thinking outside the regular boundaries of Academia and start focusing on real life problems, which are real-time opportunities to serve people."



Kevin Naidoo

What exactly is scientific computing and how is Professor Kevin Naidoo using it to better understand how disease works?

Professor Kevin Naidoo's research takes place at the intersection of biology, chemistry, statistics and mathematics. At UCT's Scientific Computing Research Unit, where he is Director, he uses informatics and computer modelling techniques to interrogate data and simulate complex molecular processes in disease. At present this includes his work on identifying cancer sub-types and isolating the key molecular signatures of different kinds of tumours. In his words, his work is all about the three C's of computing, carbohydrates and cancer.

"Our work paves the way for more accurate and earlier diagnosis by being able to detect the specific 'signals' that we have found that are associated with specific cancers."

"There is a deep connection between carbohydrates and disease," he explains, "In the past research focused mostly on the role of DNA and proteins. I am interested in the role of carbohydrates, which coat the cells of all living organisms, in human health. It turns out that much of the cellular communication is due to the very complicated carbohydrate systems that coat the outsides of cells and that trigger important biological events."

To date Naidoo and his team, primarily Dr Jahanshah Ashkani, have analysed the data of more than 1 800 patients using extracted RNA from tumours.

Running this data through statistical models they have shown that each kind of cancer displays tell-tale 'signals'.

What does this mean for individuals? According to Naidoo the impact is twofold: "Firstly, in the case of cancer, early diagnosis is crucial. Our work paves the way for more accurate and earlier diagnosis by being able to detect the specific 'signals' that we have found that are associated with specific cancers. Secondly, our research can be used to refine cancer identification. Many cancers have whole families of subtypes. There are four kinds of breast cancer, for example. Knowing the exact subtype leads to more effective treatment."

"In the last two or three decades, as everyone knows, the role of computers in our lives has been completely transformed," he says, "Now we are seeing an integration of the digital with the physical world which is very exciting."

Naidoo also hopes that more students will join the field in which he is a pioneer. "This work has many possible applications," he says, "The people who come after me will be able to use this technology to perhaps design new materials, or find solutions for other diseases from the analysis of carbohydrate enzymes in blood. This is only the beginning."



George Vicatos

The serial inventor who is developing revolutionary solutions for bone tumour patients.

For a long time Dr George Vicatos felt that he was missing some piece of knowledge that rendered his education incomplete, which includes a Master's in aeronautics and a PhD in thermodynamics.

"So I decided to return to what was really my first love: anatomy," Vicatos explains. He spent a year studying anatomy at UCT, among students half his age. Where they immersed themselves in the structure of the soft tissues of the body, Vicatos focused more on the function of the human skeleton, seeing it with the eyes of an engineer. "I knew then I had found the missing piece," he says, "It was like suddenly the lights were switched on and all the doors opened. My education was complete."

Vicatos' first opportunity to apply his new knowledge came in the form of a young man who required a knee replacement due to a bone tumour. Without an adequate replacement his leg would have to be amputated. Vicatos rose to the challenge, designing a new kind of implant and the surgery was a success. The young man had complete use of his leg.

Vicatos formed a company with another engineer and a doctor and began to design and produce a number of titanium implants. By the time the young man returned for treatment three years later in 2004, after a work related injury, Vicatos had created an implant that could replace his entire femur. "By that point, I had already created a modular system of implants which meant I had created 85% of the human skeleton in titanium," Vicatos says.

The original company did not survive but in 2013 Vicatos created a new company, Attri Orthopedics, manufacturing implants to ultra-precise specifications. In the interim Vicatos has also worked on some revolutionary devices. One such invention, in conjunction with Samuel Ginsberg, is a femur implant for children, which expands as the child grows. Vicatos has also had great success in the field of maxillofacial reconstructive surgery, creating an implant "track" device with maxillofacial surgeon, Dr Rushdi Hendricks, that helps survivors of partial maxilloectomies regenerate their own jawbones and the soft tissues of their palates. To date they have completed this process successfully with six patients.

"I knew then I had found the missing piece, it was like suddenly the lights were switched on and all the doors opened."

In the future Vicatos hopes to continue to create a wider range of components, all of which will be produced locally. "Being able to personalise the implants and work with the physician involved is incredibly important and not surprisingly, surgeons much prefer having someone on hand who can work with them to create the best possible outcome for the patient."



Samuel Ginsberg

UCT electrical engineer, Samuel Ginsberg, has had a hand in inventing many diverse devices, ranging from a heat detector for informal settlements to a wearable device that measures ambient CO₂ levels. What does he think is the secret to successful innovation?

"A lot of the things I have worked on have not been my ideas," Ginsberg says, humbly. "I think that's maybe part of how these things happen though," he says, "You take a real world problem and you find a bunch of people with very different skill sets to try and find a solution. I think you also have to listen to what the end user of the device really needs."

That was the case in the invention of the Lumkani Fire Detector, which came about out of an Honours project by engineering student Francois Petousis, whom Ginsberg had supervised. "The turning point for us came about a year and a half into the project," remembers Ginsberg. "We sat down with a group of people who lived in a community that was prone to shack fires and we asked them what they needed a fire detecting device to do. By the end of an hour we knew we had to scrap everything we had done up to that point, but we also knew what needed to be done from that point on."

Ginsberg has had a hand in many other projects, many of which form an answer to social problems or biomedical challenges. Take for example the case of the CO₂ logger that Ginsberg worked on at the request of the Desmond Tutu Foundation. "They asked that I create a device that measures ambient CO₂ levels, that was small enough to wear, not too heavy and that contained enough battery power to last through the course of a day." Ginsberg created a device that contained a GPS tracker, allowing the movements of the subjects to be tracked, along with the capacity to measure temperature, humidity and CO₂ levels.

"Trying to prevent fires or working on a device that is going to help someone hear better are areas where I can possibly make a difference. I think it's a case of doing what you can, with what you have."

Other devices that Ginsberg has worked on have included a low-cost hearing aid that can be calibrated remotely, which has been a collaboration with Lebogang Ramma (Health Sciences), a surgical implant for children who have suffered bone tumours or accidents, with Dr George Vicatos (Mechanical Engineering), which includes a motor that allows it to expand as the child grows.

Ginsberg, a fourth generation engineer, explains that as a child he grew up in an environment where his curiosity was always encouraged and where the greatest danger lay in some of the unexpected outcomes of his own engineering experiments. "As an adult and as an engineer I know I am not going to find a cure for TB, for example, but trying to prevent fires or working on a device which is going to help someone to hear better are areas where I can possibly make a difference. I think it's a case of doing what you can, with what you have."

Professor Danie Visser Retires



2016 sees the end of Prof Danie Visser's term as Deputy Vice Chancellor (Research and Internationalisation), a position that included responsibility for the innovation activities of RCIPS. Whilst having a law background, Prof Visser has definitely expressed a keen interest in driving innovation at UCT and supporting the activities and development of RCIPS wholeheartedly – something that is critical for a technology transfer office such as RCIPS in order to achieve success.

“Danie and I just visited a senior management team at Airbus Defence & Space, which is the no. 1 space company in Europe and no. 2 internationally. Danie, representing UCT, was awe inspiring. The Head of Platform & Vehicle Engineering voiced that he was quite simply “overwhelmed” by what Danie had to say. The time spent with Prof Visser and being a witness to him serve has been of the most momentous of my life. One is filled with admiration for such a humble giant.” – *Prof Arnaud Malan*

“In early 2009, when I was contemplating a second career beyond academia, Danie's support for spinning CapeRay out from UCT was crucial. I will be forever grateful to him in enabling my transition from professor to entrepreneur.” – *Prof Kit Vaughan, CEO CapeRay*

“Prof Visser inspired, encouraged, supported and inculcated a tremendous world class research culture at UCT. Under his leadership, UCT attained the best ranking in research yet seen in my nearly 20 years at UCT.” – *Prof Kelly Chibale*

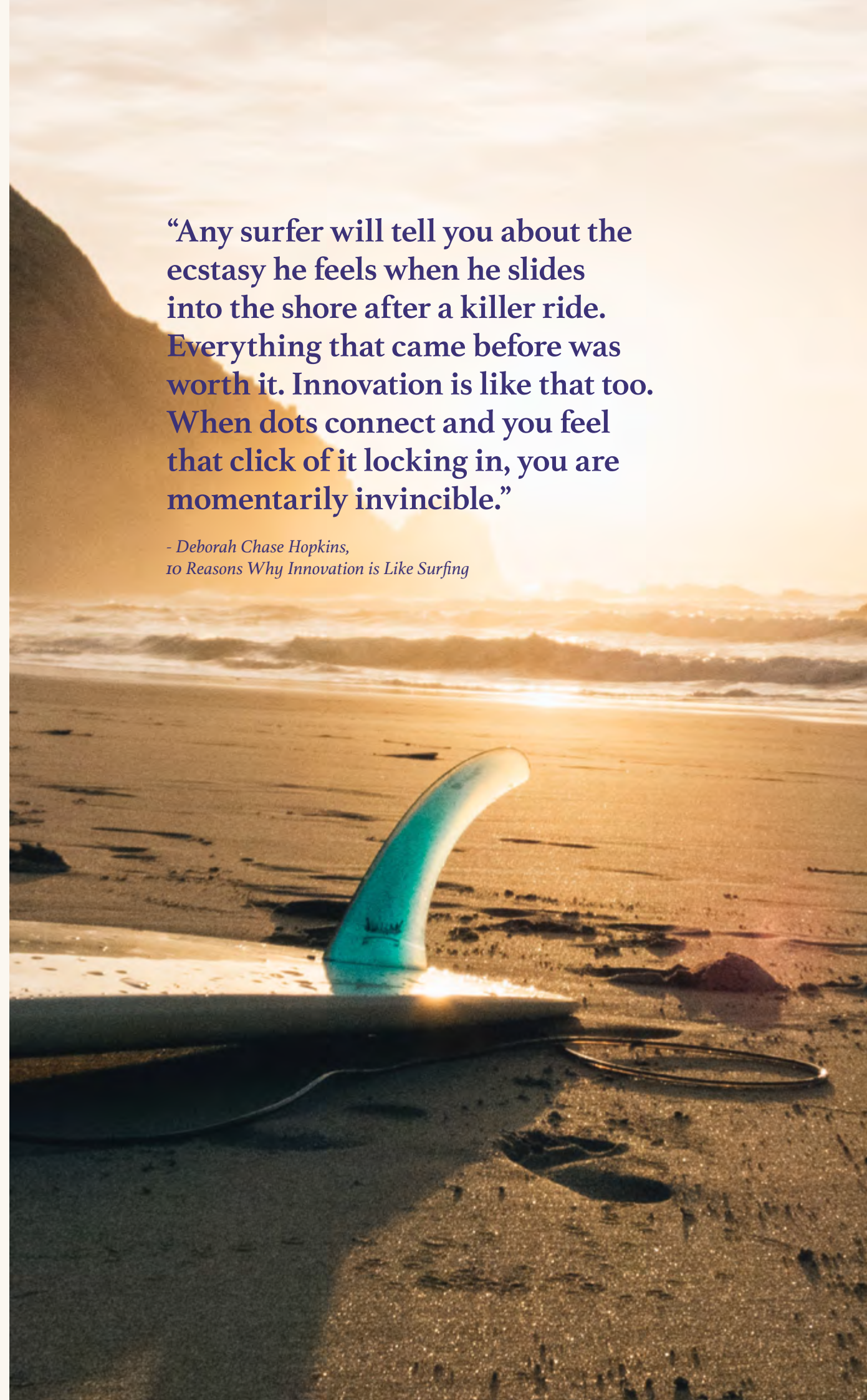
“I have always found it to be a great pleasure to interact with Danie: personally, he is highly enthusiastic and very receptive of new ideas, but at the same time well versed enough in law and in University policies and politics that his official responses are measured, sensible - and fair. I also owe my last six years' worth of employment as Research Liaison to him, and I must thank him for the best six years of my professional life.” – *Prof Edward Rybicki*

“Our thanks to Danie for his ongoing commitment to promoting collaboration between the universities in the Western Cape.” – *Ms Nasima Badsha, CEO, Cape Higher Education Consortium (CHEC)*

“Danie Visser has brought to his stewardship of research the experience, excitement and hard work that are essential elements of being a successful researcher. This has underpinned his approach to innovation, based on his understanding of the conditions necessary for success, and the part the institution must play in providing the climate and conditions for innovation, whatever the field.” – *Hugh Amoore, Registrar Emeritus*

“Any surfer will tell you about the ecstasy he feels when he slides into the shore after a killer ride. Everything that came before was worth it. Innovation is like that too. When dots connect and you feel that click of it locking in, you are momentarily invincible.”

– *Deborah Chase Hopkins, 10 Reasons Why Innovation is Like Surfing*

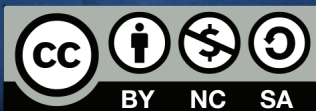


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