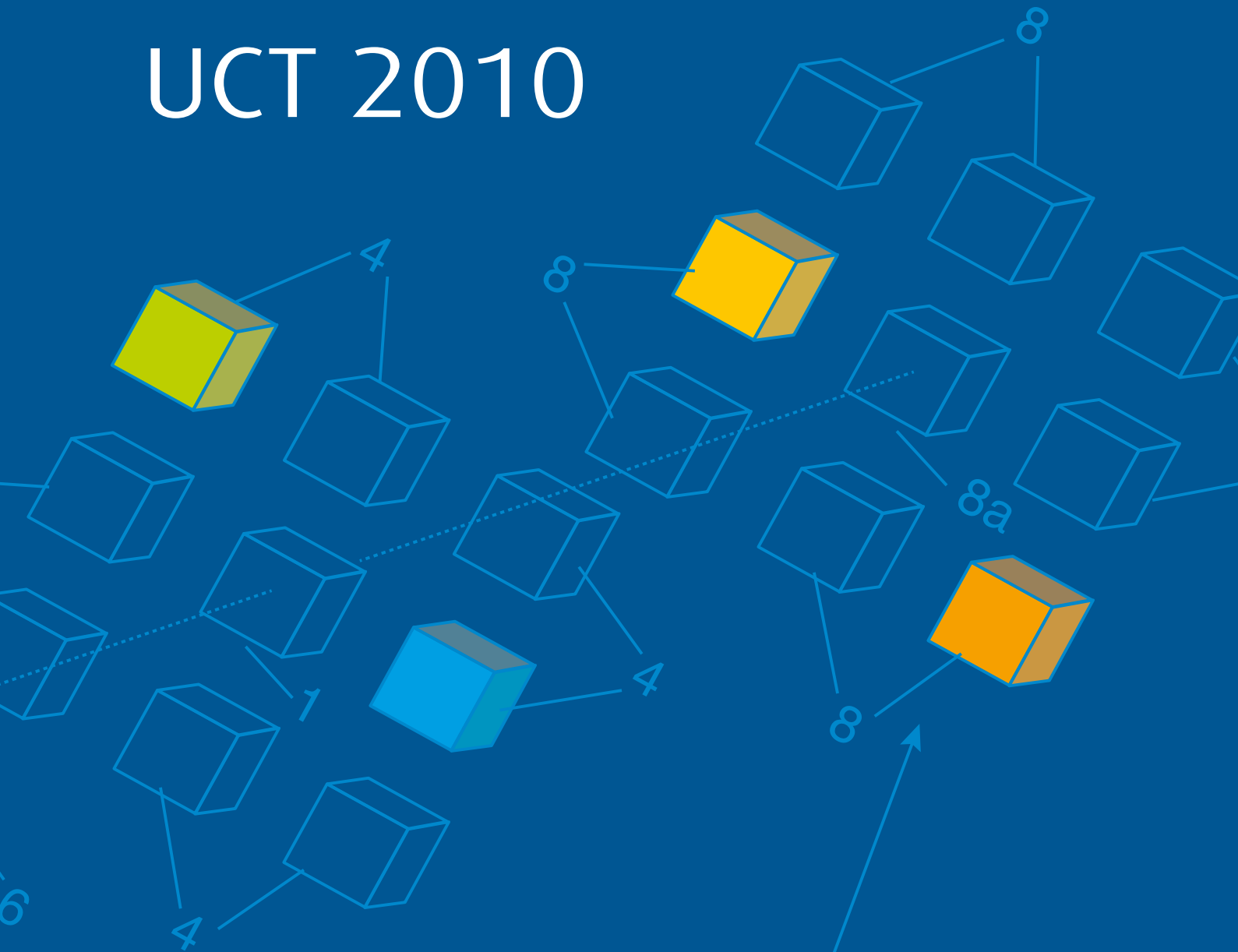


Innovation at UCT 2010



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Message from Danie Visser, Deputy Vice Chancellor



Professor Danie Visser: Deputy Vice-Chancellor

UCT's tradition of research excellence can be traced in many ways. One dimension that is often forgotten is the research that leads to great inventions and discoveries. UCT academics and graduates have been innovators in almost every discipline imaginable. These include Chris Barnard, whose pioneering heart transplants changed the narrative of medical history, and a number of Nobel Laureates, such as Max Theiler, who developed a vaccine against yellow fever; Allan Cormack who developed the CAT scanner; and Aaron Klug who contributed to the development of crystallographic electron microscopy and furthered knowledge of nucleic acid-protein complexes.

With a technology transfer office since 1999, and with many world-class researchers and innovators amongst its staff, UCT has established itself firmly in the field of innovation. We have over the years made sustained efforts to support and nurture the innovators in our midst. But, there is an increasing need to develop an integrated and focused strategy for innovation – especially in the light of the government's acknowledgement of the strategic value of intellectual property, evident through the recent promulgation of the Intellectual Property Rights from Publicly Financed R&D Act and the Technology Innovation Agency Act.

A working group, chaired by Prof Francis, Dean of the Faculty of Engineering and Built Environment, was established to develop an innovation strategy, with representation from the EBE, Science and Health Science faculties. The working group, in conjunction with international market research firm Frost and Sullivan, interviewed researchers from all these faculties. These interviews provided valuable insight into the current state of innovation at UCT and enabled the working group to give guidance on the promotion and support of effective innovation.

The Innovation Working Group has defined innovation as: “the creation and successful implementation of new ideas and inventions that make a real difference through the generation of tangible outcomes with social and/or financial value”. This definition seeks to include the notion of social innovation - an area that is gaining increasing traction. There is an increasing trend amongst graduates globally to pursue social entrepreneurship and social innovation rather than innovation with purely commercial goals.

This report showcases our innovation and entrepreneurial activities. Its intention is to provide useful information and also inspiration both within UCT and externally. Prolific inventors are profiled, along with spin-off companies and products that have been created as well as student endeavours. The activities of UCT in the different facets of the innovation chain are captured in “heat maps” to portray the level of intensity. Various challenges in respect of the commercialization of university-generated IP are highlighted as well as statistics relating to the UCT IP Portfolio. Entrepreneurial education, a key ingredient of innovation, is also included in this report.

I am sure that the stories collected in this report will inspire emulation.

Message from Piet Barnard, Director: RCIPS



Piet Barnard: Director, Research Contracts & Intellectual Property Services

In addition to the vast numbers of books, articles and conference outputs published each year, the research activities of our researchers also result in the discovery of inventions and innovations, some of which may have commercial potential.

The Research Contracts & Intellectual Property Services (RCIPS) office's role is to receive disclosures of inventions, evaluate their commercial merit, protect the intellectual property and in collaboration with the inventors, market and license the technology, or create spin-off companies. RCIPS also supports UCT's research activities by centrally managing, authorising and negotiating research contracts entered into with our wide variety of funders.

UCT's research enterprise is active and healthy. Clear evidence is seen in the dramatic increase in the value of the research-related contracts approved by RCIPS Office in recent years, rising from R337 million (2006) to R543 million (2009). In addition, the value of contracts entered into with foreign entities has increased from 46 percent in 2006 to 62 percent currently, an indication that our research activities are highly regarded internationally.

During 2007 we revisited our technology transfer and commercialisation strategy and have adopted a pro-active approach in contrast to the previous strategy which

could be described as a 'passive/re-active approach', with efforts confined to advocacy, information provision and service. The new approach pursues a much more intimate working relationship between the faculties and RCIPS. An immediate spin-off of our new strategy was the establishment of a "Pre-Seed" Fund with support from the University Research Committee. The R500 000 per year Pre-Seed Fund, which provides hard-to-get financial support for early stage development, is expected to be an important means of moving UCT's research output closer to the market (see page 32 for more on the Fund).

A successful "IP Scout Pilot" initiative was run in the Chemistry and Electrical Engineering Departments, where a resident 'Scout' acted as the first port of call for researchers in the departments, increasing IP awareness, assisting with invention disclosures and bringing concerns and misconceptions to the fore so that they could be dealt with. Following the success of this initiative, additional IP Scouts will be appointed in other departments and strategies developed to identify suitable IP Scouts.

Regular seminars and training sessions for staff and students were introduced in 2010. The seminar series covers a spectrum ranging from basic Intellectual Property issues to topics like the roles and responsibilities of a director of a company. Video presentations based on recordings from past Big Idea Conferences, which focus on entrepreneurship and running a business,

have proved very popular with the student community with over 280 members on the Vula site. Contracts, intellectual property, funding and entrepreneurship resources are made available on the RCIPS website (www.rcips.uct.ac.za) along with news articles often covering legislation impacting the university environment.

Our commitment has been acknowledged. In the Innovation Fund-run Most Innovative Higher Education Institution competition UCT received a certificate of recognition for coming second overall, won the Best Case Study category as well as the category for the Best Improvement in Technology Transfer Capacity.

In the recent national student innovation competition, also organised by the Innovation Fund, UCT received 25 entries and had the greatest level of participation of all the competing institutions. Two of our three entries to the national competition ended in the top ten, with one entry being chosen as second overall (read more on page 46).

Technology Transfer is hard work – something that is not always acknowledged. I therefore wish to express my appreciation firstly to our research community and inventors and secondly to the staff of RCIPS for their dedication and commitment.

Through this publication we wish to provide you with some insight into the wonderful world of innovation at UCT.



Contributors

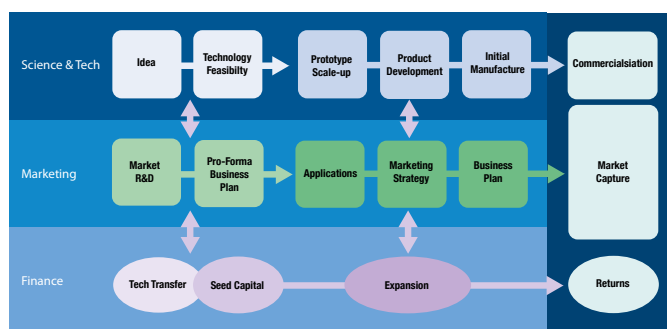
Chris Mitchell (CPR Communications)
Piet Barnard
Dr Andrew Bailey
Cynthia Best
Tumi Ngqondo
Dr Sara Grobbelaar (Frost and Sullivan)
Dr Marilet Sienert
Dr Mignonne Breier
Prof. Robert Morrell
Haajirah Esau
Christina Pather
Wilna Venter
Morgan Morris

As well as the numerous inventors, entrepreneurs and course co-ordinators who generously provided time and material.

IP Management and Technology Transfer

The technology transfer process is a complex and highly interactive process with many actors and stakeholders (see Figure 1). It can be thought of as being divided into three distinct stages, involving multiple inputs in each stage. Inputs to the first stage are research funding, the researcher and individual researcher or research team as well as Technology Transfer Office (TTO) personnel. The first-stage's output is invention disclosures. This is no more than asking the question: "Who could benefit from this research, and how can this benefit be realised?" The answer is seldom clear cut, but simply asking the question can trigger a train of thought that can lead to realising social as well as commercial benefit. Following disclosure of an invention, or answering the question "is there possible benefit?" in the affirmative, a process starts in order to determine how this benefit can be realised. Disclosures are thus the intermediate inputs to a second stage in which the TTO evaluates patent and commercial potential and applies for patents on those disclosures they believe can be patented and licensed. The third stage includes the marketing of the invention, negotiation and the production of license and option agreements.

Figure 1: Technology Transfer as a Non-linear Networking Process

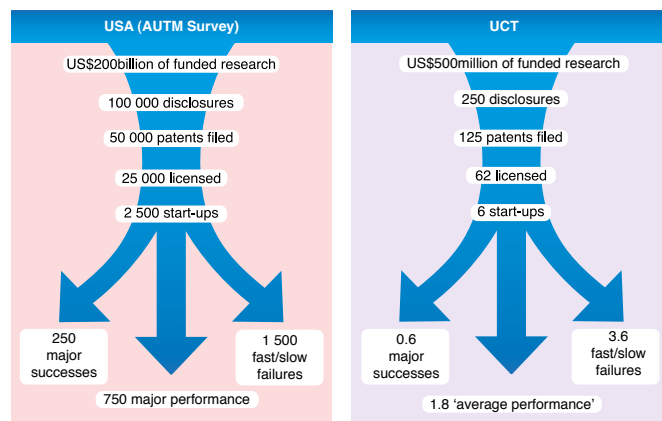


(Source: Livingstone, 1998, http://www.uilo.ubc.ca/tech_transfer/spin_off/)

The entire technology transfer process is thus predicated on individual faculty members disclosing their inventions or scientific discoveries to the university's TTO. By filing an Invention Disclosure, faculty members provide the raw materials for a university's intellectual property.

Generally, only a small subset of invention disclosures are patented and /or generate any licensing interest; of those that do, very few generate sizeable net returns. University inventions are also normally very early stage (due to pressure to publish) uncertain and require mostly extensive subsequent development to achieve commercial success.

The "funnel effect" as illustrated by Berneman's 'cascading tiers of performance' (above right) is well-known. Applying this model to UCT, considering a total research income of ca. \$500 million between 2000 and 2009, suggests a result as shown on the right.



Based on more recent data i.e the 2008 Association of University Technology Managers (AUTM) figures, in the USA there is 1 disclosure at a university per \$2.9 million invested in research. So, based on this UCT, with a research income ca. \$500 million between 2000 and 2009, should have had 166 disclosures over this period, which is indeed what has been received.

Why should universities then engage in commercialisation activities? The Australian Centre for Innovation (2002, p59)¹ provides five reasons why universities engage in technology transfer:

- to facilitate the commercialisation of research for the public good;
- to promote economic growth;
- to forge closer ties to industry;
- to reward, retain and recruit faculty and students; and
- to generate income.

They contend all universities do it for the same five reasons; the mix is just different. Those that focus on the first four may as a by-product also generate income. However, those that focus on the fifth could be left disappointed.

Technology Transfer: Disclosures and Patents

The sequence of patenting – from invention disclosure through to a granted patent – is presented in Figure 2 to assist with the interpretation of the portfolio statistics. It should be borne in mind that a single disclosure may result in one or more patent applications, or none at all, and the patent applications proliferate from the initial provisional filing.

Figure 2: Sequential Stages of the Patenting Process



¹ Best Practice Process for University Research Commercialisation.

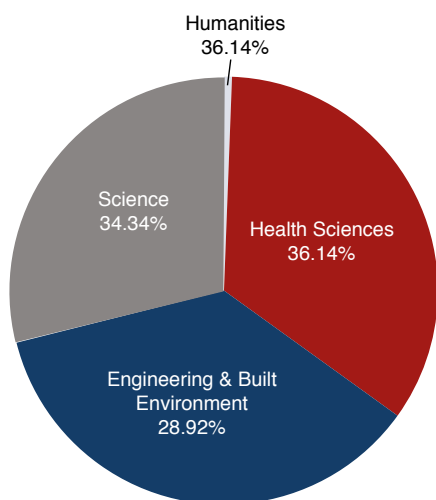
Disclosures

One hundred and sixty six (166) disclosures have been made to the Technology Transfer Group over the period 2001 to 2009. Sixty of these were from the Faculty of Health Sciences, fifty seven from the Faculty of Science, forty eight from the Faculty of Engineering and Built Environment (EBE) and one from Humanities; the relative splits are shown in the pie chart in Figure 3.

Most of the disclosures from the Faculty of Health Sciences and a large percentage of disclosures from the Science Faculty comprised therapeutic applications (related to conditions involving cardiovascular, infectious and inflammatory diseases and cancer).

Other disclosures in these two faculties represented advances in nanotechnology, information technology, medical devices, probiotics and virus-resistant crops. The disclosures in EBE include the treatment of mining and industrial wastewater, the extraction of minerals from mined ore, minerals processing and devices for use in industrial machinery.

Figure 3: Proportions of Invention Disclosures Received from Different Faculties



Patents

The disclosures received, provisional patent applications filed and total number of patent applications since 2004 are shown graphically in Figure 4 with data presented in Table 1.

One can see the variable ratio between disclosures received and the actual provisional patent applications filed as a result. The number of provisional filings is generally lower than the number of disclosures received as one would not pursue patenting if:

- There is no clear economic or societal benefit;
- If IP should be protected through

Table 1: Annual UCT Patent Portfolio Statistics

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--|------|------|------|------|------|------|
| Disclosures | 20 | 20 | 7 | 9 | 31 | 25 |
| Patent Applications Filed | 26 | 26 | 23 | 50 | 64 | 46 |
| National Phase Patents Granted | 2 | 9 | 6 | 3 | 10* | 47* |
| Application Details | | | | | | |
| Provisional | 8 | 12 | 4 | 5 | 27 | 9 |
| PCT | 3 | 5 | 9 | 3 | 3 | 20 |
| National (including Divisionals, excluding Regional) | 10 | 7 | 6 | 36 | 28 | 10 |
| Regional | 5 | 2 | 4 | 6 | 6 | 6 |

* Includes country validations following European patent grant

Figure 4: UCT Patent Portfolio Statistics

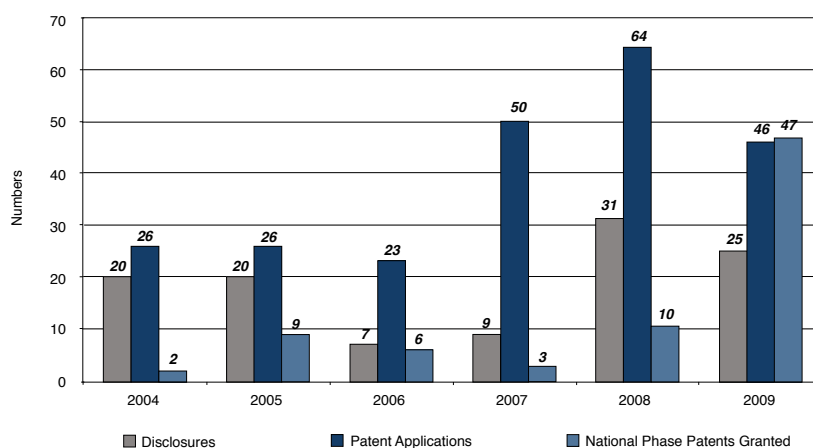


Table 2: Top Ten UCT Inventors

| Rank | Inventor | Department | Faculty | Inventions |
|------|----------------------------|--------------------------|-----------------|------------|
| 1 | Prof. Edward Rybicki | Molecular & Cell Biology | Science | 11 |
| 2 | Prof. Anna-Lise Williamson | IIDMM | Health Sciences | 10 |
| 3 | Prof. Gerhard De Jager | Electrical Engineering | EBE | 8 |
| 3 | Assoc. Prof. Dee Bradshaw | Chemical Engineering | EBE | 8 |
| 5 | Prof. Margit Harting | Physics | Science | 7 |
| 5 | Prof. David Britton | Physics | Science | 7 |
| 7 | Prof. Kelly Chibale | Chemistry | Science | 6 |
| 7 | Dr. George Vicatos | Mechanical Engineering | EBE | 6 |
| 8 | Prof. Ed Sturrock | IIDMM | Health Sciences | 5 |
| 8 | Dr JJ Francis | Electrical Engineering | EBE | 5 |
| 8 | Dr Fred Nicolls | Electrical Engineering | EBE | 5 |
| 8 | Prof. Roger Hunter | Chemistry | Science | 5 |

Table 3: Top Ten UCT Inventors by Patent Applications

| Rank | Inventor | Department | Faculty | Patent Applications |
|------|-------------------------------|--------------------------|-----------------|---------------------|
| 1 | Prof Edward Rybicki | Molecular & Cell Biology | Science | 95 |
| 2 | Prof Anna-Lise Williamson | IIDMM | Health Sciences | 53 |
| 3 | Dr Arvind Varsani | Molecular & Cell Biology | Science | 48 |
| 4 | Prof Ed Sturrock | IIDMM | Health Sciences | 43 |
| 5 | Prof Margit Harting | Physics | Science | 39 |
| 5 | Prof David Britton | Physics | Science | 39 |
| 7 | Assoc Prof Carolyn Williamson | IIDMM | Health Sciences | 24 |
| 8 | Prof Kelly Chibale | Chemistry | Science | 23 |
| 9 | Assoc Prof Dee Bradshaw | Chemical Engineering | EBE | 20 |
| 10 | Dr Aloysius Nchinda | Chemistry | Science | 15 |

some other means or cannot be patented *per se*;

- The disclosure does not meet the patentability requirements, i.e. inventive, novel and useful.

It should also be noted that disclosures received at the end of a year only result in a provisional filing the following year, or it can be decided that a disclosure is premature and additional work needs to be conducted prior to a future filing.

There has been a significant increase in the number of disclosures received, which although not as evident in 2009 for unknown reasons, is increasingly evident in 2010, where by mid-year the number of disclosures is already over 20. This has been the result of RCIPS moving from a passive service mode into a more proactive mode of scouting for new IP and raising awareness of patenting and IP in the different departments. A disclosure is typically only counted once a formal disclosure form has been completed or written details regarding the invention have been received for assessment of patentability. A verbal interaction is not recorded, but these are often noted as potential future disclosures.

UCT's Top Inventors

UCT's top 10 inventors are listed in Table 2 - many of whom are profiled in this publication. The top UCT inventor is Professor Edward Rybicki in the Department of Molecular and Cell Biology. He has 44 granted patents and a total of 95 applications arising from 11 inventions.

The numbers of national phase patent applications that ultimately result from an initial application are largely based on economic considerations (i.e. how many countries one can afford to patent in or justify patenting in, in terms of market potential) and where markets or manufacturing territories lie. It does not act as a true indicator of the invention's "quality" *per se*, although it is clear that a strong invention in terms of patentability criteria will navigate through the examination process more easily and is likely to be of more value to a commercial partner.

The top ten inventors ranked by patent applications and by granted patents are shown in Tables 3 and 4 respectively.

Technology Licensing

Forty nine license and assignment agreements relating to UCT intellectual property have been entered into over

Table 4: Top Ten UCT Inventors by Granted Patents

| Rank | Inventor | Department | Faculty | Granted Patents |
|------|-------------------------------|--------------------------|-----------------|-----------------|
| 1 | Prof Edward Rybicki | Molecular & Cell Biology | Science | 44 |
| 2 | Dr Arvind Varsani | Molecular & Cell Biology | Science | 35 |
| 3 | Prof Ed Sturrock | IIDMM | Health Sciences | 17 |
| 4 | Prof Anna-Lise Williamson | IIDMM | Health Sciences | 12 |
| 5 | Assoc Prof Carolyn Williamson | IIDMM | Health Sciences | 6 |
| 6 | Martin Cronje | Mechanical Engineering | EBE | 5 |
| 6 | Irshad Khan | Electrical Engineering | EBE | 5 |
| 6 | Prof Gerhard De Jager | Electrical Engineering | EBE | 5 |
| 9 | Dr Joanne Van Harmelen | IIDMM | Health Sciences | 4 |
| 9 | Dr JJ Francis | Electrical Engineering | EBE | 4 |
| 9 | Assoc Prof Dee Bradshaw | Chemical Engineering | EBE | 4 |

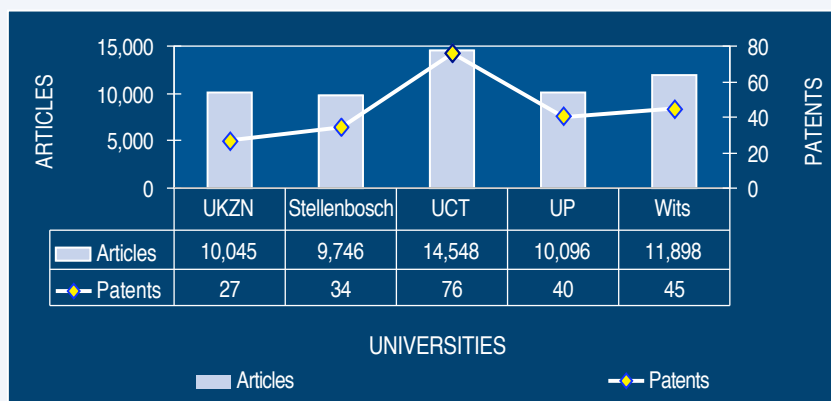
Benchmarking UCT's IP Performance

One of the most comprehensive, published recent surveys was conducted by McLean Sibanda as a World Intellectual Property Organisation (WIPO) project¹. Of note, in terms of the five top academic inventors identified at South African universities, based on their patent applications in Europe, the USA and the first stage of international patent application (Patent Cooperation Treaty / PCT) four were from UCT (Rybicki, Williamson, Britton and Harting). Their publication outputs are also significant (especially Williamson) indicating the good balance that the inventors have managed to achieve between patenting and publishing objectives; but Sibanda acknowledges that in the short term one sometimes needs to hold back on publication to get the patenting strategy right. All of these top inventors are profiled elsewhere in this publication.

The survey, which covered the period 2001 to 2007, also revealed that UCT was the top HEI in terms of PCT applications.

The size of the UCT patent portfolio is compared to that of other universities, along with their publication rates in the figure below. Crewe² (2010) reported that UCT has the largest number of patents within the top five South African universities.

Figure 5: Comparison of Research and Patents within the Top 5 Universities in SA according to Scopus, 1996-2009 (Crewe, 2010)²



In terms of spin off company creation, North West University leads the HEIs over the 2001-2007 period reviewed by Sibanda (Sibanda 2009)¹, with Stellenbosch University in second place and UCT third (see Figure 6).

¹ Sibanda, M. 2009. Intellectual Property, Commercialisation and Institutional Arrangements at South African Publicly Financed Research Institutions, *The Economics of Intellectual Property in South Africa*, Chapter 5, World Intellectual Property Organisation.

² Crewe, R. 2010. Is there a defined role for Higher Education sector in National Research and Innovation Priorities? *Overview HESA presentation*.

the period 2000 to September 2010; see Table 5 for the annual statistics. The largest contributor has been the Poison's Database developed by the Department of Paediatrics, which is licensed to public and private hospitals for free or a relatively small fee.

Spin-Out Companies

A total of five spin-out companies have been formed, based on UCT IP (their details are summarized in Table 6) four of which are profiled in this publication.

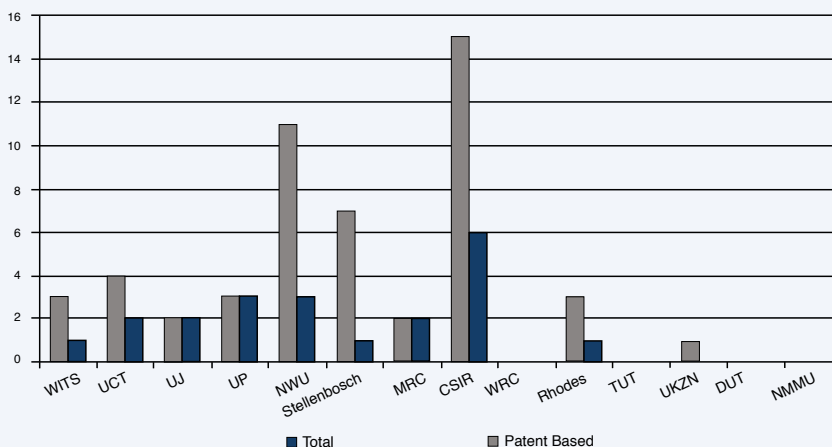
Three further companies are in the process of being spun out now in 2010 and another, for which external start-up funding has not needed to be sought, is being incubated within the university whilst it establishes itself in the market and proves its viability. UCT has taken, or will take, equity in some of these companies and has also recently taken shares in a medical device start-up who will work closely with UCT in order to develop their IP further, due to the strong synergies.

Revenue and Income

Annual details of UCT's revenue and income derived from commercialisation of its IP is presented in Table 7. The value of equity held in companies has not been included in the table and many of these companies being early start-ups have yet to declare dividends.

Two significant, multi-million Rand licensing deals have been concluded (sign off in progress) during 2010 and it is hoped that beyond the upfront payment and milestone payments, significant royalties will accrue in future years. Of particular note is the fact that a multi-million Rand research and development contract will also be entered into as part of one of the deals, which will include knowledge transfer to South African and UCT, broadening our expertise-base. 

Figure 6: Start-up Companies Created Between 2001-2007 by South African Universities and Science Councils (Sibanda, 2009)¹



Commercialisation revenues were also compared by Sibanda (Sibanda 2009). Much of UCT's revenue has been generated more recently (i.e. after the period studied by Sibanda). The data suggest a strong correlation between spin off company creation and commercialisation revenue. UCT has currently found that more revenue is derived through licensing activities, although the value of equity held in start-ups is only realised once these shares have been sold and in the longer term this may well represent the greater mode of revenue generation.

Table 5: License Agreements Relating to UCT Intellectual Property

| Year | Number of License Agreements |
|------|------------------------------|
| 2001 | 1 |
| 2002 | 1 |
| 2003 | 8 |
| 2004 | 9 |
| 2005 | 4 |
| 2006 | 3 |
| 2007 | 3 |
| 2008 | 8 |
| 2009 | 6 |
| 2010 | 7 |

Table 6: Start-Up Companies from UCT

| Year | Details |
|------|---|
| 2004 | Isiqu Orthopedics (Pty) Ltd Design & Manufacture bone & joint implants Cell-Life e-health technology development company |
| 2006 | Hot Platinum (Pty) Ltd Induction furnace Cape Carotene (Pty) Ltd Feed Additive for aquaculture (Astaxanthin) |
| 2009 | CapeRay (Pty) Ltd (formerly African Medical Imaging formed for Innovation Fund project) Mammography Equipment |

Table 7: IP Commercialisation Revenues

| YEAR | Licensing (R) | Sale of IP (R) | Profit UCT Companies (R) | Total (R) |
|------|---------------|----------------|--------------------------|-----------|
| 2001 | 0 | 87,143 | 0 | 87,143 |
| 2002 | 0 | 107,952 | 0 | 107,952 |
| 2003 | 0 | 0 | 0 | 0 |
| 2004 | 13,905 | 0 | 0 | 13,905 |
| 2005 | 1,728 | 0 | 0 | 1,728 |
| 2006 | 70,058 | 0 | 0 | 70,058 |
| 2007 | 49,815 | 0 | 0 | 49,815 |
| 2008 | 170,266 | 150,000 | 0 | 320,266 |
| 2009 | 136,494 | 0 | 693,630 ³ | 830,124 |

³ This company is currently being incubated within UCT and is as a 'ring-fenced' operation. This is an unaudited figure.

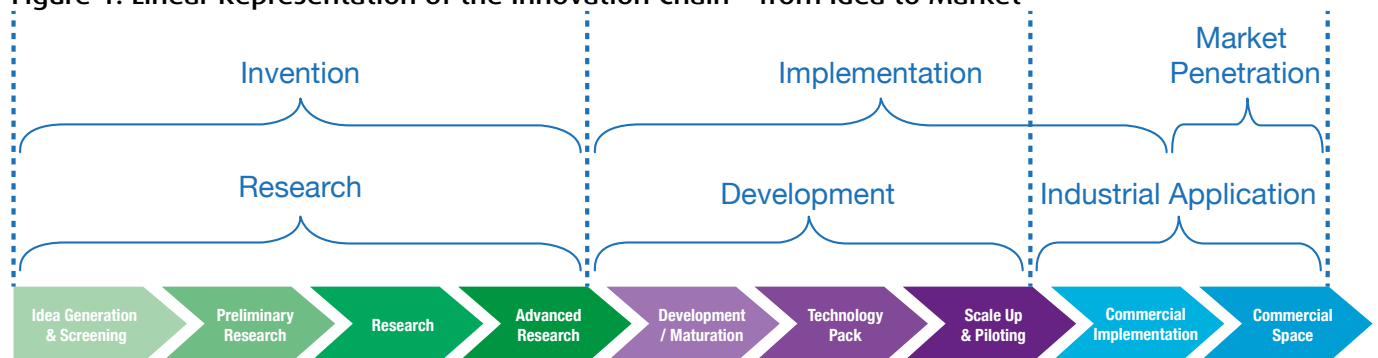
The Innovation Chain – Where is UCT Active?

The various stages that are typically involved in moving a new idea along the innovation chain and implementing it in the market are represented in Figure 1. In reality, however, innovation is not a linear process (see page 6) and there is often interactive feedback and recycling involved between stages due to new knowledge, new capabilities, set-backs or market and economic influences.

The different stages can be grouped into three broad categories: invention, implementation and market penetration,

or alternatively, research, development and industrial or commercial application. Universities traditionally operate predominantly at the early stage of the innovation chain, i.e. the research or invention domain. The activities of engineers, within a university environment, do fall into the development phase and through consulting work they may also participate in commercial implementation and industrial application of technology. In health science, medical devices often do not require 'scale-up' *per se* and prototyping is undertaken.

Figure 1: Linear Representation of the Innovation Chain – from Idea to Market



The generic characteristics of the different stages of the innovation chain are described in Table 1.

Table 1: Description of Stages of the Innovation Chain

| | Definitions |
|-----------------------------|--|
| Idea generation & screening | This process entails the generation of ideas that may originate from a wide variety of sources (market feedback, consumers, existing problems, novel application of new technology to provide better solutions, original thought) and then a process of selecting leading ideas, with greatest merit, before resources are dedicated to them |
| Preliminary research | Initial research before researchers embark on a more formal research programme, process of defining the research questions and may include ad hoc 'scouting' experiments to test hypotheses, process is experimental and investigative. May provide preliminary proof of concept. |
| Research | Process of systematic discovery in a structured framework. Generates a deeper understanding of underlying principles. |
| Advanced research | Research is broadened in scope and depth and research project often draws on collaborative relationships with other universities or even industry. More than one PhD student may typically be involved and a 'team' may be investigating different areas. |
| Development / maturation | This phase involves validation and repeatability. Optimisation of processes, ways of achieving increased yields and productivities, with reduced cost. First level of techno-economic evaluation and comparison with other routes may be conducted. Broader technology aspects are considered that the original research focus. |
| Technology pack | Assimilation of all the knowledge required to fully implement the technology in an industrial/commercial environment. The package would include all peripheral technologies, beyond that IP that may have been developed by UCT and has been the research focus. |
| Scale-up and piloting | The demonstration of the technology on a successively larger scale that is order(s) of magnitude above laboratory-scale, but generally smaller than full commercial scale. |
| Commercial implementation | Implementation of the technology at commercial scale. This may be incorporated into an existing operation (e.g. licensing of the technology) or through the creation of a new company and the establishment of a new facility. |
| Commercial space | Here a company is established and operational and involved in market penetration either by increasing their capacity (increasing the number of sites where they operate or markets that they serve) or by diversifying their product or technology portfolio. |

As part of the Innovation Working Group, Chaired by Prof Francis Petersen, Dean of Engineering and Built Environment, UCT's activities along the innovation chain were represented as a "heat map" to provide a visual representation of their relative intensity and an idea of the nature of the 'innovation space' that UCT plays in. The heat maps arose from qualitative assessment by members of the group and they are not based on precise, quantitative information and are open for discussion.

Activity was classified into three levels:

- High
- Moderate
- Emerging

The term 'Emerging' activity was chosen, rather than 'low' as in many instances the activity is not regarded as unimportant, but rather it represents the current status, i.e. not much expertise has been established in the area, or it is an area of development.

The activities were grouped into a number of categories.

- **Funding**, starts with a research focus and gradually migrates into development, seed and innovation funding and ultimately venture capital and start-up funding at the commercial end of the innovation chain.
- **Intellectual Property**, covering the spectrum from freedom to operate (i.e. patents held by others), through initial patenting to licensing (in/out) and commercialisation.
- **Technology**, the core of the research and development work
- **Market Intelligence**, awareness of the market in which the technology finds application
- **Personnel**, ranges from staff and students to conduct research in the early stage of the innovation chain, to those within the university who pursue more applied development work and then primarily entrepreneurs and graduates who would populate the commercial space, either by moving into industry or creating spin-out businesses.
- **Training**, relates to the training of human resources to perform the tasks associated with the particular stage in the innovation chain. This would start with research-oriented skills through project management and into more

entrepreneurial, business planning and techno-economic evaluation skills at the end of the chain.

- **Marketing**, initially is all about promotion of the university's research and researcher capabilities, attracting postgraduate students. As technology develops and intellectual property is protected, the technology needs to be marketed to potential commercialisation partners and licensees.
- **Process Support**, is the availability of the necessary infrastructure required for the specific phase.
- **Networks and Linkages**, are initially an important resource for identifying new research opportunities, collaboration opportunities as projects develop and ultimately commercialisation partners.

Two heat maps were created, one representing UCT as a whole (Figure 2) and the other specifically looking at the activities of the Research Office and Research Contracts and IP Services, within the Department of Research and Innovation (Figure 3). Tables that follow the heat maps, identify key activities falling into each "cell" in more detail.

This map plots the activity considering the university as a whole.

Figure 2: Heat Map Indicating Activity levels along the Innovation Value Chain

| | Invention | | | | Implementation | | | Market Penetration | |
|---------------------|-----------------------------|----------------------|----------|-------------------|--------------------------|-----------------|---------------------|---------------------------|------------------|
| | Research | | | | Development | | | Industrial Application | |
| | Idea Generation & Screening | Preliminary Research | Research | Advanced Research | Development / Maturation | Technology Pack | Scale-up & Piloting | Commercial Implementation | Commercial Space |
| Funding | Emerging | Emerging | Moderate | Moderate | Emerging | Emerging | Emerging | Emerging | Emerging |
| IP | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging |
| Technology | High | High | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |
| Market Intelligence | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging | Emerging |
| Personnel | High | High | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |
| Training | High | High | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |
| Marketing | Emerging | High | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |
| Process support | Emerging | High | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |
| Networks / Linkages | Emerging | Emerging | High | High | Emerging | Emerging | Emerging | Emerging | Emerging |

| |
|-------------------|
| High activity |
| Moderate activity |
| Emerging activity |

Some general comments on the different rows:

- **Funding:** there is often a shortage of funding for pure 'blue sky' research, new researchers battle to find start-up funding to build up their track records, which will lead to their securing grants successfully in the future. UCT has seen a significant increase in research and advanced research phase funding. The objectives of development projects often fall outside the scope of research funders. As one progresses further along the innovation chain it becomes more difficult to access funding so this zone is rated as 'emerging'. This is the space where some commercial funders who are interested in the new technology may become involved and will be the space in which the new Technology Innovation Agency will operate, along with the UCT Pre-Seed Fund.

- **Intellectual Property:** this is generally built up towards the end of the research phase. In terms of technology packages there is little activity around in-licensing of IP, although this does occur in the biotechnology area.
- **Technology:** the emphasis at UCT is understandably in the research zone, with less activity in the development stage or at pilot-scale activity, although this does occur. Commercial implementation does occur in conjunction with industrial partners, or where significant scale-up is not required and consulting and troubleshooting occurs in the commercial space.
- **Market Intelligence:** in the early research stage and idea screening, market intelligence relates to both knowledge of cutting-edge areas in the technical field, through needs of an industry sector, to reviewing the intellectual property

landscape. Often funding dictates research direction. In later stages it is knowledge of other research group activities, but in the development and implementation phase it is about market readiness, market trends and size, competition and knowledge of commercial leads to license the IP.

- **Personnel:** again there is a predominance of highly skilled research personnel (students and staff), but skills taper off in the later stages of the innovation chain.
- **Training:** in the research phase the focus is on 'research methodology' and although increasing, there is little training in entrepreneurship, business creation and technology commercialisation.
- **Marketing:** initially this relates to the capabilities of the university and its research activities. Proposal writing is a form of marketing in the research phase. Marketing

technology available in the UCT IP portfolio is a growth area, although there is already significant activity.

- **Process Support:** there is significant support both within the departments and faculties as well as the Research Office to support research activities. There is a need for increasing support in the later stages of the innovation chain, especially where new spin-off business are being created. This is a growth area.
- **Networks / linkages:** these are research networks initially and the funder, entrepreneurial and commercial partner oriented further down the innovation chain. RCIPS is striving to build these networks and has made significant headway.

The support that is provided to UCT by the Research Office and Research Contracts and IP Services (RCIPS) is indicated in the heat map in Figure 3. The office primarily responsible for a particular cell in the matrix is indicated and the footnotes provide some insight into the level of activity. Some activity is outside of the remit of these offices and lies with the different faculties.

Figure 3: Heat Map Indicating Department of Research and Innovation Activities

| | Invention | | | | Implementation | | | Market Penetration | |
|---------------------|-----------------------------|----------------------|----------------|-------------------|--------------------------|-----------------|---------------------|---------------------------|------------------|
| | Research | | | | Development | | | Industrial Application | |
| | Idea Generation & Screening | Preliminary Research | Research | Advanced Research | Development / Maturation | Technology Pack | Scale-up & Piloting | Commercial Implementation | Commercial Space |
| Funding | R ¹ | R ¹ | R ¹ | R ¹ | I ² | I ² | I ² | I ² | I ² |
| IP | I | I | I | I | I | I | I | I | I |
| Technology | | | | | | | | | |
| Market intel | I ³ | I | I | I | I | I | I | I | I |
| Personnel | | | | | | | | | |
| Training | R | R ⁴ | R ⁴ | R ⁴ | | | | I ⁵ | |
| Marketing | R ⁶ | R ⁷ | R ⁷ | R ⁷ | I ⁸ | I ⁸ | I ⁸ | I ⁸ | I |
| Process support | R ⁹ | R | R | R | I | I | I | I | I |
| Networks / Linkages | R ¹⁰ | R | R | R | I ¹¹ | I | I | I | I |

R = Research Office remit
I = RCIPS remit

| | |
|--|------------------------|
| | High activity |
| | Moderate activity |
| | Emerging activity |
| | Faculty responsibility |

Explanatory Notes

1. Coordination of URC activities, assistance with external applications, e.g. THRIP, NRF and International (SANPAD, NIH, EU). Funding calls are advertised on 'research' listserv. Calls are coordinated. Funder information events and workshops are hosted.
2. Information on funders available in innovation space is maintained. Relationships are established with funders and detailed knowledge of their investment criteria and objectives is built up by RCIPS – as well as learning experiences from other applicants. Information made available on RCIPS website.
3. Facilitation of access to Frost & Sullivan market reports. Use of Pre-Seed Fund to generate focused market research report.
4. Emerging Researcher Programme and newly introduced Programme for Enhancement of Research Capacity (PERC) strengthen capabilities of UCT researchers.
5. Business Plan Writing workshops. *Ad hoc* courses on business creation, directorship, presentations by entrepreneurs. RCIPS seminar series.
6. Marketing here involves promotion of researchers (through nominations, NRF ratings, publication count) and the university by participating in ranking projects (e.g. Times Higher Education, Shanghai Rankings). The proposed research portal, current website and Research Report also promote activity.
7. Marketing in this context is the ability to write research proposals to attract funding. Specific assistance is provided for some of the newer funders or where applications are more complex. Writing proposals per se is not a core responsibility of the Research Office. Internal review and feedback is given.
8. IP is marketed using direct approach to leads, or advertising on-line such as Tektique (www.tektique.co.za). Human Resource availability is a significant constraint on the level of activity.
9. Signature themes and VC climate change initiative (ACDI) are examples of ways in which focused research direction is developed.
10. Networks and linkages in the Research area have a funder focus, rather than collaborators. Collaboration – e.g. signing MoU's between institutions, international collaborations, etc. are the remit of other offices within the university. So for Research Office this is this is a moderate activity, but growing! The RO does help to set up collaborative partnerships, some in collaboration with other UCT Offices. e.g. World University Network partnerships, initiated with input from IAPO. There is also currently a bid to fund the development of a database of international collaborators and collaborations.
11. There is an acknowledged need by RCIPS to develop greater networks and forge linkages with industry and headway is being made.

Table 1: Discussion of Heat Map - Part 1: Research Phase

| | Research | | | |
|---------------------|---|--|--|---|
| | Idea Generation & Screening | Preliminary Research | Research | Advanced Research |
| Funding | <ul style="list-style-type: none"> Grants from the URC, e.g. Start-up grants, conference travel, sabbatical funding, short research visits and level of URC / departmental funding. Often limited resources. NRF funding, e.g. Blue Skies, Community Engagement, etc. | <ul style="list-style-type: none"> Start-up grants and level of URC / departmental funding. Often limited resources and for new researchers growing their group can be constrained by access to funding without a track-record (locally). | <ul style="list-style-type: none"> Access to local and international funding. Experience and track recording in attracting top funders. Large collaborative projects. | <ul style="list-style-type: none"> Access to local and international funding Experience and track recording in attracting top funders Large collaborative projects |
| IP | <ul style="list-style-type: none"> Little screening of IP in terms of freedom to operate and IP landscaping or analysis. | <ul style="list-style-type: none"> Little screening of IP in terms of freedom to operate and IP landscaping or analysis. | <ul style="list-style-type: none"> Access to research materials through material transfer agreements. Level of background IP specification in research contracts. | <ul style="list-style-type: none"> Access to research materials through material transfer agreements Level of background IP specification in research contracts Increasing awareness of IP protection and review or project outcomes to identify protectable IP. |
| Market intelligence | <ul style="list-style-type: none"> Aware of status of research field, but not necessarily market. Often market does not exist. Lower level of 'gap analysis' or market needs analysis or direction of research to answer industry questions. Perhaps faculty dependent. Patent landscape analysis not prominent in research planning | <ul style="list-style-type: none"> Not necessarily market focussed. | <ul style="list-style-type: none"> Not necessarily market focussed. Not actively monitoring market trends to refocus direction of research. | <ul style="list-style-type: none"> Due to external funding requirement, preliminary market research often included as part of application. Not strong on monitoring market trends, competitor knowledge, market requirements. This includes knowledge of regulatory requirements. Not strong on techno-economic analysis to assess different flowsheet/process options |
| Personnel | <ul style="list-style-type: none"> Are researchers equipped with the tools to conduct idea generation and screening conducted in a systematic way? i.e. Brainstorming, focus groups, research group strength analysis. Development of a strategic direction for a group largely comes from research groupings and their "business" plans that are presented to URC. | <ul style="list-style-type: none"> Supply of postgraduate students to support this activity; increasing focus at UCT of building this base. Post doctoral researchers available for this activity and supported by Postgraduate Funding Office | <ul style="list-style-type: none"> Highly skilled researchers exemplified by highest number of NRF rated scientists at an HEI and greatest share of SARChI research chairs. | <ul style="list-style-type: none"> Significant number of international leaders in fields. Significant knowledge of managing and participating in large international research collaborations |
| Training | <ul style="list-style-type: none"> Part of Emerging Researcher Programme Budget training and support available to all researchers who apply for NRF funding PhD proposal writing workshop offered by Research Office | <ul style="list-style-type: none"> Typically training in research methodology derived from own PhD research. | <ul style="list-style-type: none"> Emerging Researchers Programme (ERP) (operated by Research Office) develops skills in this area. | <ul style="list-style-type: none"> Programme for Enhancement of Research Capacity (PERC) in Research Office to support mid-career academics. |
| Marketing | <p>Of research activity:</p> <ul style="list-style-type: none"> Nominations (nationally and internationally) Dissemination of information via the research portal, web site, research listserv etc Production of annual glossy research report NRF rating of researchers Publication count Participation in ranking projects, e.g. Times Higher Education, Shanghai Rankings | <ul style="list-style-type: none"> Knowledge of proposal and grant writing Supported by Research Office | <ul style="list-style-type: none"> Knowledge of proposal and grant writing Supported by Research Office | <ul style="list-style-type: none"> Knowledge of proposal and grant writing Supported by Research Office |
| Process support | <ul style="list-style-type: none"> Ethics compliance, via the Office of Research Integrity. NIH Mapping project to understand funder requirements. Quality assurance aspects (e.g. review of accredited research groupings). Faculty Research Committees are playing a greater role in this area. They are strategising how to leverage areas of strength via internationalisation of collaborations. Also how they publish research. | <ul style="list-style-type: none"> Departmental infrastructure See points to left The new Research Portal will embrace ICT to provide tools for doing research. | <ul style="list-style-type: none"> Departmental infrastructure See points in first cell. Support with compliance with Acts such as Biodiversity Act, etc. Research contracts for funded or collaborative research. | <ul style="list-style-type: none"> Departmental infrastructure Funding for Post Docs Quality Assurance reviews Research groupings – e.g. signature themes. PERC is publicised through UCT's internal and electronic media. ERP provides courses to participants, designed to increase their research capabilities. The programme targets academics at lecturer level. Research contracts for funded or collaborative research. |

Table 1: Continued

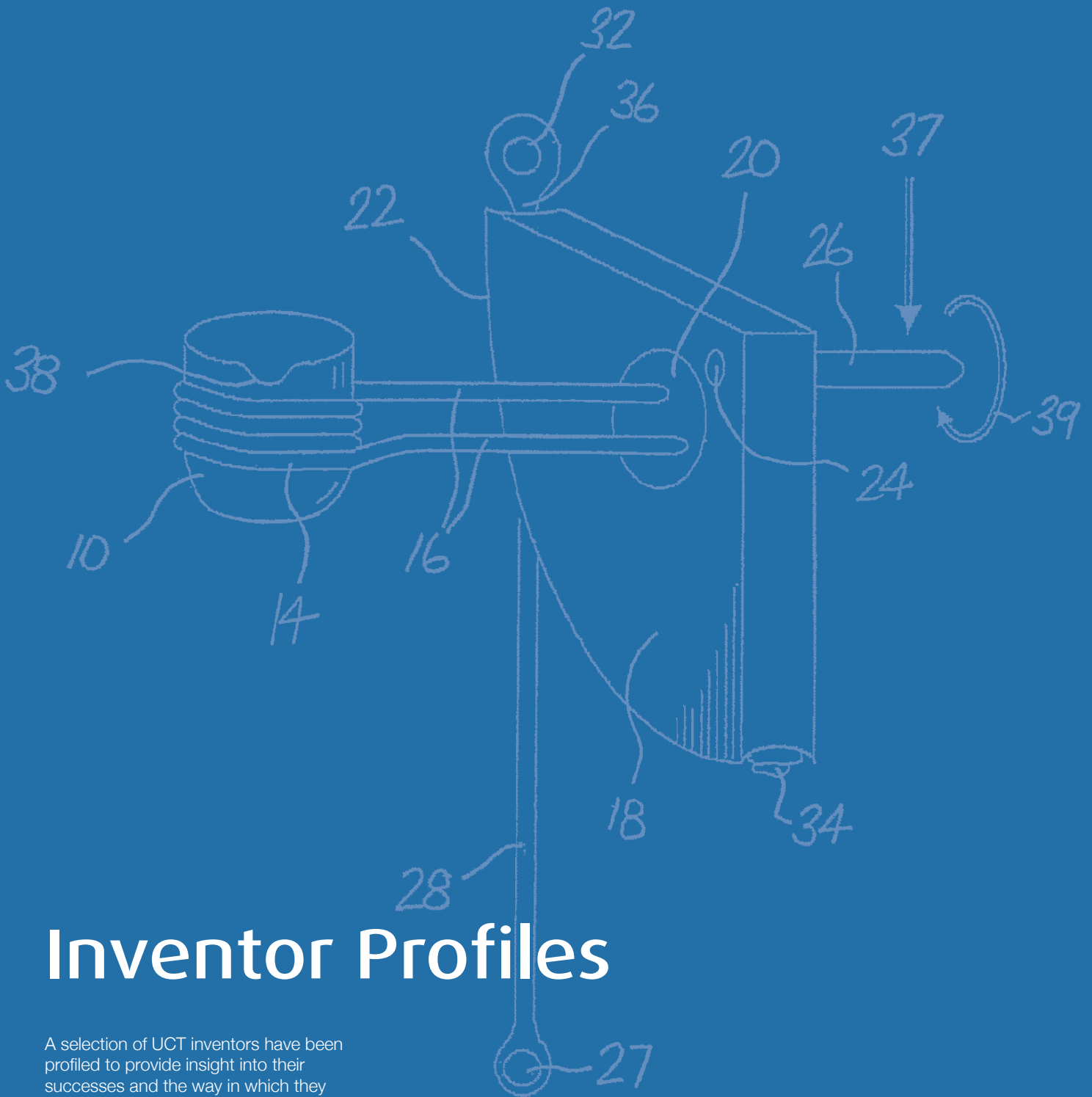
| | Research | | | |
|--------------------|---|---|---|---|
| | Idea Generation & Screening | Preliminary Research | Research | Advanced Research |
| Networks/ linkages | <ul style="list-style-type: none"> Some level of personal network that would be drawn on to inform this New database on international linkages World Universities Network IAPO are forging international networks Student exchange. Research-related memoranda of understanding between institutions. | <ul style="list-style-type: none"> Network is not necessarily a strong factor here and may be an internal network and related to accessing materials or equipment prior to own procurement | <ul style="list-style-type: none"> Researchers have strong links locally and internationally | <ul style="list-style-type: none"> Researchers have strong links locally and internationally PERC promotes links between UCT academics and counterparts in African universities. This will be supported by the development of a single UCT-wide database on international collaborators (an initiative of the Research Office and the DVC (Internationalisation). |

Table 2: Discussion of Heat Map - Part 2: Development and Industrial Application Phases

| | Development | | | Industrial Application | |
|---------------------|--|--|--|---|--|
| | Development / Maturation | Technology Pack | Scale-up & Piloting | Commercial Implementation | Commercial Space |
| Funding | <ul style="list-style-type: none"> RCIPS Pre-Seed fund exists, but the quantum is limited Dearth of external funding available of up to R1 to 2 million Research-type funding cannot be applied here. | <ul style="list-style-type: none"> Similar issues to Development and Maturation | <ul style="list-style-type: none"> Innovation Fund (TAP programme), BRICs (TIA) and IDC's Venture Capital Fund which invests uncharacteristically for VC in early Development activity. RCIPS has relationships with parties in this funding space and UCT has knowledge from previous funded projects. Need to develop Angel Network – especially amongst Alumni | <ul style="list-style-type: none"> Typically same players as scale-up and piloting. | <ul style="list-style-type: none"> Innovation Fund (Seed Programme) now migrated into Technology Innovation Agency (TIA) IDC's Venture Capital Fund. dTi SP11 funding. THRIP Venture Capital RCIPS has relationships with parties in this funding space and UCT has knowledge from previous funded projects. Need to develop Angel Network – especially amongst Alumni. |
| IP | <ul style="list-style-type: none"> Robust IP management system in place. Need to strengthen review process i.t.o. market and technology review | <ul style="list-style-type: none"> Little activity in terms of sourcing other IP required to create a complete technology package. | <ul style="list-style-type: none"> Similar to technology pack. | <ul style="list-style-type: none"> Resource constraint in terms of assessing freedom to operate issues for full technology package – often restricted to scope of UCT patent, at a preliminary level. Funding to support national phase patent application is limited. Needs to be borne by commercial partner. | <ul style="list-style-type: none"> n/a – becomes operating company's responsibility |
| Market intelligence | <ul style="list-style-type: none"> Frost & Sullivan reports made available. Pre-Seed Funding can be used to conduct specific market studies. Often new markets or in regions(developing countries) where market knowledge is not readily available. | <ul style="list-style-type: none"> Frost & Sullivan reports made available. Pre-Seed Funding can be used to conduct specific market studies. Often new markets or in regions (developing countries) where market knowledge is not readily available. | <ul style="list-style-type: none"> Frost & Sullivan reports made available. Pre-Seed Funding can be used to conduct specific market studies. Often new markets or in regions(developing countries) where market knowledge is not readily available. Limited end user assessment can be conducted. Often part of an "innovation" project budget as a key outcome | <ul style="list-style-type: none"> Frost & Sullivan reports made available. Pre-Seed Funding can be used to conduct specific market studies. Forms part of business plan. Typically conducted by a consultant. Often part of an "innovation" project budget as a key outcome. | <ul style="list-style-type: none"> n/a |
| Personnel | <ul style="list-style-type: none"> Need specific development-oriented staff who are not focussed/ performance managed on publications, teaching, post graduate students. Also people who are interested in the challenges of development, rather than research. | <ul style="list-style-type: none"> Require skilled individuals that can look at an entire flow sheet and beyond core IP that has been developed. Requires in-depth knowledge of the requirements operating business and particular industry as opposed to discrete technology. | <ul style="list-style-type: none"> Issues related to piloting and scale-up not strong focus of university. Need work experience at industrial scale, also in technology transfer. Modelling and simulation strong capabilities within engineering. Hands-on equipment often not available. Expensive to maintain if not to be repeatedly used and space constraint. | <ul style="list-style-type: none"> Post Docs and graduates useful to staff start-ups. Need to form teams of technical and business (MBA) people. This process is not being facilitated. No general 'support staff' for start-up companies; rely on outsourced services and occasionally piggy-back UCT services. | <ul style="list-style-type: none"> Routine employment of graduates from university. |

Table 2: Continued

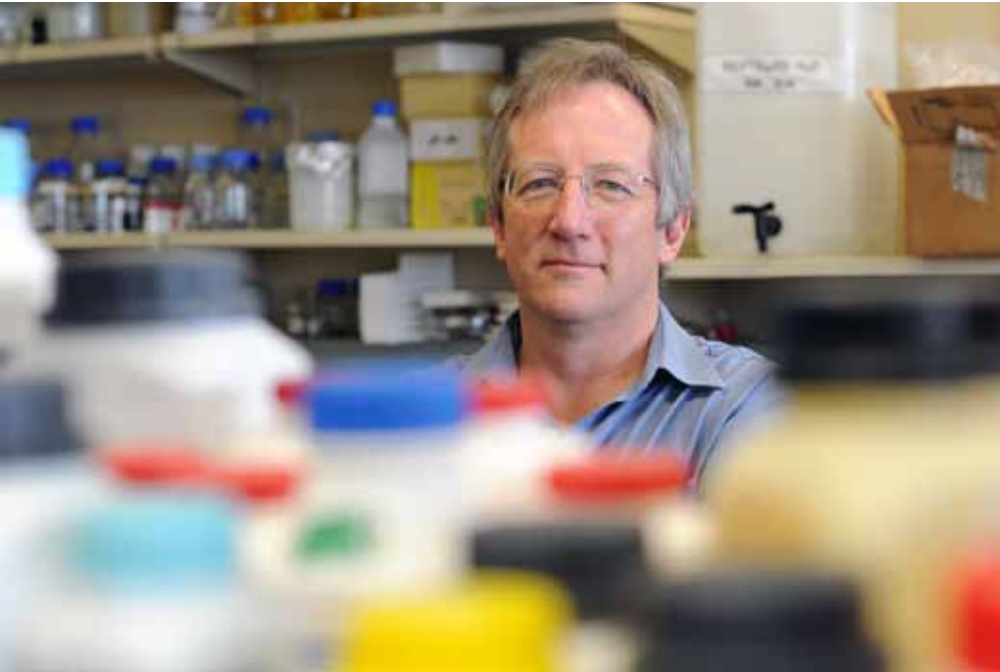
| | Development | | | Industrial Application | |
|--------------------|--|---|---|---|--|
| | Development / Maturation | Technology Pack | Scale-up & Piloting | Commercial Implementation | Commercial Space |
| Training | <ul style="list-style-type: none"> Standard research training within departments. Academic supervision | <ul style="list-style-type: none"> The Research Development Cluster (including ERP and PERC) offers generic training in grant proposal writing. | <ul style="list-style-type: none"> Theoretical issues dealt with primarily as part of undergraduate engineering training | <ul style="list-style-type: none"> Training in entrepreneurship – New Venture Creation course. Ad hoc seminars and workshops facilitated by RCIPS Business Plan writing workshops. | <ul style="list-style-type: none"> Ongoing professional development. MBA programmes for engineering and science graduates MSc or PhD programmes |
| Marketing | <ul style="list-style-type: none"> Mainly directed at proposal writing to obtain funding | <ul style="list-style-type: none"> n/a | <ul style="list-style-type: none"> Attracting “innovation” funding through proposal writing. Advertisement of technology profiles on Tektique and targeted lead identification to attract commercial partner | <ul style="list-style-type: none"> Start-up –marketing the investment opportunity to potential investors via business plan. Licensing – finding leads to approach to license the IP | <ul style="list-style-type: none"> n/a |
| Process support | <ul style="list-style-type: none"> Equipment, personnel available within departments | <ul style="list-style-type: none"> None specifically. Would be reliant on Principal Investigator to establish requirements of full technology package. | <ul style="list-style-type: none"> Pilot scale equipment often not available at university. Would need to rely on commercial partner. Depending on the scale of piloting would need to rely on engineering firm for design. They would also determine the data requirements as part of the scoping for a full-scale plant. Often the domain of a science council (e.g. CSIR or Mintek) or commercial partner (e.g. Sasol) Very discipline dependent as to what is available / can be done at UCT / constitutes piloting. Space constraint may exist. | <ul style="list-style-type: none"> Pre-Seed Fund support of Business Plan writing. Information available on RCIPS website. No business incubation support due to resource constraints. No dedicated space or support personnel – for operating the business or establishing it. Facilitation of a level of incubation within UCT prior to leaving campus. | <ul style="list-style-type: none"> n/a |
| Networks/ linkages | <ul style="list-style-type: none"> Reliant on industry collaborations. Difficult when no local industry. | <ul style="list-style-type: none"> Scarce networks existing to source required IP. Search would be initiated based on specific need. | <ul style="list-style-type: none"> Reliant on own Science Council or Industry contacts. | <ul style="list-style-type: none"> Links to other technology transfer offices Links to funders Need database of SMMEs Tektique advertises opportunities Weak global networks Poor use of UCT Alumni network | <ul style="list-style-type: none"> Industry collaboration – individual / department specific |



Inventor Profiles

A selection of UCT inventors have been profiled to provide insight into their successes and the way in which they juggle their research and innovation activities.

Leading SA Virologist has Commercialisation in Sights



Prolific inventor and one of the country's most cited researchers, Professor Ed Rybicki is an international authority on the creation of human and animal vaccine candidates – including trial vaccines for HIV and Human papillomaviruses (HPV).

As top UCT inventor, Rybicki has 44 granted patents in territories including South Africa, Namibia, China, India, USA and Europe and numerous ongoing applications from the 11 patent families on which he appears as a co-inventor. He is now also seeing the commercialisation of his intellectual property bear fruit, with significant royalties beginning to flow from 2010. Importantly one licensing deal has brought further research and development work into his laboratory as well as in-bound technology transfer. Another exciting collaboration with a commercial partner is finally moving an animal vaccine, which has floundered in the innovation funding chasm for a number of years, well into the development and commercialisation phase.

Based in the Department of Molecular and Cell Biology, but also working in the Institute of Infectious Disease and Molecular Medicine (IIDMM), Rybicki concentrates on the expression of antigens from human and animal viruses in both plants and insect cells for use as human and animal vaccines, and also investigates the genetic diversity and molecular biology of single-stranded DNA viruses.

Aside from advances in the creation of vaccines for mucosal Human Papilloma Virus (HPV) (which is responsible for cancers of the cervix) and Human immunodeficiency virus type 1 (HIV-1) subtype C, made in conjunction with his wife and colleague Professor Anna-Lise Williamson's research group at the IIDMM (see page 21), Rybicki and his researchers have made progress on the characterisation and molecular biology of the parrot Beak and feather disease virus (BFDV).

Rybicki also remains committed to the work on the maize streak virus and other southern African Mastreviruses which he embarked upon 25 years ago. An important part of this is an ongoing project on genetically engineering maize for resistance to maize streak virus, initially done in collaboration with Professor Jennifer Thompson, and more recently with Dr Dionne Shepherd.

In addition to HIV, HPV, BFDV and maize streak virus research, the group are also applying established plant expression technology to quickly produce multiple structural proteins for the distantly related reoviruses, human rotavirus and bluetongue orbivirus 7, and have also recently generated a patent application for a candidate plant-made vaccine for H5N1 avian flu.

Collectively with Williamson's research group, Rybicki and his team have been highly successful in generating IP, but although some of this is being licensed to major companies, "the lack of any other products than the US- or UK-manufactured HIV candidate vaccines in human trial presently, is a matter for frustration," he says. In part this relates to the significant barrier to entry when establishing a local start-up in the human vaccine sector and the dearth of a variety of local vaccine producers to partner with; there is currently only one in South Africa, the Biovac Institute, with whom they collaborated on certain projects.

Rybicki says that the development of transgenic maize resistant to maize streak virus is highly advanced. "A number of transformed plant lines having been successfully tested in glasshouse trials, and used in experimental breeding



collaboration agreement.

“We are developing novel chimaeric HPV vaccine candidates in plant and in insect cell expression systems as well as exploring the production of a novel subunit South African rotavirus strain vaccine against infant diarrhoea in plants,” he says.

“Progress has been very satisfactory, with five different HPV variants all produced in both plants and insect cells, three at very high yield, and tested in mice for immunogenicity. The rotavirus capsid protein expression has also gone well, with several proteins produced at high level.”

Rybicki and Hitzeroth are also making breakthroughs in their work on a viral disease responsible for a common malady in parrots and related birds. Beak and feather disease virus (BFDV) causes skewed beaks and feather malformation in affected birds, as well as weight loss in adult birds and often death in juveniles. Since 2002, in work initiated with Prof Anna-Lise Williamson, the researchers have been investigating the possibility of making vaccines and therapeutics for the virus disease.

BFDV causes psittacine beak and feather disease (PBFD) in all psittacine birds (parrots). It is a highly infective and debilitating disease and to date no specific treatment exists to protect against it. It is a contributing factor to the decline of wild populations and especially endangered species such as the South African Cape Parrot. It is also the scourge of a multi-million rand global pet industry in which parrots and related birds are a lucrative trade item.

“We have made candidate subunit protein vaccines against BFDV which have been subjected to preliminary testing in budgies, as well as progress towards establishing a reliable challenge model for infecting vaccinated birds,” Rybicki explains.

If successful the vaccine could significantly aid eradication of the disease in South Africa and help ensure infected birds are not traded or exported, it could counter this virulent disease in wild populations of parrots, especially the endangered Cape Parrot, which has been found to have high infection rates in the wild in South Africa.

Rybicki and Hitzeroth are excited about the prospect of its development. “We have comprehensively mapped diversity and made significant progress to both making and testing vaccines and therapeutic antibodies against the virus

programs to “introgress” the trait into commercially-usable breeding lines,” he says

With funding from Pannar Ltd of South Africa, the team is presently developing second- and third-generation transgenic maize lines resistant to maize streak virus, via pathogen-derived resistance. “This involves expressing a mutated virus protein involved in virus replication as a ‘dominant negative mutant’ to destructively interfere with virus replication in transgenic plants,” he explains.

“First generation plants proved the concept for the resistance mechanism in greenhouse trials, but contained antibiotic resistance genes. Second generation plants now no longer have this gene and are resistant to the virus and will be field-trialled soon, while third-generation plants are being developed which will contain a novel inducible gene technology which could be more effective,” Rybicki reports.

This work has resulted in one patent and he is confident of success further along the innovation chain. “There’s a very real possibility of serious, international commercialisation coming out of this patent,” he maintains.

“This is mealies we’re talking about and people sell a lot of mealies,” he exclaims. “So we’re witnessing an undisputed success story in motion, but we haven’t seen the financial rewards as the product isn’t out in the field yet.”

His initial HPV vaccine work began in the mid-1990s, funded by Poliomyelitis Research Foundation, and led on in 1999 to two successive Department of Science and Technology Innovation Fund projects which ended in 2006; these resulted in several major breakthroughs. They were able to produce the L1 capsid protein, which forms the heart of the vaccine, in both plants and insect cells in addition to a chimaeric form that it is hoped will elicit a wider spectrum of cross-neutralising antibodies than standard L1.

“We were among the first – one of three groups publishing simultaneously in 2003 – to demonstrate the feasibility of making a HPV vaccine in plants via transgenic plants, and were the first to demonstrate both that a plant-derived HPV vaccine was protective in an animal model and that transient expression in plants was a very good means of making HPV vaccines,” he says proudly.

After the Innovation Fund project ended in 2006, the papillomavirus vaccine development has continued in a consortium composed of several collaborators. The consortium, led by Professor Johann Gorgens of the University of Stellenbosch, comprises Rybicki’s (with colleague Dr Inga Hitzeroth an important contributor), as well as researchers from the University of the North West, Medunsa, NICD (JHB) and the University of Limpopo. The project began in 2007 and is financed by the DST and NRF with funds that stem from a South African and Cuban

which has generated a patent," he says.

"My vision for these projects is that we can develop novel, low cost vaccines and therapeutics and reagents using both plant and insect cell expression technology, and at the same time train students and technical folk to a high degree of skill in cutting-edge techniques," he adds.

Rybicki's laboratory is also investigating the feasibility of producing emergency response vaccines against highly pathogenic avian influenza viruses - specifically, H5N1 flu - in both plant and insect cells and as a DNA vaccine.

He explains this particular study was initiated in 2006 with extraordinary one-year funding from the local Poliomyelitis Research Foundation (PRF) following warnings by WHO officials that there would be no vaccines available for developing countries if a bird flu pandemic hit. This funding was extended in 2008 with a Major Impact Project Grant from PRF (2008-2010) and progress has been heartening.

"We have been able to produce large amounts of H5 haemagglutinin protein in plants, as well as in insect cells, with the former producing surprisingly large amounts of protein that appeared to fold properly, and to have haemagglutinating ability, and to be immunogenic. A DNA vaccine candidate is also being investigated," elaborates Rybicki.

His research team also obtained EU funds as part of a Europe-Russia-SA consortium called "PlaProVa" for plant-produced vaccines. The funding, which is for the period 2009-2011, is being used by them to develop plant-made vaccine candidates against bluetongue virus of ruminants.

The virus causes bluetongue disease mainly in sheep, but also can also affect cattle, goats and animals in the wild such as a buffalo and antelope. The disease is endemic in South Africa and is currently a serious emerging disease problem in Europe. Rybicki believes satisfactory progress has been made in this area, with several of the virus structural proteins expressed and reagents made for detection of proteins.

The fact Rybicki works 'across species' has given him an extremely broad view of virology and biotechnology. "It also gives one unique advantages when it comes to exploiting certain niches of research, and in having unique ideas in the innovation space. However, mostly

this is due to my having been a plant virologist, which is a narrow enough field of work that one takes a lot of information from the human and animal virology spheres, which definitely does not work in reverse!" he stresses.

"This allowed a fairly easy transition into working with animal and human viruses, after plant virus research did not attract funding in the 1990s."

It was this reduction in funding that led to Rybicki seeking funding from other sources and which ironically led to his group receiving ten-fold his previous funding amounts. "Thereafter, it has been an interesting tightrope walk over a plant virology-virus biotechnology divide, with

the viral biotechnology side gradually becoming predominant in my interest bubble," he reports.

Looking back over his rollercoaster innovation ride Rybicki candidly expresses that despite the ensuing success of many of his projects, innovating was something he "drifted into". He advises others testing the innovation waters to prepare for a serious learning curve with regard to understanding intellectual property, and how to not only develop it, but also how to exploit it.

"Do not divulge things willy-nilly, but rather talk to RCIPS about whether or not something is protectable, and if so,




how to patent, copyright, or protect other rights. Also prepare to visit and revisit things that you thought you'd left behind years ago, as patent disputes, renewals and/or revisions come up at regular intervals," he cautions.

He says part of the recipe for successful innovation is being open-minded enough to shift from established positions.

"You've got to be able to change your mind and you've got to shift with imperatives, and that includes funding imperatives. You've got to be able to move fairly fast to keep abreast with, in this country especially, trends in funding."

Despite setbacks he hastens to add that over almost two decades they have collaboratively managed to build up a valuable body of expertise, including a legion of trained students and other scientists, as well as a large body of published work.

As for the immediate future, Rybicki envisages he and his researchers becoming a dedicated animal and emergency response human virus vaccine development group, a technology platform for insect cell and in particular plant expression of high-value proteins, and a centre for the development of transgenic maize for other traits than MSV resistance." 

| Application in Reference style | Granted Regions | Pending Regions |
|---|--|-----------------------|
| Rybicki, E.P., Varsani, A.D. Chimaeric Human Papillomavirus 16 L1 Virus Like Particles and a Method for Preparing the Particles. | AU, ZA, US, EP: [LU, IT, MC, RO, PT, DE, SE, SI, TR, NL, CY, SP, AT, FI, CH, IE, CZ, DK, SK, FR, GB, GR, HU, BE, EE, BG] | JP, US Reg. |
| Rybicki, E.P., Varsani, A.D., Williamson, A-L. Pharmaceutical Compositions and a Method of Preparing and Isolating Said Pharmaceutical Compositions, and Use of Said Compositions for Prophylactic Treatment of Lesions and Carcinomas. | IN, ZA, CN | - |
| Rybicki, E.P., Varsani, A.D., Williamson, A-L. Vectors, Constructs, and Transgenic Plants for HPV-11 and HPV-16 L1 Capsid Protein. | CN, ZA | ARIPO |
| Mangwende, T., Rybicki, E.P., Shepherd, D.N., Thomson, J.A. An Isolated Nucleotide Sequence and Transgenic Organism Containing Said Sequence. | ZA | - |
| Meyers, A.E., Rybicki, E.P., Williamson, A-L. A Method for the Production of HIV-1 Gag Virus-Like Particles. | NA, ZA | - |
| Heath, L., Rybicki, E.P., Williamson, A-L. Beak and Feather Disease Virus Sequences, Compositions and Vaccines and the Use Thereof in Therapy, Diagnosis and Assays. | EP | ZA, AU |
| Halsey, R.J., Rybicki, E.P., Tanzer, F.L., Williamson, A-L. Chimaeric HIV-1 Subtype C GAG-Virus-Like Particles. | ZA | IN |
| Rose, R.C., Rybicki, E.P., Williamson, A-L. Oral Immunization with Papillomavirus Virus-Like Particles. | US | EU, JP, CA |
| Hitzerth, I.I., Maclean, J.M., Rybicki, E.P., Williamson, A-L. Expression of Proteins in Plants. | | CN, ZA, EP, IN, US |
| Rybicki, E.P., Tanzer, F.L. Expression System Incorporating a Capsid Promoter Sequence as an Enhancer of a Cytomegalovirus Promoter. | ZA | ARIPO, BR, EP, IN, US |
| Mangwende, T., Rybicki, E.P., Shepherd, D.N., Thomson, J.A. A Transgenic Organism and Method of Producing Same. | ZA | NA |
| Hitzerth, I.I., Rybicki, E.P. Method for Enhancing the Expression of HPV L1. | Prov | - |

Williamson's Vaccines a First for Africa



Renowned UCT scientist Professor Anna-Lise Williamson and researchers from UCT's Institute of Infectious Disease and Molecular Medicine (IIDMM) reached a research and innovation milestone last year with the announcement that two of their new preventative HIV vaccines were set for the first stage of human clinical trials.

A first for Africa, the trials represent almost a decade of exhaustive research and is a major accomplishment for Williamson and her colleagues. It also makes South Africa one of the few developing nations to have successfully created an HIV vaccine that has gone forward to human clinical trials.

The initial human trial is being conducted jointly with the HIV Vaccine Trials Network and the NIAID, part of the US National Institutes of Health. The Desmond Tutu HIV Centre, based at the IIDMM, is one of three international sites that will conduct the trials, with the others located in Johannesburg and Boston in the United States.

Williamson reports that the first Phase 1 trial HVTN 073 / SAAVI 102 has been completed and that the initial immunogenicity results look promising.

"The lab work still needs to be completed in Johannesburg and the USA. Participants in this trial will be invited to participate in a modified protocol where they are immunised with a protein vaccine made by Novartis. A second trial is also planned to look at different combinations of the SAAVI DNA-C2,

SAAVI MVA-C and the Novartis protein vaccine. We are looking for financial support to fund the manufacturing of our vaccines for a Phase 2B efficacy trial," she says.

These vaccines are the culmination of eight years of research by scientists at the IIDMM, UCT, and collaborators from the US National Institutes of Health and the Vaccine Research Centre. Their development and testing has been underpinned by funding from the South African AIDS Vaccine Initiative (SAAVI) and the US National Institute of Allergy and Infectious Diseases (NIAID).

Williamson is dedicated to her research work because of vaccines potential to greatly reduce global health burdens. "Vaccines are designed to be given a limited number of times and are the best way of preventing diseases. Millions of lives are saved because of the immunisation of children throughout the world. For example, smallpox was eradicated by vaccination."

She attributes her success in vaccine development to her early initial research she conducted into veterinary vaccines. "It was because I had so much vaccine expertise, it enabled me to achieve in the HIV field," she explains.

The UCT group is investigating a number of different strategies to make HIV-1 vaccines, based on HIV-1 subtype C virus, which is the dominant strain circulating in southern Africa. The mission of this group is to develop HIV-1C vaccines which are both effective and affordable, and through a comparative strategy, to advance the most promising vaccines or combination of vaccines to clinical trials.

Among Williamson's multidisciplinary research team are Principal Investigators Professor Carolyn Williamson, Associate Professor Enid Shephard and Professor Ed Rybicki. Together they have notched up significant progress on a number of candidate HIV vaccines. Ed Rybicki and Anna-Lise Williamson have also made progress on the development of novel Human Papillomavirus (HPV) vaccines.

“Our most successful project is our HIV vaccine project because we went from the basic concept all the way to clinical trials. And that’s a major achievement in South Africa to be able to get a vaccine to human trials,” says Williamson.

The first vaccines selected to move forward to clinical trials are DNA vaccines (SAAVI DNA-C2) and a modified vaccinia virus Ankara vaccine (SAAVI MVA-C). This DNA prime – MVA boost combination is regarded as one of the most promising vaccine strategies. The bacterial vaccine group is developing vaccines based on live recombinant Bacillus Calmette-Guérin (BCG) and previously also worked on Salmonella bacteria, while the subunit vaccine group was making candidate vaccines using baculovirus and tobacco expression systems prior to SAAVI funding being stopped.

Therion Biologics (USA) and Althea Technologies (USA) have produced the vaccine doses that are being used in the clinical trial. The UCT SAAVI development team included both the Williamsons and Shephard, as well as Dr Katrina Downing, Dr Joanne van Harmelen, Dr Gerald Chege and Dr Wendy Burgers. They are working in partnership with NIAID (NIH, USA); the HIV Vaccine Trials Network (HVTN) of the National Institutes of Health (NIH,

USA), Professor Clive Gray of the NICD in Johannesburg and Professor Glenda Gray of Chris Hani-Baragwanath Hospital.

The next most promising vaccine, developed by Rybicki and Dr Ann Jaffray, is the virus-like particle (VLP) vaccine based on an HIV-1 subtype C Pr55 Gag protein, which is produced in insect cells via recombinant baculovirus. This vaccine induces an excellent immune response in mice as well as non-human primates. If successful, this will be a cheap and effective production system for the subunit vaccines. (see article on Ed Rybicki on page 17)

In another project, Williamson’s group, together with Dr Ros Chapman, are optimising bacterial vectors as vaccine delivery vehicles. Williamson explains that BCG – which is better known as the TB vaccine - has many advantages as a vaccine vector. Production costs are also very low in comparison to other vaccine production strategies. Although rBCG expressing our HIV-1 proteins induces an immune response in mice and in baboons, it is not yet optimal for use as a vaccine. Several different approaches are being taken to improve this response.” Williamson elaborates.

Williamson’s group has also been at the forefront of research on human

papillomavirus (HPV) – the virus responsible for cervical cancer and a number of other cancers. “Our group has been active in HPV research for almost two decades. We have an on-going interest in studying HPV types associated with cervical and oral disease throughout the region,” she says.

“The papillomavirus projects are just a totally different type of project,” she says. “We’ve done a lot of work to show what different HPV types are prevalent in the country, so that if vaccine were introduced into South Africa we would know the impact on circulating HPV types.”

The development of HPV vaccines and exploring different immunisation strategies are a core focus and Williamson’s laboratory has established various working models to evaluate papillomavirus vaccine production strategies, taking into account the need to develop inexpensive vaccines, appropriate for the continent.

For Williamson the milestones in this domain have included the extensive collaborations on HPV projects which have provided information on the immune response to HPV and the molecular epidemiology of HPV types in cervical cancers, pre-cancers, women with normal cytology, as well as the impact



of HIV. “A particular highlight was the demonstration by my post-doctoral fellow, Dr Vandana Govan, that BCG expressing papillomavirus genes could successfully protect against infection with cotton tail rabbit papillomavirus” she says.

Her group is no longer working on HPV vaccines and this work has been taken up by Ribicki’s research group. “My group is now concentrating on projects investigating the impact of HIV co-infection on HPV. HPV causes cervical cancer and women with HIV are at much higher risk of getting cervical cancer because they have more persistent HPV infections. We are also interested in oral HPVs.”

In relation to her HIV vaccine work, Williamson believes that several important factors aligned to ensure this research was successful. Firstly, she credits the international partnership with the NIH in the US which resulted in access to both funding and expertise, and secondly acknowledges the initial funding made available by the South African government.

“We couldn’t have done it without that NIH partnership, it was absolutely essential. They committed an enormous amount for our infrastructure. They also provided the expertise to manage the projects in the instances where we didn’t have the expertise.”

Williamson clarifies that an academic group can only manage so much along the innovation chain. “There comes a point where you need to hand over to someone to run with things that we can’t do. We got a lot of training in the process, and we are a lot better than when we started, but it’s still a very big problem embarking upon these kinds of projects in South Africa.”

“One reason why the HIV vaccines initiative was so successful was not only did we have good international partners but there was initially a lot of funding from government – R10-million a year which enabled us to set up a very sophisticated group with enough depth and flexibility to deliver. Those resources gave us huge capacity and the ability to respond rapidly. Government’s cut in funding has, however, had a negative impact on this ability.”


“Long-term, secure funding has to be obtained for vaccine research as the time frames needed to test vaccines tends to be longer. This is because in order to test a vaccine in an efficacy trial, there is the need to recruit people at risk of the disease. Enough people have to be recruited to get a statistically valid result to show that the vaccinated arm of the trial differs in protection from disease from the placebo arm of the trial.”

Williamson explains that in a drug trial “sick” people are recruited and then treated, so the time to show efficacy is reduced. However, it can take just as long to develop effective drugs compared to effective vaccines depending on the disease targeted. Both vaccine and drugs have to go through stringent phase one and phase two trials – to show safety and determine dosage – before doing efficacy trials.

Williamson is justifiably proud of the progress made thus far. “We have learnt to function within the global HIV milieu and our collaboration with people within South Africa as well as NIH and HVTN has helped us bring two products to clinical trial which is a huge achievement for our research group. Ed and I are inventors on a number of patents and so novel IP has been generated. Lastly, but not least, we have trained many students.”

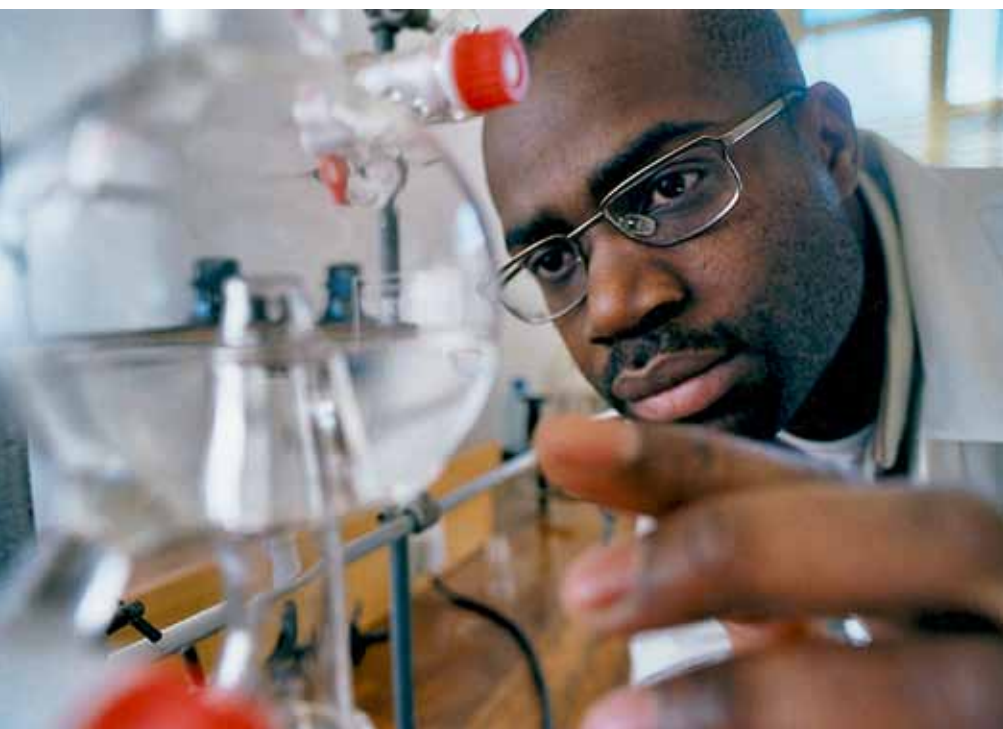
She believes the future of her group lies in continuing with BCG based and poxvirus vaccine vector development. Aside from the continuing exploration of local poxviruses as vaccine vectors, Williamson maintains an abiding interest in veterinary vaccine development using poxviruses as vectors and is determined to continue to work on HPV and the impact of HIV co-infection.

“Vaccine research is appropriate research for Africa and, if successful, could have a massive impact on people’s lives. It has been very rewarding to be involved in these projects and to be surrounded by such a dedicated team of people as well as wonderful collaborators. However, the funding environment has been challenging and so at times we have found it extremely stressful!”

On a personal level Williamson notes that she has been fortunate to have worked on these projects with close family, her sister Carolyn and her husband Ed Rybicki. “It has been wonderful to work with them over the years. I work much more closely with Ed and we have shared supervision of a number of students and collaborated on projects since I came to Cape Town in 1987. We both really enjoy our research but try and limit “work” conversation around our children because they feel excluded!” 

| Inventors and Title | Granted Regions | Pending Regions |
|---|-----------------|--------------------|
| Halsey, R.J., Rybicki, E.P., Tanzer, F.L., Williamson, A-L. Chimaeric HIV-1 Subtype C GAG-Virus-Like Particles. | ZA | IN |
| Heath, L., Rybicki, E.P., Williamson, A-L. Beak and Feather Disease Virus Sequences, Compositions and Vaccines and the Use Thereof in Therapy, Diagnosis and Assays. | ZA, EP | AU |
| Meyers, A.E, Rybicki, E.P., Williamson, A-L. A Method for the Production of HIV-1 Gag Virus-Like Particles. | ZA, NA | |
| Rose, R.C., Rybicki, E.P., Williamson, A-L. Oral Immunization with Papillomavirus Virus-Like Particles. | US | JP, EP, CA |
| Rybicki, E.P., Varsani, A.D., Williamson, A-L. Pharmaceutical Compositions and a Method of Preparing and Isolating Said Pharmaceutical Compositions, and Use of Said Compositions for Prophylactic Treatment of Lesions and Carcinomas. | IN, CN, ZA | – |
| Rybicki, E.P., Varsani, A.D., Williamson, A-L. Vectors, Constructs, and Transgenic Plants for HPV-11 and HPV-16 L1 Capsid Protein. | ZA, CN | ARIPO |
| Hitzerth, I.I., Maclean, J.M., Rybicki, E.P., Williamson, A-L. Expression of Proteins in Plants. | – | CN, ZA, EP, IN, US |
| Williamson, A-L., Shen, Y-J., Douglas, N. Recombinant Lumpy Skin Disease Virus for Preventing Aids. | – | ZA |

Chibale's Crusade Launches Africa's First Integrated Drug Discovery Centre



Professor Kelly Chibale's crusade to challenge Afropessimism and to kick-start Africa's drug discovery industry is gaining momentum as he prepares to formally launch Africa's first integrated Drug Discovery Centre at UCT in 2011.

Chibale is passionate about developing future generations of world-class scientists and creating an infrastructure and environment that will spur on drug discovery and related industries. In turn it is his hope that many more solutions will be found to counter some of the world's most devastating diseases which make their presence felt so overwhelmingly and painfully on the African continent.

While these issues are close to Chibale's heart, they also lie at the core of UCT's Drug Discovery Signature Theme – one of several research themes the University is committed to nurturing and supporting in the foreseeable future.

A Professor of Organic Chemistry with joint appointments in the Department of Chemistry in the Science Faculty and the Health Sciences Faculty's Institute of Infectious Disease and Molecular Medicine (IIDMM), Chibale has already made significant progress towards establishing the new Centre. The vision is to create a fully-fledged

drug discovery centre, whose activities mirror those of a start-up biotechnology or pharmaceutical company. The model envisaged for the Centre is that once medicinal chemistry starting points (hits) are identified within a particular project, they will then be progressed along the value chain in terms of hit-to-lead and lead optimisation. This process will utilise and integrate medicinal chemistry, biology, pharmacology, as well as drug metabolism and pharmacokinetic studies.

"Projects will tap into the expertise the Centre will offer, that being the available platforms along the value chain, as well as pharmaceutical industry know-how and associated expertise," he says.

An attendant vision is to deliver clinical candidates ready for testing in humans which will complement and strengthen the IIDMM's activities, bridging the current gap that exists between basic science and the clinical studies of various diseases at UCT.

In talking about his work the phrase "Kill quick, kill cheap," is one he often uses. It is in reference to the need to cut one's losses early on in the drug discovery innovation process if the signs of progress are in anyway tenuous. It also conveys Chibale's sense of urgency about finding potential new drugs to fight malaria, tuberculosis, HIV/AIDS, cancer, hypertension and cardiovascular disease.

"Sadly most patents in South Africa, which are filed and maintained at great cost, are meaningless in that they have little value and are not really attractive to potential partners from the pharmaceutical industry. There needs to be substantial real value added to a potential medicine before filing or maintaining a patent."

"Even when a provisional patent is filed, it's crucial to have follow-up action to access the platforms and skills required to move the molecules along the value chain as quickly as possible, and to only consider progressing the Provisional

Patent to PCT and National Filing once a true lead molecule with substantial value has been identified," he says.

Chibale believes the Centre will add substantial value to projects because potential gaps and weaknesses have already been identified. "We have put in place the necessary platforms and will be looking to bring in relevant pharmaceutical industry expertise as well as partnerships with pharmaceutical companies and 'virtual' Drug Research and Development organisations such as Medicines for Malaria Venture, Global Alliance for Tuberculosis Drug Development, BioVentures for Global Health, to name but a few."

The energetic Chibale also holds the DST/NRF South Africa National Research Chair in Drug Discovery under the South African Research Chairs Initiative (SARChI) and is Director of the South African Medical Research Council (MRC/UCT) Drug Discovery and Development Research Unit. In 2005 his laboratory was selected as one of the World Health Organisation's (WHO) Synthetic/Medicinal Chemistry "Workstations" or Centre of Excellence by its Tropical Diseases Research. At the time his lab was the only one in Africa to be singled out for this honour and has been among only a select few scattered across the globe.

Although he is immersed in the myriad tasks and minutia of detail involved in establishing an interdisciplinary Centre, he also is equally passionate about his role as a teacher and supervisor. He currently supervises some 35 postgraduate and postdoctoral students and delights in helping his students appreciate the thrill and excitement that is part of the reward for rigorous scientific research and innovation.

Chibale is candid about his initial foray into innovation, believing that he squandered valuable research time and energy, without tangible outcomes. "When I began my career at UCT in 1996 I was innocently embarking upon Drug Discovery, but in terms of really doing drug discovery as it should be done, it took me at least up until about 2007 to begin making real headway. I just was naïve and didn't know what it took to really say, 'This is a real lead'. Secondly, there wasn't an infrastructure to tap into, to make progress possible."

He points to the fact that Africa has not got a track record or history of discovering and developing modern pharmaceuticals i.e. from discovery all the way to market.

Kelly Chibale - Antimalarial Drug Discovery in Perspective

The burgeoning burden of disease on the one hand, and an annual US\$350 billion market for leading therapeutic drugs, is driving the pursuit of new methods in drug synthesis, and drug development and drug target identification.

The need for safe, effective medicines must take into account the fierce competition in the drug-development industry which is experiencing considerable cost pressures.



While the traditional drug-discovery approach is to identify a therapeutic target, link this to a specific biological mechanism, and thereby provide a focus for a discovery effort, the advent of high-throughput screening (HTS) methods enable a large number of compounds to be screened in a relatively short time. These recent advances in synthetic chemistry methodology have facilitated the rapid construction of lead analogs. These lead compounds can then be subjected to a variety of substrate binding and toxicological tests to determine their efficacy as drugs.

The speed with which drug discovery is now moving can be illustrated by a project headed by Professor Kelly Chibale, in conjunction with experts in the pharmaceutical industry from across the world, which has led to the identification of novel chemotypes that are unrelated to existing drugs on the market.

Chibale is immensely proud of the project's progress thus far and candidly remarks that he feels he has achieved more in six months than he achieved in a decade of adopting the traditional approach to drug discovery.

"We started this project last year with Medicines for Malaria Venture (MMV), a 'virtual' drug research and development organization which on average spends in the order of US\$60 million dollars per year just on malaria," says Chibale.

When it was formed a decade ago, MMV was the first public-private partnership of its kind. It now has the largest ever portfolio of projects on discovering antimalarial drugs in the history of mankind, and is involved in the whole process from drug discovery and development, through to clinical testing, product launching and marketing.

The MMV project involves processing hits from a phenotypic whole cell High Throughput Screening (HTS) of a commercial library purchased from the biopharmaceutical company BioFocus in the UK.

"In investigating a molecule with application for the treatment of malaria, we accessed a collection of 35,000 small molecules from BioFocus. As we don't have the capability in Africa for high throughput screening (HTS) – it's a very unique, specialised technology that is extremely expensive – we sent this library to

“There is also a critical shortage of skills in medicinal chemistry, that integrates drug metabolism and pharmacokinetic studies, which are crucial to drug discovery.

This serious shortage of requisite drug discovery skills is indeed our Achilles Heel in our quest to discover and develop our own medicines. These skills will initially need to be urgently imported onto our continent from the western pharmaceutical industry,” he states.

“Although South Africa has a strong reputation in basic science and clinical studies of diseases, there has always been the challenge of how to translate this into new potential medicines. Similarly, although UCT is a leader in the area of drug discovery in Africa and also has an excellent track record in basic research, what we are really missing is being able to bridge this gap between the basic sciences and the clinical sciences,” says Chibale.

“The challenge has always been how to translate what comes out of the basic research into tangible outcomes to which real value has been added,” By that I mean, if you look at the whole drug discovery development and preclinical phase of development in terms of the value chain, what is seriously lacking in South Africa will actually render any of these efforts useless if we don’t bridge this gap and actually put in place key platforms and technologies along this value chain that allow things to move meaningfully forward.”

The establishment of the centre will be the first step in bridging that gap, creating an appropriate infrastructure for collaborative drug discovery and development and sowing the seeds for a viable pharmaceutical industry in South Africa. The centre’s links with a strong global scientific network will also ensure that projects meet internationally recognised standards.

Chibale believes this combination will produce a critical mass of new scientists to develop drugs to fight infectious and other diseases, but with a unique focus on the issues facing sub-Saharan Africa.

“There’s a lot of Afro-pessimism in this country and elsewhere, but I think the work of this Centre should convince any doubting Thomases that we can do excellent innovation here. Innovation is really what sustains a venture of this nature. I want the work of the Centre to be based on intellectual property and

Australia to the Eskitis Institute at Griffiths University in Brisbane for HTS,” Chibale continues.

“They were able to screen this library of 35,000 molecules on malaria. Once we had established the molecule’s cytotoxicity, which measures its general toxic effect on cells, and determines its safety, we then went through a process called a “Hit Triage”.

“A “hit”, in simple terms, is basically just something that gives you a positive result in a primary screen. So in our case, we looked for molecules in that 35,000-strong library which had an effect on parasites, and anything that gave us a positive result was simply a “hit”.

Chibale observes that even with this obvious progress, there is no point in filing a patent until further investigation is completed. Here, he pauses to talk about the role of the team that is carrying out the work and the need for it to be interdisciplinary.

“A good Project Team actually includes not just the obvious disciplines that you need to move things forward, not just chemists who make molecules, but experts in biology, genetics, drug metabolism, patenting and so on. You basically harness their combined expertise to design a molecule that overcomes any obstacles to becoming a drug. It’s really a market experiment,” he maintains.

As part of the triage process, Chibale and his team revisited the progression criteria in order to see if those criteria had been met. “We selected those molecules that fulfilled our criteria. The next phase was to carry out what we call “Hit Validation” – retesting, to double check that what we found was really true. After this came a very important and expensive process, the Hit-to-Lead process.”

“The way that I define it, a “Hit” is simply something that gives you a positive result, while a “Lead” gives you confidence that you may have found a suitable candidate. There again, you have predetermined criteria of what characteristics a lead should have,” he says.

Within the lead there are two categories: an “Early Lead” and a “Late Lead”. An early lead shows that apart from its efficacy, the molecule is going to be bio-available – which involves predicting what the human body is likely going to do to the drug.

“Once the work on the “Early Lead” is completed, work begins on a “Late Lead”, where you embark on “Lead Optimisation”. So when you find the lead, you synthesise it and test it with respect to criteria that you defined upfront. You then make sure that you understand its liabilities and problems, which you can then address during lead optimization,” Chibale explains.

He believes the lead optimisation stage is where the real innovation lies – the penultimate step before the chemist hands over to clinicians during the “Candidate Selection” phase.

Chibale takes up the story: “The HTS was conducted against malaria parasite strains at the Eskitis Institute. The goal of this MMV project is to conduct a medicinal chemistry programme on selected hit compounds from the HTS to identify quality leads suitable for optimisation and, ultimately, candidate selection as potential agents to treat various forms and stages of malaria.”

Chibale explains that MMV’s Expert Scientific Advisory Committee (ESAC), of which he is a member, has been instrumental to the project’s progress along the innovation chain. “Before you do anything with regard to innovation you’ve really got to establish that there’s freedom to operate, because when it comes to innovation, you really don’t want to go blindly into something,” he cautions.

The MMV’s ESAC comprises international experts in drug discovery who have given Chibale invaluable advice, leading his team in an exciting new direction. He is grateful for the experience gained from sitting on the committee and interacting with these luminaries of the pharmaceutical industry.

“A number of the members have 30 years of experience and a proven track record of discovering, developing and putting new drugs on the market – thereby

innovation where substantial value has been added so that when you file a patent, it really is good value.”

Chibale is excited about the Centre’s operational model. In addition to the establishment of a drug metabolism and pharmacokinetics platform, an associated Foundation will be established to help fund various initiatives whether at UCT or elsewhere in Africa.

The Cape Biotech Trust, which is now part of the Technology Innovation Agency (TIA), has already provided funds to establish a drug metabolism and pharmacokinetics platform, which is currently housed in Chibale’s IIDMM laboratories. The funds have been spent on key capital items of equipment and some staff salaries. In conjunction with MMV, Cape Biotech Trust has also contributed funds towards the secondment of two UCT postdocs at BioFocus, a British biopharmaceutical company for training in drug metabolism and pharmacokinetic studies focusing on assays.

“We are currently setting up the various assays that will be required to conduct these studies. So effectively the platform has now been established and should be in a position to provide a service to the scientific community by mid-2011. In the meantime, I am currently in discussion with TIA to provide additional funds to recruit key personnel with the relevant experience, and to keep the platform running for at least the initial few years before it becomes financially self-sustaining.”

“We wanted to develop a business model which includes spinning out companies based on intellectual property to which substantial value has been added through this platform and secondly, to create a Foundation.”

The creation of the proposed Foundation is unprecedented, he says. “The proposed Foundation will raise money, specifically for innovation in drug discovery and development and basically, seed drug discovery, not just at UCT, but at other African institutions. In fact, wherever there is a good project to support and where we have the necessary platforms. In turn the foundation will have a controlling stake in the Intellectual Property that comes out of any project that they fund.”

The Drug Discovery Centre, which will also be known as Holos 3ple-D, will be formally launched during the first week of April 2011. 

saving millions of lives. So they know what they’re doing! At this point of my career I suspect I take more than I give by serving on the MMV’s ESAC, but it really has been an amazing learning curve,” Chibale chuckles.

His MMV colleagues have been instrumental in helping him determine the freedom to operate – the first major task to scope when embarking on innovation. “In other words, are there not perhaps other researchers working in the same area who are already further along the innovation chain?” he posits.

This brings him to the next innovation milestone – creating a Target Product Profile or TPP.

“Imagine that you have discovered your products, what is the profile that is going to help? For example, if it’s a drug for cancer, how many times is the patient going to take it? Are they going to take it orally? The answers to all these questions determine your approach to dealing with the problem. So you define a TPP.”

The next phase involves defining the progression criteria. “In other words, how are you going to proceed from there in terms of the value chain and what are the criteria that will really help you make decisions to move along the value chain?”

Chibale believes this phase is absolutely pivotal and determines the difference between academic research and real innovation. “How well researchers apply their minds to this phase will make a difference to a project’s success or failure. You actually must learn to let go of it, if the signs of progress aren’t there.” He invokes his pet phrase: “Kill quick, kill cheap!”

“The major stumbling block to successful drug development is not actually its efficacy, it’s what the body does to the drug” continues Chibale. “You’ve always got to keep in mind how the patient will metabolise the drug. So you have to think about this early on, when you’re defining the Target Product Profile and defining its progression criteria.”

Chibale completes his summary of the drug discovery process with the revelation that these steps have accelerated one of his innovation projects. “In less than six months, we achieved something I have never ever seen in my entire career. We have identified novel chemotypes that are unrelated to existing drugs on the market. One of the prioritised and promising series has reached the confirmed lead stage and we are currently pursuing a lead optimisation campaign, to address all identified liabilities with a view to declaring a clinical candidate in the very near future.”

“It highlights that taking out a patent at too early a stage is senseless. We never filed a patent until this year when we had entered the lead optimisation stage. That’s when we filed!” Chibale exclaims.

| Participants and title | Granted Regions | Pending Regions |
|--|-----------------|-----------------|
| Chibale, K., Greenbaum, D.C., McKerrow, J.H. Anti-Parasite Compounds and Methods of Their Use. | ZA | – |
| Chibale, K., Nchinda, A.T., Sturrock, E.D. Angiotensin I-Converting Enzyme (ACE) Inhibitors. | EP, ZA | US, AU, CA |
| Chibale, K., Nchinda, A.T., Sturrock, E.D. Angiotensin I-Converting Enzyme (ACE) Inhibitors. | ZA | US, EP, CA, AU |

Serial Inventor Sturrock Holds All the ACEs



Having solved a problem that has confounded the scientific community for decades, UCT Professor Ed Sturrock of UCT's Institute of Infectious Disease and Molecular Medicine (IIDMM) is one of UCT's most successful innovators.

A world leader in the field of metalloproteases, Sturrock is internationally renowned for his pioneering work on illuminating an understanding of the human angiotensin-converting enzyme (ACE) – a protein that plays a key role in blood pressure regulation.

Together with his UCT colleague Sylva Schwager and Professor Ravi Acharya and Dr Ramanathan Natesh based at Bath University, Sturrock published the first three-dimensional structure of ACE in Nature in 2003.

Their breakthrough created enormous interest from the international scientific and medical communities at the time, as over the years numerous high-profile research teams had tried – and failed – to map the enigmatic enzyme.

Armed with a better understanding of the peptide and its interaction with its inhibitors, the team of scientists was then able to begin work on developing a new generation of ACE inhibitor drugs. “ACE consists of two parts, the N and C domains, with different functions. Current drugs inhibit both domains,” Sturrock explained. “By designing specific

domain-selective ACE inhibitors we expect to produce next-generation drugs that are safer and more effective and have fewer side effects.”

The current generation of ACE inhibitor drugs, which are widely used to treat cardiovascular diseases, such as high blood pressure, heart failure, coronary artery disease, and kidney failure, as well as other related ailments, has unpleasant, and sometimes dangerous, side-effects. These include a persistent dry cough and swelling of the mouth and upper respiratory tract – termed angioedema – which can be life-threatening.

Using the unique knowledge of the three-dimensional structure of ACE, Sturrock and his collaborators have engaged in the design and synthesis of domain-selective ACE inhibitors and patents have been filed for the C-domain and N-domain crystal structures of the ACE protein and related features, as well as for novel C-domain-selective ACE inhibitors. The IP is presently owned by the Universities of Cape Town and Bath.

“The potential is huge, but the time from breakthrough to presenting new drugs on the market is anything between six and 12 years,” Sturrock added.

During 2008 the board of Cape Biotech Trust approved support for the commercialisation of the technology through a spin-out company, AngioDesign Therapeutics Pty Ltd (ADT). Due to various reasons, *inter alia*, the formation of the Technology Innovation Agency, into which CBT was incorporated, this funding arrangement has not been finalised as yet.

But the show is going on. Sturrock says, “At present the work is being done in my laboratory, in Kelly Chibale’s laboratory, and at the University of Bath. We’re also outsourcing some of the work. So it’s a bit of a hybrid in terms of being an industry-academia venture.”

“However, in its current form it is a brilliant way of helping students in my group get a real sense of what is involved in innovation and the translation of science from the laboratory to the clinic,”

he adds.

Sturrock explains that the most costly aspect of the drug discovery and the associated development process is the validation of therapeutic targets during clinical trials. **“ADT aims to short-circuit the process by applying structure-guided drug design to proven disease targets and developing next-generation drugs with superior efficacy and side effect profiles,”** he says.

The plan is for ADT to guide the lead ACE inhibitor candidates through phase I clinical trials in order to establish proof of concept and maximize the value of its core intellectual property and technology. ADT then hopes to negotiate licensing and co-development deals with pharmaceutical companies with relevant therapeutic interests.

A UCT alumnus, Sturrock began work on the ACE protein nine years ago at Harvard Medical School while on a Fellowship sponsored by the National Research Foundation (NRF) and National Institutes of Health (NIH). It was at Harvard that he established links with his Bath collaborator – a working relationship that has endured and prospered.

His work at on ACE at Harvard prepared him for his breakthrough a decade later on the three-dimensional crystal structure of the enzyme and the structure-based design and synthesis of novel domain-selective inhibitors.

Sturrock returned to South Africa and UCT in 2007 and set himself the goal of maintaining and developing his contacts with internationally renowned colleagues abroad. “This was particularly important as the skills and technology in protein X-ray crystallography were lacking in South Africa and in the Western Cape,” he noted.

Now based at UCT’s Institute of Infectious Disease and Molecular Medicine, Sturrock is a Wellcome Trust International Research Fellow. He believes this fellowship has been instrumental in giving him time and space to dedicate to his research. “I think that I have been very fortunate, in that these senior fellowships give academics five years in which to focus on research.”

“The conditions allow you to spend only 15% of your time doing teaching and administration. That really gave me the opportunity to do research – to pursue something that I am passionate about and enjoy. What drives me is that one is developing – not just new compounds

which could become new drugs – but one is finding out new things about science, about life, and it’s really that discovery process that drives me,” Sturrock enthuses.

Another major research project Sturrock and his team are working on is related to ACE, but looks more at the processing of the proteins attached to the cell membrane. These molecules are cleaved by another protease and released into the extra-cellular milieu – into the bloodstream in the case of ACE. This process is important, because recent work has shown that the membrane-anchored form is the more physiologically important form.

“We’ve done quite a lot of work trying to understand that process – how ACE is cleaved off the membrane and to try and identify the protease that is responsible for that cleavage. And this would also potentially be something that could be developed into a therapeutic application – although we are not really at that stage yet with this project. Fortunately we’ve been able to get a steady stream of publications, and PhD and Masters students out of that work.”

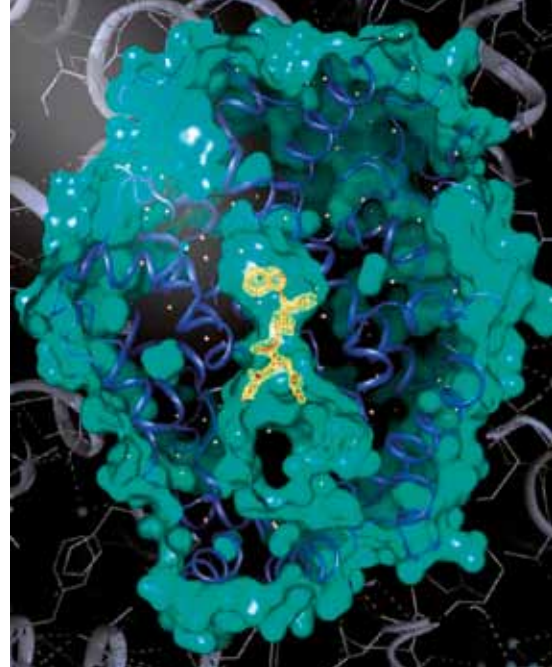
Sturrock and his colleagues’ work looks promising. “We have a couple of early lead compounds which are selective for the ACE C-domain. Current ACE inhibitors are not domain-specific - so they interact with both – and this causes an increase in a hormone called bradykinin which is largely responsible for the side-effects of these drugs – like the angioedema and the persistent cough.

“Our approach has been to develop inhibitors that block the one domain – the C domain – so that the other domain can nibble away at the bradykinin and bring those levels down and thus improve the side-effect profile.”

Sturrock explains that the patenting process can be long and laborious. It took about seven years for the patent on the C domain structure to be granted in Europe and the US patent is still being processed.

Sturrock pays homage to his co-researchers. He says that one of the most important aspects of a research project is developing a team spirit, so that everyone works towards a common goal, sees themselves as part of the same team and can share in the project’s successes and failures.

He maintains that the principal investigator’s enthusiasm, passion, and ability to deliver relevant outputs,



generates enthusiasm within the research team. He also believes in encouraging collaboration with other groups and participation in local and international conferences, as it all helps to build a spirit of innovation and discovery within the research context.

Sturrock says that he thinks his team is fortunate in being embedded within the IIDMM as it enables them to utilise the skills and technologies of other groups to supplement their own skills sets when it is necessary. For example, he’s placed a number of his students either part-time or full-time in Professor Kelly Chibale’s Chemistry Laboratory and they work with Chibale’s team to supplement their chemistry skills.

Sturrock also acknowledges the assistance and advice he’s received from experts and specialists in the pharmaceutical and associated industries. “I think that is really key to have their input – so that we continue with the caliber of research that will result in great drug-discovery.” **i**

| Title and Inventors | Granted Regions | Pending Regions |
|---|--|-----------------|
| Acharya, K.R., Sturrock, E.D. ACE N-Domain Crystal. | ZA | US, AU, CA, EP |
| Acharya, K.R., Sturrock, E.D. Crystal Structure of an Angiotensin-Converting Enzyme (ACE) and Uses Thereof. | AU, ZA, US, EP, SE, CH, DE, DK, FR, GB, IE, LU, NL, SI, MC, CA | US Div |
| Chibale, K., Nchinda, A.T., Sturrock, E.D. Angiotensin I-Converting Enzyme (ACE) Inhibitors. | EP, ZA | US, CA, AU |
| Chibale, K., Nchinda, A.T., Sturrock, E.D. Angiotensin I-Converting Enzyme (ACE) Inhibitors. | ZA | US, EP, CA, AU |

Physics Researchers Take Nanotechnology to the Big Time



Internationally renowned for their research breakthroughs in the field of printed electronics technology, UCT physics professors Margit Härting and David Britton, together with the University, are busy spinning out a company and are also in the process of establishing a UCT-based centre for innovation in the nanosciences and technology.

The research partners only began working on printed electronics technology in the solid-state and materials physics group in the early 2000s, but they made groundbreaking advances right from the outset.

Among the first was the production of semiconducting inks using silicon nanoparticles – an innovation that now underpins the rest of their work. They later became the first scientists in the world to deposit silicon nanoparticle-based ink onto paper and other substrates at room temperature, and have it work as a semiconductor.

This April the UCT colleagues walked away with one of the world's most prestigious academic awards – the Academic Research & Development Award – which they received at the IDTechEx Printed Electronics Europe Awards 2010, in Dresden, Germany, for this technology.

Their innovation allows electronic ink to be printed onto a substrate (the material on which an electrical circuit is built) where it works as a semiconductor that can carry electrical charges. An important aspect of the innovation lies in the fact that they have produced

silicon nanoparticle-based inks without the need for the usual high-temperature processing – and they've been able to achieve this at an extremely low cost. Using a novel printing technique, the researchers are able to print “electronic ink” onto substrates like paper, producing semiconductors with a performance quality comparable to silicon thin film transistors.

The scientists describe their method of fabricating silicon nanoparticles as “a lean process, using inexpensive material.” By using renewable substrates and non-toxic materials their technology is also biodegradable and environmentally safe. They point out that when silicon is burned it produces sand, which can be safely used in landfills.

This technology has infinite applications they explain. “The commercial potential is dangerously broad,” comments Härting wryly.

“Producing inks from silicon nanoparticles presents a new way to produce electronic devices. Therefore printed silicon could become the universal platform for disposable electronics, and could lead to a countless new product designs and applications,” says Härting.

“It could bring inexpensive, ubiquitous electronics in terms of electronics in packaging, electronics in clothing, electronics in rooms, in furniture, electronics in documents, flexible displays and much more,” says Britton.

They illustrate this point by using imaginative examples such as the construction of paper-thin solar panels, the creation of animated billboard posters which could light up or feature video footage, and the production of ‘smart fabrics’ that is used in sportswear to monitor muscle fatigue during training sessions.

One application which could have a significant impact locally is using solar cells as charging units for portable

electronics. ***“In an African context, a lot of people have cell phones, but don’t have regular access to electricity,” explains Härting. The researchers say that organic solar panels could be used to charge cell phones and other low-power household devices in rural areas that have no access to the electricity grid.”***

Echoing the sentiments of several other inventors at UCT, Härting and Britton say their location in Africa served as a boon in many ways. “In a so-called First World environment, you see things differently,” she says. “You go into the stream where everybody else is going. In another environment there are no such influences, and you can go for your own idea.”

As postgraduate supervisors the researchers have created a network of UCT alumni throughout Africa.

In partnership with the United States Agency for International Development, they’re hoping to collaborate with some of their former students and other researchers at universities in Rwanda and the rest of Africa.

Their work has been funded by the Department of Science and Technology through the Innovation Fund. The team is also working in conjunction with the US Agency for International Development (USAID) on its programme for higher education development in Africa.

“This programme funds projects in Africa that build up capacity for research and development, as well as encourage entrepreneurship and innovation,” says Britton.

In addition to all this work, they are well on the way to launching the Nanosciences Innovation Centre – the first of its kind in Africa – which will be based at UCT.

“It’s going to concentrate on basic research and on innovation,” explains Britton.

“If you take the innovation chain, starting with fundamental research, then basic research, then applied research, then development, then innovation and commercialisation, the Centre will focus on the ‘middle bit’ – basic research to innovation,” elaborates Härting.

“This Centre will be of enormous long-term benefit to the university and the country,” adds Britton.

The scientists warn that innovation is a complex environment to operate within.



“You have to be extremely careful when going into innovation – you must have an excellent overview and a comprehensive understanding of the environment in which you are going to be operating”, caution the professors.

They refer to the ‘ecosystem’ in which they are working. They have to keep abreast of the work that their counterparts, as well as people in affiliated industries, are conducting.

“While we’re working on our aspects, other people are working on displays, other people on new substrates, other people on power supplies, and each of those has to fit together, if you’re going to actually have the interconnected world that you want,” Britton maintains.

“This is not only printed silicon alone, you have to see this in the bigger picture – you can make a circuit, but a circuit has to be powered, and a circuit has to give out a signal,” says Härting.

“And it has to have a market!” interjects Britton. “It is also essential to go and talk to the commercial and industrial communities. So you have to go to the industrial and commercial conferences, not just the scientific conferences.”

Understanding of the market is even more important at the point when one is about to spin-out a company, they say.

“When potential funders, like venture capital funders, want to talk to us we have to present our technology in a framework that it can be easily understood, and which makes

sense in the economic and social environment,” observes Härting. 

| Patent title and Inventors | Granted Regions | Pending Regions |
|---|-----------------|----------------------------|
| Britton, D.T., Harting, M. A Thin Film Semiconductor Device and Method of Manufacturing a Thin Film Semiconductor Device. | ZA | US, JP, EP |
| Britton, D.T., Harting, M. Doping of Particulate Semiconductor Materials. | ZA | US, KR, JP, IN, EP, CN |
| Britton, D.T., Harting, M. Semiconducting Nanoparticles with Surface Modification. | ZA | JP, IN, EP, KR, US, CN |
| Britton, D.T. Harting, M. Odo, A.E. Thick Film Semiconducting Inks | – | IN, EP, US, KR, ZA, CN, JP |
| Britton, D.T., Harting, M. Method of Producing Stable Oxygen Terminated Semiconducting Nanoparticles | – | PCT |
| Britton, D.T. Harting, M. Odo, A.E. Inkjet Printing of Nanoparticulate Functional Inks | – | PCT |
| Britton, D.T., Harting, M., Jickerson, J.H. Nanolabelling of Metals. | – | PCT |

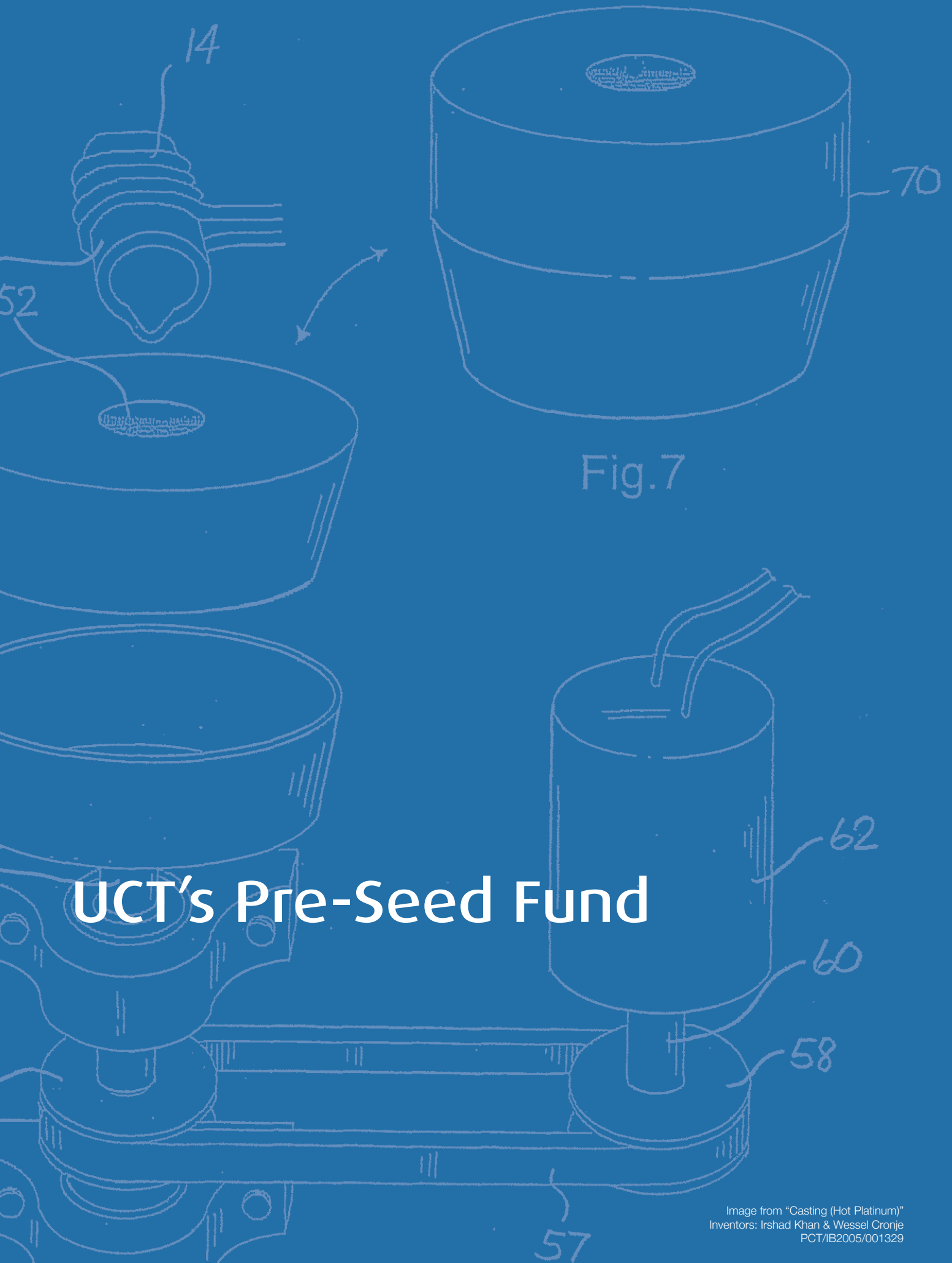


Fig.7

UCT's Pre-Seed Fund

Pre-Seed Fund Spurs on Innovation at UCT

A funding initiative, managed by Research Contracts & Intellectual Property Services (RCIPS) is helping nurture fledgling IP projects around the University. Established in 2008, the Pre-Seed Fund will by the end of 2010 have granted close to R1.5-million to several innovative researchers and helped turn good ideas into viable innovation projects.

RCIPS's Dr Andrew Bailey explains the Fund provides financial support for early stage development and aims to bridge the funding gap that exists in the innovation chain.

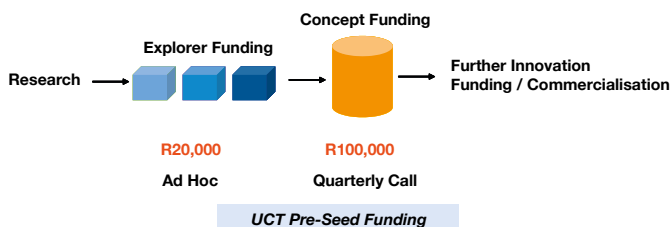
"Pre-Seed is there to help researchers at the point before traditional funding mechanisms, such as the Innovation Fund (now part of the Technology Innovation Agency) and venture capital, can be accessed. It gives researchers an opportunity to assess the potential for commercially viable IP, as well as an opportunity to accelerate research and technology transfer activities that support the commercialisation of IP," Bailey elaborates.

Whilst there have been several successful, or "useful" outcomes Bailey believes the full impact of the Pre-Seed Fund will only be seen when some of the larger projects successfully enter the next phase of the innovation chain.

Professor Jonathan Tapson, an assessor on the Fund's peer-review panel, maintains the projects funded demonstrated a significant capacity for commercially viable innovation.

"I have been amazed at the variety and creativity of proposals that have been put forward. I think that the presence of the fund is having a much wider effect than is measurable in the amount of funding and research output."

"It is sending a very clear message that UCT is serious about innovation, and willing to put some money down to make things happen. I hope that we are able to scale up the size of this initiative in the next few years," Tapson says.



UCT staff, as well as students who have a staff supervisor, are eligible to seek two levels of funding: namely **Explorer** and **Concept** funding from the R500,000 that is allocated annually.

Explorer Funding

Explorer funding of up to R20,000 is available for short projects of around four months duration. Typical activities funded in this category include market research, compilation of information destined for business plans, conducting detailed intellectual property and freedom to operate assessments, seeking expert

advice and the production of prototypes or samples. There are no specific deadlines for applications and proposals can be submitted at any stage of the year.

Concept Funding

Concept funding of up to R100,000 per project is available for longer-term projects. These funds are often used to refine or implement designs, conduct field studies and demonstrations, develop prototypes or samples, pilot projects and to further technology development. There are essentially quarterly calls and proposals are reviewed by an Advisory Committee.

For further information about Pre-seed funding visit the RCIPS website (www.rcips.uct.ac.za) and download the detailed criteria for the Pre-Seed Funding to ensure that your project qualifies.

Pre-Seed Project Highlights



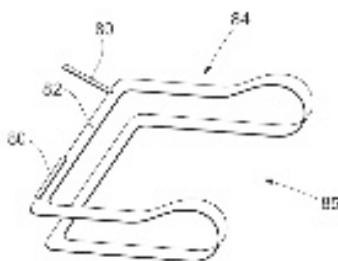
Dr Nick Kairinos is certainly a serial inventor. He had several inventions under his belt before becoming a Registrar in the Department of Plastic Surgery in Health Sciences and then making two further

inventions with patent applications filed through UCT. The first invention arose from his PhD research and relates to **Negative Pressure Wound Therapy**, a concept used to promote optimal wound healing through the application of a vacuum via a speciality dressing. This invention won him the 'Best Invention Award' from the Association of Plastic and Reconstructive Surgeons of Southern Africa (APRSSA) as well as third prize at the UCT Surgical Research Day.

Kairinos accessed Concept Funding to develop a first prototype of his unit, which incorporated innovation feedback control to regulate the level of vacuum applied. An initial animal trial was conducted and a great deal was learnt in terms of successfully running a trial and applying a dressing connected to tubing and a vacuum pump to a moving animal! The progress made using the Pre-Seed funding generated commercial interest, which resulted in the signing of an Option Agreement with a medical device start-up company.

The project has not been without its challenges! The Negative Pressure Wound Therapy space is heavily patented and hotly contested by rival competitors and although prior art searches had been performed, damaging prior art was found during the PCT stage and the patent application was abandoned. Problems were also encountered when using the minute pressure sensors that are embedded in the wound and required

for the feedback control system. This will be the scope of future investigation. It is anticipated that key IP will be created in this area, as currently there is nothing suitable on the market. A key requirement for commercialisation will be licensing to a firm that already manufactures a standard vacuum dressing product, so as to navigate the patent thicket.



Kairinos's other invention, the **'Lip Clip'**, has received similar accolades winning joint first prize at the 2008 APRSSA conference for 'Best Innovation'.

The Lip Clip is a simple device that can be applied to a torn lip by a doctor or plastic surgeon to facilitate the repair by suturing. The clip is applied with an applicator and effectively exsanguinates the area, preventing excessive bleeding, it improves the alignment of the tear and reduces the amount of anaesthetic that needs to be used (which often leads to additional distortion of the lip). The clips are intended to be disposable.

The other advantage is that the doctor can work un-assisted; typically this procedure would require the assistance of nurse to hold the lip whilst suturing is taking place. The procedure can also be conducted in less time than usual when using the clip.

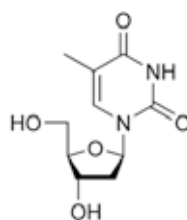
Explorer funding was used to develop three prototypes of the clip and two of the applicator and achieved successful proof of concept in a clinical environment. At this stage a commercial partner is being sought to take this invention into the market place. In the next phase of work the selection of the polymeric material used to produce the clip needs to be finalised and the applicator needs to be refined to make it appear less intimidating to patients!

A **TB Test Strip** invented by Prof. Keertan Dheda, for which a PCT patent application has been filed, will bring the possibility of rapid testing of pleural TB to the patient bed-side enabling the immediate prescription of appropriate medication.



Concept funding was successfully used to develop a preliminary prototype test-strip that performed well in trials. A spin-off company, Antrum Biotech (Pty) Ltd has been created to further develop and commercialise the IP. They have been successful in attracting Department of Trade and Industry SPII funding to pursue the next stage of prototype development which is nearing completion. Currently more significant funding is being raised to take the product through to market.

Thymidine is required for the production of the anti retroviral (ARV) AZT. A novel process was developed by Professor Roger Hunter in the Department of Chemistry, which is of interest to a new South African pharmaceutical start-up. Reagent substitution, optimisation and scale-up were required to determine whether the UCT process offered the desired economic advantage.



The Pre-Seed funding attracted co-investment by the pharmaceutical firm and this has been further leveraged by a THRIP application. The project had excellent outcomes, with the successful substitution of a cheaper solvent, with an expected increase in the yield and more importantly an easier final product isolation. All of these aspects will have a positive impact on process economics and the likelihood of commercial application. Unfortunately the company has been taken over by another firm and their interest in the technology has been diverted. UCT will be exploring other avenues for commercialisation.



Pre-Seed funding also allows one to assess a project from a different point of view to that considered during the research phase and to inform patenting strategy. Explorer funding was used

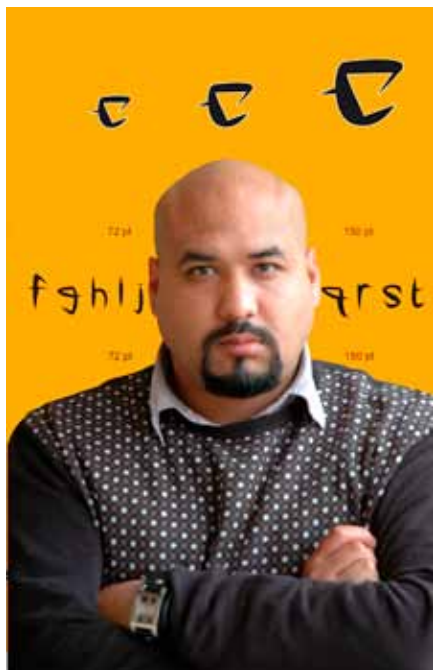
to appoint an external Biochemical Engineering consultant to evaluate the commercial feasibility of UCT's **Asphaltene Degradation** technology, developed by Prof. Stephanie Burton and Dr Caryn Fenner. Asphaltene is problematic when drilling for oil creating as it creates blockages and there would be a significant operational improvement if it were able to be removed.

Whilst the technology was proven in a laboratory environment there were concerns about whether the environment within oil wells was suitable for the growth of the microorganisms involved. There was also the practicality of generating the initial inoculum and potential regulatory issues with the large-scale release of a microorganism (especially one imported from another country) below ground. It was found that the oil well application was indeed unfeasible. Initially there was hope that asphaltene could be degraded in coal to improve the coal quality, but in testwork it was found that the coal itself was also degraded! But this feature opens up waste remediation opportunities which will be the focus of ongoing research. A South African patent application has been filed.

In another application, PreSeed funding has been used to debottleneck the creation of end products based on a patented **ultra-hard platinum alloy**. Provision of the specialist alloy has been constrained by the shortage of funds to purchase platinum for the 'pool' of material that is used and then recycled. The Explorer funding has enabled additional platinum to be purchased to increase the size of the pool and to alleviate the bottle-neck to some extent. The IP assessment has progressed positively with unique products already having been developed along with specialist insight into the handling of the novel alloy.



New Foundry a Font of New Ideas



In a history-steeped studio on the University of Cape Town's original Hiddingh campus on Orange Street, Kurt Campbell is challenging the notion that innovation is the domain of the hard sciences.

AUCT alumnus, Campbell is also challenging the historic hegemony of typeface and creating new fonts that are imbued with a sense of African and more particularly, South African, cultural heritage.

Now back at his alma mater as a lecturer in the New Media section, Kurt is grateful for the creative freedom academia gives him. Aside from his teaching responsibilities, he produces his own works of art and sculpture and has embarked on a crusade to create fonts that reflect the shapes and textures of the African continent.

"Although creating new fonts has a strong design element, I still see it as making art. It involves using tools that are commercial, but using them with a creative focus," he explains. Campbell has already meticulously researched and designed several new typefaces, whose very names embody his innovative quest for fonts with an African identity: Mapungubwe, Kaggen and Heirloom.

Mapungubwe's reference points are the contours of the famed gold foiled rhinoceros discovered during excavations of the 13th century settlement in Limpopo province. The figurine has become symbolic of the sophisticated civilisations that existed in Southern African centuries prior to colonisation. Kaggen alludes to the mythical Khoisan deity which took the form of a praying mantis and whose claws have inspired Campbell's design of this particular font.

Campbell describes his Heirloom font as "...visually undermining the idea of design categories and glyph evolution". While at first inspection the letters appear to have a distinctly European blackletter gothic origin, in fact they were constructed by only using the patterns and diamond shapes found on traditional Zulu headrests.

His font making also has a strong academic focus. He uses his knowledge and expertise in this field to further develop the existing curriculum, which until recently only focused strongly on the history of Western fonts.

This very Eurocentric approach prompted Campbell to shift his research. He investigated the roots of African fonts, charting the history of fonts on this continent.

"I really want to give a balanced view of the history of typography and writing systems to the students that include the crucial influence of African," he says.

He observes that while in recent times Postmodern and Postcolonial schools of thought challenged the dominance of Western and Eurocentric ideas in many academic disciplines, resulting in many curriculum overhauls, the status quo of typography had not been affected."

Campbell is in the process of establishing a font foundry – the Iron Age Font Foundry – that will serve as a repository for his creativity and also facilitate commercial application of the new fonts. "Part of the foundry's strategy is to create new avenues for the fonts to be taken up and used in a variety of ways – from corporate logos to signage and everything in between."

To establish the foundry and bring three fonts into a commercialisable format, Campbell accessed UCT's Pre-Seed funding that is administered by Research Contracts and IP Services (RCIPS).


Piet Barnard, Director: RCIPS, said that ***"it was pleasing to receive a proposal from the Humanities as the majority of the applications come from science or engineering. Kurt executed his project really well, made strong progress, and ended it on brief, on time and on budget!"***

It was actually the first of our Concept Fund projects to be completed and it provided a great deal of insight into the commercialisation of fonts, such as how to present them electronically as an interactive marketing tool, but preventing them from being copied, what they were typically sold for and the various business models used. The knowledge and infrastructure developed during this project has paved the way for Kurt and others to make use of the foundry as an outlet for their work. Kurt has already used the Mapungubwe font to develop

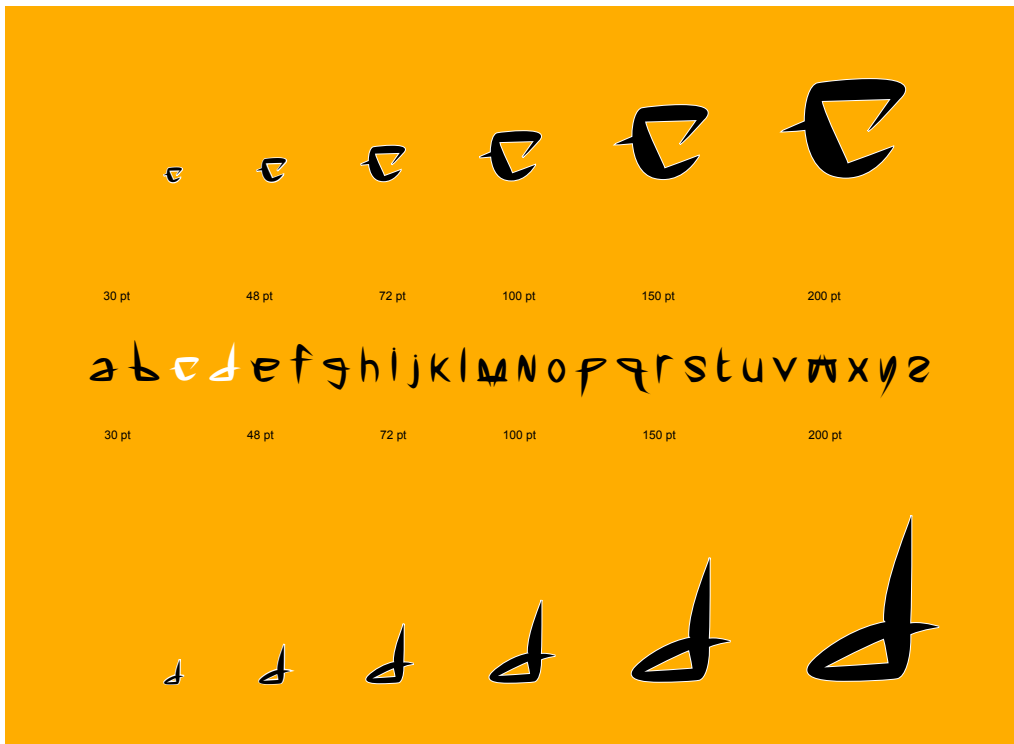
a logo for UCT's Africa Alive Corridors™ initiative and they will use this inherently African font in their publications.”

Aside from creating a platform from which new fonts can be launched, the Foundry has the potential to bring in a third stream of funding for our department, says Campbell, “For example in creating bursaries and increasing our academic resources.”

“Good fonts stem from in-depth research and a consideration of history and they must also be pleasing to the eye. Reading is an intimate act, a one-on-one experience that typography can uniquely exploit,” says Campbell.

“And with this in mind, the field of typography should continue to develop in increasingly sophisticated ways as a commercial tool, as well as a critical part of visual research in the Humanities.” 

For more information about the Iron Age Font Foundry contact kurt.campbell@uct.ac.za





Teaching Entrepreneurship and Innovation

A number of formal and informal courses, seminars and workshops are presented that educate students, postgraduates and staff on different aspects of entrepreneurship and innovation. Three core areas are profiled in this section: the Centre for Innovation and Entrepreneurship, at the Graduate School of Business; the Postgraduate diploma in Enterprise Management, in the Commerce Faculty and various programmes in the Department of Biomedical Engineering in Health Sciences. Highlights from the student business plan competition funded by the former Innovation Fund, National Innovation Competition (NIC) are included, as well as Information Systems' third and Honours year development project.

RCIPS runs a seminar series, generally presented by external experts, that covers aspects ranging from intellectual property protection and management through to tax issues and the responsibilities and requirements as a director of a company in terms of King III. Additionally, workshops are facilitated in business plan writing or around innovation, such as a

recent one on Market Driven Innovation – Turning Ideas into Sustainable Businesses.

A more student-oriented seminar series uses recorded sessions from the 'Big Idea' workshops, followed by a Q&A session, interspersed with live presentations from seasoned entrepreneurs – learning from their real-life experiences. This is coordinated through a Vula site (Entrepreneurs at UCT) and currently there are in excess of 280 members subscribed.

Professors Jonathan Blackburn and Sue Harrison ran a successful MSc level course in Bioentrepreneurship in 2009. This even drew participants who were not in the core biotechnology space. Dr Mike Herrington and JP Kloppers present undergraduate course in New Venture Creation to most of the final year students in the Engineering departments and several in the Faculty of Science. Business planning, understanding innovation and entrepreneurship is also finding its way into a number of courses, such as in chemistry and information science.

The UCT Centre for Innovation & Entrepreneurship (CIE)



a large part of our activities on putting together programmes which will assist in the training and development of South African entrepreneurs. This is done through meaningful interactions with entrepreneurs and involving students in actual entrepreneurial projects which provide an experiential learning process.”

“Because many new ventures include, and are often started by non-business people, the approach is to create a collaborative classroom environment with students contributing different talents to the entrepreneurial table. They learn how to identify opportunities, make a plan, launch a venture, grow a business and harvest it,” Herrington adds.

The Centre is engaged in teaching at several levels: at the MBA level; at the corporate level through the Customised Academic Learning programmes; at the undergraduate level in various UCT faculties; at the school-leaver level through its Raymond Ackerman Academy; and at the community level for SMMEs in the Western Cape.

“At every level of engagement students are presented with the opportunity to develop and refine their critical thinking skills, especially as it pertains to building strong innovation and entrepreneurship capability within a South African context,” explains Herrington.

The entrepreneurship courses delivered by the Centre are closely integrated with new venture activity in the local business and investment communities. Herrington clarifies that the intention is not to compete with incubators or other business promotion projects, but to seek mutually beneficial partnerships with the most successful of these.

“The Centre is involved both in high-value-added and high-potential new ventures, as well as in township and other community-based enterprises. Since its establishment, the Centre has assisted over 100 township enterprises by providing practical business advice

Since its establishment almost a decade ago, the UCT Centre for Innovation & Entrepreneurship (CIE) has been making a national contribution towards enhancing innovative and entrepreneurial capacity in South African.



Based in the Graduate School of Business, the CIE combines its research with teaching and material development, as well as with business creation and other small development initiatives.

CIE Director, Dr Mike Herrington, explains that the Centre aims to deliver quality entrepreneurship education to all levels of society encompassing postgraduates, undergraduates and school leavers.

“Our philosophy of entrepreneurship education is that to be effective, it must be practical.” Herrington explains. “In line with the overall strategy of the Graduate School of Business, we focus

and access to finance and training, with the objective of enabling them to become independent, sustainable businesses with greater potential for expansion,” he says.

The Centre is also involved in numerous other activities including:

- research that aims to develop a better understanding of the capacities and needs of all the different categories of entrepreneurs in South Africa so that advisory services and finance can be more precisely targeted;
- advising academics on the commercialisation of their intellectual property;
- assembling a group of high-profile entrepreneurs in the Western Cape in order to finance and assist high-growth business ventures; and
- assisting large companies in nurturing innovative and entrepreneurial behaviour in their organisations.

Herrington believes entrepreneurship is critical in securing South Africa’s economic future as, is the case in most developing countries where SMMEs provide the majority of new jobs and are vital to the continuing growth and success of any economy.

“Entrepreneurship lies behind the development and start-up of SMMEs, especially in South Africa. SMME development is of critical importance as it helps to create more jobs thereby reducing the severity of other socio-economic issues, such as unemployment and crime.”

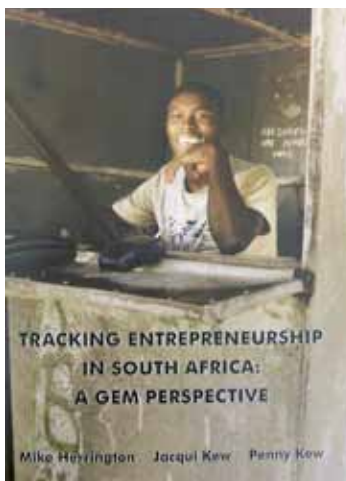
The CIE is regarded as one of the country’s top entrepreneurship institutions, with UCT’s GSB’s entrepreneurship courses rated first in the country in the 2006 and 2008 Financial Mail Report. It also considered a leading authority on SMME development in South Africa.

Researching Entrepreneurship in SA

One of the CIE’s pillars is research in the broad area of entrepreneurship. Its flagship research project is the South African edition of the Global Entrepreneurship Monitor (GEM) undertaken annually for the last nine years. The GEM report aims to compare countries in terms of their entrepreneurial activity, establish what factors and policies encourage entrepreneurship and determine whether the rate of entrepreneurship in a country affects national economic growth.

Considered to be the most prestigious, comprehensive and authoritative

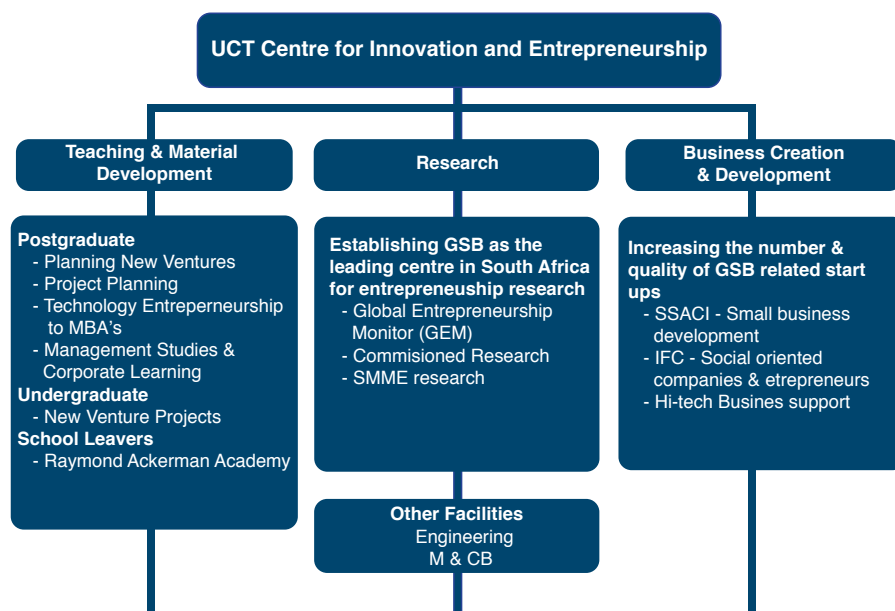
longitudinal study on entrepreneurship in the World, GEM is a multi-national study involving over 60 countries. It was started in 1997 by academics at the London Business School and Babson College in the USA.



“CIE staff are currently conducting the research in preparation for the tenth edition which will once again benchmark South Africa on a globally standardised entrepreneurship scale. In addition, localised research is undertaken each year into various aspects of entrepreneurship and small business management within the South African context,” said Mike Herrington.



“The outcomes influence many government policies in a number of countries, and our South African GEM report is now being used by parts of government to formulate small, medium and micro-enterprise policy in our country,” says Herrington. **i**



Postgraduate Diploma in Entrepreneurship



Discussing the entrepreneurial mind-set, UCT academic David Priilaid explains that while certain environmental and structural forces adversely impact our country's ability to encourage entrepreneurship, other issues run deeper and are fundamentally existential in nature.

As programme co-ordinator of the Commerce Faculty's Postgraduate Diploma in Entrepreneurship, Priilaid has dedicated a large portion of his academic career to understanding what it takes to nurture an entrepreneurial mind-set and to translate this into a curriculum.

He maintains that, "The main existential issues that govern people's ability to be entrepreneurial include understanding what it takes to do what one truly loves and how in the pursuit of happiness one needs to draw on an inner resilience during the hard times, to face down the pain of adversity and possible failure and then to start again".

In a soon-to-be published book which dissects the entrepreneurial spirit, Priilaid presents the argument that the creative mind-set can be broken up into a number of inter-related components. *Inter alia* these components include rediscovering the inner child, drawing on the power that is inherent in being an "outsider", and tapping into the artistic imagination.

Although these concepts are hardly ever discussed in the conventional literature on the entrepreneurial mind-set – which usually focuses on operational

requirements – he believes a person's ability to embrace these more personal aspects will be a key determinant of their success as an entrepreneur.

Priilaid dedicates a great deal of his teaching time to getting his students to understand and integrate these concepts. In doing so they can begin to imagine the unimaginable, take considered risks and learn to manage success as well as failure.

He has been involved in teaching entrepreneurship since 1995, two years after the programme's inception. Originally named the Postgraduate Diploma in Organisational Management, it underwent name change to Postgraduate Diploma in Enterprise Management (PDEM) before adopting its current title in 2010.

Priilaid believes the name change truly reflects the current position of the programme. "It has become a flagship for creative and collaborative teaching, and sets the benchmark for entrepreneurship education in South Africa," he maintains.

The change in name also reflects the escalating shifts in globalization where innovative business models, strategies and products have fuelled collaborative and competitive efforts across the value chain. Over the last decade the advance of Brazil, Russia, India and China, the "BRIC" countries into the digital global economy has doubled the number of skilled white collar workers from 150 million to over 300 million.

In this kind of environment, it can no longer be 'business as usual' says Priilaid and he points to the fact that only a minority of Fortune 500 companies have survived the last half century. The relentless force of change has swept dinosaur-firms aside – and today surviving companies are desperate to reconfigure into the next decade.

"Thus our students need to understand that the old rules no longer apply, and in order to survive we have to innovate" he says. "This is not easy because creativity and innovation are very difficult to propagate and harness and remain beyond the

grasp of most management models today. While entrepreneurship is so sexy today, acquiring the ability to innovate is thus the most critical skill we wish to impart on the PDEM graduate. We want our students to understand what it takes to be innovative and have the ability to apply creativity and passion across functional boundaries,” says Priilaid.

The PDEM, as it is now called, is an experiential learning programme that is widely regarded as a national leader in entrepreneurship education. Priilaid believes the highly-coveted, one-year diploma's reputation is due to its innovative curriculum that equips young graduates with the requisite skills for today's challenging business environment.

He explains that since its formative years a central focus has primarily been on an action-learning based approach in which in groups of six or seven students start up, and run, their own businesses for the duration of the academic year.

“The core thrust of the diploma challenges the orthodox view that entrepreneurship is mostly about spread sheets and cash flow projections. Instead our programme encourages students to see themselves as change-agents, artists, creators, and visionaries,” Priilaid elaborates.

The programme's originator, Professor Piet Human, was a firm believer in the principle of “learning by doing”, recalls Priilaid. “It was agreed that the programme would include a real-life action-learning project called ‘Genesis’, whereby students start up and run their own businesses in groups of six or seven students.”

The Genesis Project runs parallel to the year's requisite theoretical coursework and serves as a virtual ‘laboratory’ in which students apply acquired theory to the businesses they run.”

“Even at the outset, these are real, not virtual, businesses, involving real money,” Priilaid emphasises. “Through this process students come to locate their authentic inner voices, learn to be proactive, and begin to take on the practice of artistry, inter-alia. These are all constituent parts of the entrepreneurial mind-set, a construct better ‘discovered’ than taught.” he maintains.

The groups of students have to come up with their own business concept and put it into action. This involves sourcing their



own start-up capital – either through the local Standard Bank – who underwrites loan amounts up to the value for R2000, or through their own fundraising activities.

One fundraising activity that all PDE students have to undertake is a biannual “cake sale” which illustrates Priilaid's philosophy behind entrepreneurship.

Here student groups must sell some form of confectionary in order to see how much money they can make in a week. They have to decide whether their product will be value-driven, such as high quality chocolate cake, or a volume-driven, like popcorn. The choice is up to them.

The results can be fascinating, and not just in monetary terms says Priilaid, who adds that the record so far has been R10 000 in a week.

“The student groups observe each other closely during this process and the second cake sale that takes place later in the year sees some groups change tactics to try and mimic the success

stories of the first sale,” he says.

“With the repeat exercise it often happens that the groups that initially did well are less successful second time around. It is an object lesson in learning not to become complacent and in appreciating that the different variables that contribute to success cannot be controlled for at all times. Sometimes success is due to luck – the so-called black-swan phenomenon” he explains.

Although just an exercise, the cake sales also generate funding for each student enterprise to fund prototype production, and sales costs further down the line. This year some particularly innovative products include shoes that can be easily folded up, a satchel that converts into a sling bag and slip-on sneakers that are hand-painted.

The most successful groups of 2010 have by far exceeded the profit-records set by previous Genesis groups to date. One such group, Wing-It, sold South African-branded car mirror socks just prior to the



some employers now recruit directly from the programme.

“The programme was specifically designed to improve student confidence, knowledge and ability, and to demonstrate that collaboration and teamwork are effective ways of getting the job done. Our graduates are working in different industries all over the world. They can think on their feet, work well with each other and apply their knowledge in almost any situation,” Prilaid concludes. **i**

World Cup and made R190 000, while another group whose watches had to be manufactured in the East have netted R137 000. This group, Time Factory, aim on reaching an impressive R200 000 in sales by year-end.

“Individually these groups sales are more than double that of last year’s winning team,” Prilaid states proudly. A great deal of input is sought from a host of Genesis participants including lecturers, facilitators, and volunteer business people, including past graduates from the programme. Most importantly there is a lot of learning that transpires between the students themselves. “The resulting learning process is as much about heart as it is about technique, as the collaborative learning process progresses through the year.”

He maintains the practical environment of the Genesis Project gives students a place to take “safe risks” and an opportunity to channel valuable lessons back into the learning process.

Prilaid explains that as students apply their course-work theories to the practice of running their own businesses, mistakes are inevitably made. Rather than making this a shameful experience he says, mistakes are welcomed! “In the process of getting it wrong, students are encouraged to interrogate their mistakes and reconfigure their working constructs so as to improve on the next iteration of action,” he says.

As the programme’s reputation has grown, successful students are quickly employed in just about every organisational sector imaginable and

Innovative Health Sciences Programme Addresses Healthcare Delivery Challenges



South Africa's under-resourced healthcare sector's pressing need for improved performance with regard to health facilities and healthcare technologies is being addressed by an academic programme offered in the Health Sciences Faculty.

This comes against a global background of increasing acceptance that proper planning, assessment, acquisition and utilisation of technologies and physical infrastructure are essential elements of accessible, affordable, effective, equitable and quality healthcare service delivery. The local urgency is underlined by the discussion around the National Health Insurance and the accompanying imperatives for stewardship, efficiency and sustainability.

Based within the Division of Biomedical Engineering in the Department of Human Biology, the Healthcare Technology Management (HTM) Programme aims to build institutional capacity and provide evidence-based tools to support decision-makers, says programme director Mladen Poluta.

HTM is an emerging multi-disciplinary field of study, in both resource-rich and resource-poor countries. UCT's HTM Programme offers a unique mix of capacity-building opportunities, from individual courses to Postgraduate Diploma and research-degree options, and is accessible to a wide range of professionals and practitioners.

According to Poluta, "whatever the practitioner's background, our programme will enrich their skills base and open doors for exciting new career opportunities." The programme will be further enhanced with new continuing professional development (CPD) initiatives in 2011, to be offered in partnership with national, regional and international partners. Other areas of available expertise within the HTM programme include health technology assessment, health economics, clinical- and hospital engineering, physical asset management, e-Health, lean thinking and performance benchmarking.

A biomedical engineer by training, Poluta initiated the programme 10 years ago in response to the needs and challenges faced by the Sub-Saharan Region, in particular. "Developing countries, and especially those in our Region, face the double burden of inadequate investment in public sector healthcare infrastructure and technologies on the one hand, and a chronic lack of management and maintenance capacity on the other."

"The latter manifests in typical scenarios where more than half of the medical equipment asset base is not functional, and where poorly-maintained health facilities cannot provide a safe and amenable environment for healthcare and healing. While we recognise the shortage of health workers as the most pressing issue facing our health systems, the role of infrastructure and technologies in health system performance has been neglected, and this impacts negatively on



borne fruit and several innovations have been triggered by the NU-UCT collaboration. These include assistive technologies for Kangaroo mother (skin-to-skin) care of premature infants, digital X-Ray imaging at the primary level of care and point-of-care rapid diagnostics for HIV and TB.

The former has generated an innovative bilirubin blanket, an apnoea monitor and a pulse oximeter, all optimised for the skin-to-skin setting. The bili-blanket, as it is commonly called, is a portable phototherapy device for the treatment of neonatal jaundice while the apnoea monitor detects cessation of breathing activity in the infant which otherwise may go undetected, especially if the mother is drowsy or asleep. The pulse oximeter checks on the respiration and oxygenation levels and circulation of the neonate.



These devices have the potential to reduce neonatal mortality and morbidity, especially in resource-poor settings. Interestingly, research being done by Poluta's colleagues is showing the psychosocial benefits of skin-to-skin care for both infant and mother; in other words, says Poluta, "skin-to-skin is not a poor second to conventional practice whereby premature infants at risk are placed inside an incubator, surrounded by monitoring devices; it may well be that skin-to-skin care provides better outcomes in resource-rich settings too."

"We've also installed a digital X-Ray imaging system at the Crossroads CHC (Community Health Centre) and are using the site as a rich pilot environment to assess different scenarios to support replication of similar solutions elsewhere. More than 60% of poor people worldwide do not have access to basic medical imaging, and this project aims to assist in addressing this great need," Poluta continues. A dimension that has been added to the project in 2010 is consideration of the social responsiveness and impact of such technologies in a primary healthcare context, thus addressing a central tenet of the comprehensive primary healthcare approach which calls for community participation in decisions around healthcare service delivery and the technologies deployed.

"Other devices that have emerged from the collaboration with Northwestern University include the redesign and testing of a versatile patient transporter, in association with a local supplier of assistive and rehabilitation aids; this transporter facilitates transfer of injured people or patients in informal settlements

coverage, quality and safety of healthcare services," he says.

According to Poluta, UCT's programme is unique in that covers the full spectrum of Assessment, Innovation and Management (AIM) of Healthcare Infrastructure and Technologies (HIT), with a focus on under-resourced healthcare environments.

"The need for a comprehensive and integrated programme was reinforced at the First Global Forum on Medical Devices, held recently in Bangkok. The institutional danger of dealing with these issues in the traditional silo-fashion is being recognised.

The HTM Programme has existing collaborative partnerships with the CSIR, Northwestern University (USA) and Brunel University (UK), with others in the pipeline. Through these partnerships, the programme has access to local and global experts in the areas of health facility planning, design and assessment; airborne-infection control; medical device- and health technology innovation,

and healthcare process modelling and simulation.

A key aspect of this collaboration is a programme, facilitated by Poluta, whereby Biomedical Engineering students from Northwestern University (NU) in the USA spend time in local health facilities (both urban and rural) to better understand the practical requirements of medical teams and patients, as well as the challenges faced in technology adoption and deployment.

Poluta explains this programme's objectives as two-fold: "Firstly the experience provides the NU students with an opportunity to experience the needs, realities and constraints of resource-poor environments in the context of health technology innovation. Secondly it gives local health workers a chance to work together with NU in developing appropriate, affordable and sustainable medical devices and other healthcare technologies that meet local and regional needs".

This 'win-win' collaboration has

and rural areas from their homes to local health facilities across challenging terrain, or to a road accessible by ambulances. The NU students have also designed and built a Pelvic Examination Simulator to assist in the training of health workers, specifically palpation as part of an internal, physical examination of the female pelvic organs. The simulator measures the pressure applied at various locations within the pelvic cavity and provides feedback to the trainee in the event of excessive pressure being applied.

One of the NU collaborators, Professor David Kelso, is currently in the process of setting up a foundation which will serve as a medical device innovation delivery and technology transfer vehicle. Technologies that will be fed through this route include low-cost point-of-care rapid diagnostics for HIV and TB being developed by Kelso and colleagues.


The courses run under the NU-UCT collaboration include Health and Community Development (HCD), Health Technologies for Resource-Poor Environments (HTRPE), Healthcare Technology Assessment and Planning (HTAP), and Health Technology Innovation and Design (HTID).

The first introduces health systems in the context of the global, regional and local disease burdens and the role of technologies in facilitating and supporting health and wellness, with special emphasis on developing countries. The HTRPE course unpacks the special needs of resource-poor environments and identifies criteria - such as accessibility, affordability, acceptability and availability - that healthcare technologies should meet in such environments. The HTAP course considers, inter alia, the processes and systems responsible for assessment and planning of technologies and devices as part of healthcare delivery, and explores interventions and solutions for strengthening these in support of safer, efficient, equitable and sustainable service delivery at all levels of care, including home-based care. Finally the HTID course - with major input from NU faculty - provides biomedical engineering students with evidence-based insights and some of the generic skills needed for successful technology innovation.

These courses are complemented by a course on Medical Device Innovation and Entrepreneurship offered to students in UCT's HTM programme. This course, according to Poluta, offers participants a greater understanding of innovation models, product development and new product management, as well as how to



handle product failure. Students on this course are introduced to medical devices and their classification, how to undertake healthcare needs assessment and to identify the enabling environment required for successful technology innovation. This course is currently being repackaged to support the local medical device innovation industry, in partnership with the Medical Devices to Market (md2m) Centre of Excellence of the Technology Innovation Agency, and the Medical Research Council which has recently established a National Medical Device Innovation Platform, the latter serving to promote innovation-related activities and collaboration amongst tertiary institutions in South Africa.

“At the end of the day, these projects, collaborations and programmes serve to facilitate, support and strengthen improved health system performance, especially in resource-poor environments. It should also not be forgotten that innovations that grow out of specific, resource-poor settings might well have applicability in other, better-resourced settings,” Poluta continues. 



UCT Students Come Up with the Next “Big Idea” at SA Innovation Competition



Two 2010 UCT Student Business Plans Rank in Top 10 Nationally

Dr Siphso Mfolozi of UCT's Division of Forensic Medicine placed second at the finals of the 2010 National Innovation Competition for his invention that will help forensic pathologists determine a body's time of death. The R200,000 in prize money that he was awarded will partially go to his Department to further research, with the remainder going directly into development and commercialisation of his forensic device.

While Mfolozi's "NecroChronometer" is still in the early stages of development a provisional patent has been applied for and it looks set to become a stock forensic tool. He and his invention were ranked first in the UCT institutional phase – a precursor to his national award.

Other UCT inventions put through to this year's national finals included "Uncontained", an innovative eco-friendly housing solution and "Dry Bath™", a creative substitute for a conventional bath, which also placed in the top ten finalists.

Invented by Ludwick Marishane of the student company Headboy Industries, DryBath™ ranked third in the institutional phase of the competition, while Uncontained, invented by Justin Beswick, was ranked second.

DryBath™ addresses the problem of access to water and is designed especially for homeless people and those in refugee camps, as well as hikers – in fact for anyone living in a water-scarce environment, particularly where there may be health-related issues associated with personal hygiene. HeadBoy Industries is currently undertaking

From 'waterless' baths and fleet vehicle tracking systems to a device for gauging a corpse's time of death, UCT students are demonstrating their inventive natures and entrepreneurial prowess across the spectrum of human endeavour.



Fascinating, inventive – and sometimes verging on the bizarre – students have come up with not just brilliantly clever concepts, products and services, but with tangible plans for getting them into the market place as illustrated by their submissions to the biannual Innovation Fund's Student Business Plan Competition.

The Student Business Plan Competition forms part of the National Innovation



Competition, run by the Innovation Fund (now absorbed into the Technology Innovation Agency) with the aim of stimulating technological innovation at university student level, through both internal and external competition with other tertiary institutions.

There is generally stiff competition amongst student teams for an institutional first prize of R50,000. The competition comprises two phases: firstly a university-wide competition; and secondly the national competition which comprises the top three finalists from participating universities, competing for the grand prize of R300,000.

The Expo held in conjunction with the national awards ceremony provides excellent exposure for the top businesses. Judges for both competitions include experts in licensing, technology transfer and commercialisation, and all have expertise in evaluating business plans and proposals.

The UCT leg of the competition is administered by Dr Andrew Bailey of UCT's Research Contracts & Intellectual Property Services (RCIPS) and is open to teams and individuals comprising registered students under 35-years.

Submissions can represent any technological sector or academic stream, but there are minimum entry criteria. Entry requirements include: demonstrable proof of the concept, or evidence that achieving this proof is in process; presence of technological innovation; and

allergenicity testing prior to getting their product to market. They are also sourcing funding to manufacture the first large batch of their product.

Uncontained designs and maintains modular eco-friendly housing units for private accommodation or corporate use, and can quickly be assembled. The one- to three-roomed units exemplify environmentally friendly living by converting solar power into energy, recycling rainwater, using environmentally friendly building materials all of which express minimal impacts on the environment.

As the units do not have to connect to the energy grid they are able to be placed in locations that would usually be uninhabitable.

What has Happened to Winners from Previous Years?

Devin De Vries - WhereIsMyTransport? (UCT Winner 2007)



Using live tracking information in combination with operator schedules, WhereIsMyTransport? enables commuters to accurately plan trips by receiving up-to-date predictive information about arrival

times and transport routes via sms or a web-based application.

A twist of fate sowed the seed for the idea. One of team members missed a test when his bus did not arrive on time. Together the teammates decided to try and prevent this situation from happening to others, and came up with the concept that has seen several international buyers bidding for rights to the system.

WhereIsMyTransport? services are currently being put into operation by the University of Cape Town's Jammie Shuttle service. "With a little luck the system will be operational for the students by the end of the first quarter of next year. We are currently in the process of drafting agreements for the University to review and awaiting the green light," he says.

De Vries says that as more modes of public transport utilise their system, their services can collaborate better, improving the quality of information available to a commuter. "Through these innovative services, WhereIsMyTransport? aims to bring South African public transport up to first world standards and beyond," he says.

"We focus our efforts on customisation, providing end-to-end solutions tailored specifically for public transport. In doing this, WhereIsMyTransport? offers information system designs to a competitively wider range of public transport service solutions, and even private shuttle services. These various products integrate seamlessly to solve the problem of a truly integrated urban transport mix," De Vries explains.

Since its inception in UCT's Information Systems Department, when De Vries and some of his fellow classmates called themselves "Team Smile", WhereIsMyTransport? has won a host of local and international accolades. These awards include winning the British Telecom Innovation Accelerator Award, receiving second place in the SA Technium Challenge, and being named one of the top 12 finalists in the Worldwide Software Design Competition which boasts over one million contestants. De Vries and his "Team Smile" members (see page 50) also walked off with South Africa's top student innovation award in 2008 after winning the international Microsoft Imagine Cup in 2007.

The company was incorporated in 2008 with De Vries as the CEO. He says the entire experience has been a dream come true. "Starting a business is an adventure! It forces you to adapt and learn quickly. Along with this come many stresses, as well as joy, as you make the many little conquests along the way. Starting a business requires patience, as things seldom happen when – and how – you plan. Lastly, doing it with the right team is key. Having the right mix helps keep everyone focused and on top of their game."

evidence of financial viability.

Dr Bailey said the 2009 competition was once again popular with students, and that there was a considerable increase in the number of entries compared to the previous 2007 competition, with 25 business plans submitted involving 70 students. "A remarkable aspect of this year's entries was they included several existing UCT student businesses which had proven track records," he said.

"The RCIPS office facilitates workshops to assist students with the development of their 10-page Business Plans and is only too happy to give advice and guidance to budding entrepreneurs," he said.

This year Dr Mike Herrington, Director of the UCT Graduate School of Business Centre for Entrepreneurship, presented workshops on Business Plan Writing which were attended by over 90 students, while "One-on-Team" sessions were held to help teams polish their draft business plans.

Dr Bailey observed that students generally came up with innovative ideas, but that some struggled to articulate their ideas and translate them into business plans. "In future it may be more constructive to screen student's ideas earlier on in the competition and then devote more time to coaching teams to ensure the development of more carefully thought-through and well-rounded business plans."

The next competition takes place in 2012 and students interested in finding out more about it should visit the Competitions page on the RCIPS website (www.rcips.uct.ac.za) 

He is very appreciative of the advice and guidance offered by his former Information System lecturers and the RCIPS office. "Firstly the lecturers and mentors of the IS programme are an amazing team, and an inspiration to every student who has the opportunity to come through that department. It was without a doubt their guidance which made it possible for our team to formulate such a well put together project."

"RCIPS was instrumental in planting the thought that this project could be more than just that, by providing the competition platform, namely the national innovation competition, to explore this option," he adds.

Jean-Claude Malengret, itracklive (2005 UCT Finalist)

Inventors Jean-Claude Malengret, Richard Parry and Tristan Phillips won third place at the 2005 NIC for their Next Generation Personal Tracking Device, which formed the nucleus of a company that is still thriving today (www.itracklive.co.za/). The device allows a user to track anything via the Internet using a cell phone. Users can SMS or log on to the device via the Internet and retrieve its location, speed, altitude, inclination and numerous other readings. Applications range from fleet management to protection of solar panels (which send an alert when their inclination changes indicating damage or theft).

More recently, the product has been tailored for athletes such as runners, cyclists and canoeists. Called i-Track Sport, it also has an inbuilt global positioning system with memory and an interface to a personal computer. The software also analyses sportspeoples' top and average speeds and other performance-related factors.

Clive Garcin - African Biological Extracts (UCT Winner 2004, 2nd Place Nationally)

Now a postdoctoral student in the Chemical Engineering Department, Clive Garcin won the Innovation Fund's Student Business Plan Competition as a PhD student in 2004, with his entry which detailed a commercialisable method of reclaiming water and recovering valuable antioxidants from the salt water in which olives are cured.

The nano-filtration system he uses works on the basis of molecular separation. In addition to being able to separate out the antioxidants, he was able to also reclaim the water from this process – removing the salt and organic pollutants enabling the water to be recycled and reused again in the curing process.

Six years down the line Dr Garcin is spinning out a company, African Biological Extracts, which is up-scaling his nano-filtration technology for initial trials on an olive farm outside of Wellington in the Western Cape.

"The innovation lies in extracting a substance of value – the antioxidants – to offset the cost of recovery of purified water for the purpose of recycling," explains Garcin. The antioxidants will be sold to the cosmetics and pharmaceutical industries as well as the food and beverage industry.



Information Systems Projects Prime Students to Become Innovators of the Future



Students in UCT's Information Systems (IS) Department have a well-deserved reputation for innovation and entrepreneurship and annually take home some of the top national and international student business awards.

IS students at UCT get a head-start in their careers thanks to the experience they gain participating in projects during their third and honours years which are aimed at developing system solutions for real-life business and organisational problems.

Every year lecturers in the department take on the role of project managing several teams of students. "There's lots of expertise and a great deal of sharing of knowledge, which has always been the ethos of this department," says senior lecturer Elsje Scott.

Elsje joined the department in 2000 and soon realised that students needed additional technical knowledge related to programming. Over time she and her colleagues have built upon the department's tradition for running project-based, experiential learning programmes and currently run projects for the third year and assist with the honours projects which help students become

more innovative programmers and also cultivate their entrepreneurial natures.

These projects involve off-campus organisations and businesses that face a business-related problem that can be addressed by developing appropriate software. Students seek out companies that are in need of their services and develop the necessary systems.

In third year the programming project takes the form of two pilot projects during the first semester. During the first pilot, which is generally very technical in nature, students receive hands-on help from their project managers and other lecturers. The second pilot involves a detachment phase in which students work more independently without the constant input of their project manager or lecturer. Scott explains the pilots are run concurrently during the initial stages of the project for industry. "The rationale being to enhance students' technical skills and better prepare them for the development stage of the final project which commences in June," she says.

The third-year Systems Development Project is for students majoring in Information Systems (IS) and is designed to give students first-hand experience of the management issues and complexities of running a real-world system development project. While learning the practicalities of project management, the students find out more about the user requirements of their clients.

"The theoretical parts of this course introduce the student to the important aspects of managing projects and people in the ICT Project environment. It also equips the student with crucial problem-solving skills using object-oriented techniques, and endeavours to improve technical document writing skills," Scott explains.

"This capstone programme facilitates the development of important core competencies which are nurtured within a complex, interactive project environment and which requires students to work in teams in a process that includes carefully designed interventions and reflection points."

"The whole process underlines the importance of coherent practise and serves to pull all the strands of knowledge and practise together, helping students integrate and deepen their understanding," she adds.

"Students experience the subtleties and complexities of interacting with users in actual organisations. An important benefit is that students gain valuable experience of working in teams and realise the challenges that this entails. **These projects are an excellent way of helping students to integrate theoretical knowledge with deliverables and leads to the creation of business case studies and user requirement documents.**"

The philosophy behind both the third and fourth year projects is explained by Scott's colleague and fellow IS senior lecturer, Kosheek Sewchurran. "Aside from trying to instil an appreciation of the notion of life-long learning in our students, we aim to nurture specific graduate attributes which will stand them in good stead in the world of work."

Scott and Sewchurran believe a key attribute is the ability to be reflexive. "We therefore spend a great deal of time helping students to appreciate their own unique interpretation patterns and how they can employ some core theories to understand these patterns," says Sewchurran.

"These projects represent a huge learning curve for our students. It is an intensive process, but it informs the basis of coherent practise and teaches students to refine and improve on aspects of programming. Students come away with excellent experience and gain much more confidence in their abilities and in how they handle themselves in professional situations," Scott adds. Such has been the success of this UCT initiative that business now approaches the IS department directly so that students can tender for particular projects.

Sewchurran points to the fact that the artificial sciences such as IS, economics and accountancy have always tended to present subject theory that is based on the implicit notion that there are specific rules that govern a great number of variables. However he points out

Student Innovators Score with Imaginative Information Systems

UCT information system students are showing that not only can they compete with the best young programming minds in South Africa, but can hold their own against their international competitors in what has been dubbed the world's premier student technology competition.

Teams of UCT students have a history of being named finalists in the annual Microsoft Imagine Cup and its associated Project Firefly competitions, with novel programmes that help not-for-profit organisations bridge the digital divide by creating innovative system solutions to problems that beset businesses and other organisations.

The Microsoft competitions aim to promote a culture of innovation among young programmers by encouraging them to research and develop new programmes. More specifically students must demonstrate a comprehensive knowledge of programming and of the science of developing and maintaining efficient, functional IT systems that can seamlessly be applied in real-world organisational settings.

This year's Imagine Cup SA 2010 Local Finals will be held in early December. If history does indeed repeat itself, look out for a strong UCT presence.

2009

Bag making problems unEARTHED

The 2009 award for Design Development was won by the UCT team "unEARTHED", who devised a system to automate and manage some of the processes within the company Mielie, who produce unique hand-crafted "hooked-rug" bags using reclaimed and recycled materials.

The team of Information Systems students developed a centralised database to enable Mielie to better manage employee, customer, supplier and community project information.

Have Starfish, will travel

The 2009 second place for Software Design went to the UCT team who devised a public transport ticketing and revenue system that uses contactless cards and readers that enable cashless payment for public transport. Entitled the "Starfish" system, the system is web-based and allows for multiple transport operators to manage all aspects of the ticketing process, including pricing, special cost packages and customer accounts.

Commuters also stand to benefit from the system by being able to pay for multiple forms of transport using just one Starfish card.

2008

Commuter information system wins international honours

Team Smile achieved international recognition in 2008 by winning the Imagine Cup 2008 at the Musée du Louvre, after competing against fellow finalists selected from a pool of more than 200 000 students from over 100 countries.

Devin de Vries, Christopher King, Nabeel Nazeer and Nadeem Isaacs developed innovation to enhance the lives of bus commuters using SMS technology, winning a trip to California's famous Silicon Valley to further develop their "Where is my Shuttle?" concept which was initially devised for UCT students to use SMSs to query the arrival and departure times of buses.

Over an intensive two week period, the team were mentored and helped to develop their designs and viable business plans, with close guidance from some of the best minds at Microsoft and a leading US technology transfer company, Business Development for Emerging Technologies.

Team Smile went on to win UCT's stage of the NIC Student Business Plan

that what has not been factored in in the teaching of these subjects is an explanation of human behaviour, creating many assumptions that are flawed.

What the projects do, he explains makes students aware of how fragile understanding is and this makes students more conscious of listening and establishing meaning. They thus become more conscious that while goals are necessary they have to be agile enough to negotiate the unpredictability of human nature”

Students are given specific readings that elucidate these issues and are then expected to write and present reflexive essays in which they relate the lessons they learnt during the completion of the project.


It is at this point that students often experience “lift off”, reports Scott. Both academics believe the experience primes students for a life-long learning journey and they have seen student become more innovative and are able to better interpret theory.

Student showcase their projects and their associated systems at an annual expo held in UCT’s Jameson Hall. Scott points out that these systems are seldom absolutely complete. “The point is not to have an immediately commercialisable product, but to rather give students the experience of creating a system. “Most systems presented at the expo still have a couple of hundred hours of development needed before they can be properly implemented,” says Scott who explains that the systems are viewed as pilots. “The companies concerned retain their IP, while UCT retains ownership of its IP.”

“When our graduates arrive in industry, they are not out of their depth and are well equipped to meet the challenges that programming systems present.”

Sewchurran agrees that the reality-based project work helps graduates to acclimatise easily in whichever working environment that they find themselves in. “Project work prepares them for the element of uncertainty that is always present in the world of work.”

Proof of this experiential learning’s worth lies not only in the success of graduates in the field, but also in the success of students in national and international competitions.

UCT IS teams have performed well in the Microsoft Imagine Cup, with a number of teams winning the national honours. (See side bar.) 

competition and has since spun out into a going business concern.

Common Ground creates access to cyberspace

The Common Ground system designed by “Team Revotech” won the Rural Innovation Award for 2008.

Common Ground helps members of Cape Town townships and other low-tech areas around the Peninsula to manage and maintain websites dedicated to healthcare information and other useful community information. The aim is to empower community members, who previously did not have access to computers or the internet, by encouraging them to become responsible for their health and other key areas of their lives.

Customer relationship management made easy

In 2008, the third place for Software Design went to “Team Noesis” who developed a web-based Customer Relationship Management system, which facilitates local and international credit card payment for donations. The value-added aspect of this system is that it allows the donor to choose which organisation to support and then enables them to track their donation to see to how it is eventually used.

Innovation in Action

Several of UCT's spin-off companies are profiled in this section as well as the social entrepreneurial initiatives of SHAWCO. MPTech in the Centre for Minerals Processing, one of our many effective consulting initiatives, is also featured.

UCT's Approach to Commercialisation

UCT approaches technology licensing and commercialisation on a case by case basis. Various factors influence the decision, whether to license through exclusive or non-exclusive licences, whether to spin-out a company and take equity in such an entity or even to do an outright sale of the intellectual property.

Factors that are considered include the following:

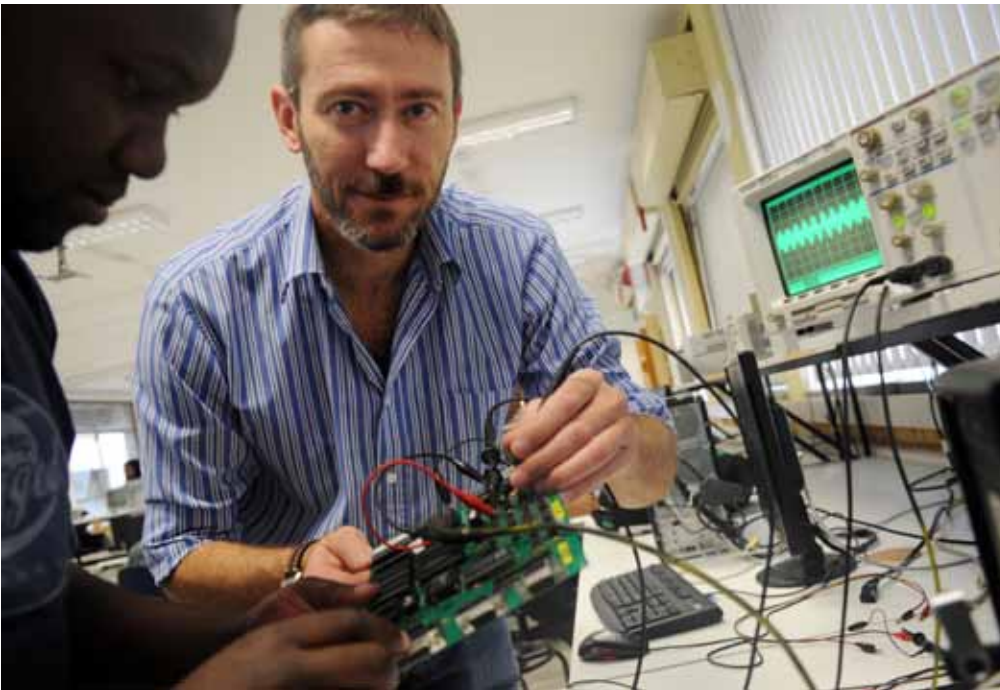
- The stage of development of the invention;
- The state of the industry;
- The number of markets to which the invention may be applicable;
- The applicability of the invention to be a foundation for a larger product stream;
- Type of intellectual property protection that can or should be pursued;
- The applicability of an invention as the basis for a new company (vs. licensing);
- The inventor's goals and interest with respect to the invention.

One of our core objectives is to stimulate the growth of the South African economy by fostering small business development and/or the creation of jobs through the commercialisation of UCT's intellectual property. We therefore look for potential partners who are able to assist the innovation process through technology development, especially through scale-up, piloting and market trials. We often form consortia and partnerships to access funding to support these initiatives, successfully commercialising our technologies in the marketplace.

UCT strives to identify potential commercial partners and initiate discussions with them before embarking on the PCT phase, or in the initial stage of PCT at the latest. This ensures that: commercial partners benefit from the maximum period of patent protection during which to market their products; UCT's costs are minimised; and the commercial partner has the opportunity to select countries in which national phase patent protection will be sought, in line with their production and marketing strategies

Although the commercialisation decision ultimately rests with UCT/RCIPS, inventors are encouraged to play an active role in the commercialisation of their IP. They often already have strong established links with industry and can readily identify potential commercial partners. Inventors may also be interested in forming start-up companies based on the IP that they have developed and RCIPS will assist with them with developing Business Plans and conducting market research.

Tapson's Entrepreneurial Spirit Finds Innovative Success in Start-Ups



Between teaching and conducting research in UCT's Department of Electrical Engineering and successfully spinning out three high-tech start-up companies, Professor Jon Tapson, one of UCT's innovation pioneers, has clearly had his work cut out for him over the past decade.

He is bemused by the glamorous image, painted by the media, of innovators all who seem to have made unimaginable fortunes from their "one big idea". "Those innovators and entrepreneurs, who do seem to have that one huge breakthrough, are the exception rather than the rule," he comments ruefully.

It could be said of Tapson, however, that he had three "big ideas" in the sense that three of his innovation projects have been spun out of the University and found success in the marketplace in various guises. His, and his co-inventors', ideas have found productive niches in the marketplace in the form of two companies and a non-profit organisation.

Tapson is the founder of **Motornostix** – a web-based industrial monitoring system for industrial machinery; **Hot Platinum**, a technology company whose products enable jewellers to enter the high-value-added platinum jewellery market with minimal start-up costs; and **Cell-Life**, a non-profit organisation that among other innovations, is implementing a cellphone-based support

system for antiretroviral therapy. The two latter companies are profiled in following articles.

Currently Head of Electrical Engineering, Tapson first joined UCT in 1997 from the then Cape Technikon, bringing with him his wealth of knowledge in intelligent systems, including sensor and neural networks. A novice to innovation when he arrived at UCT, Tapson remarks wryly, that he really didn't know what he was letting himself in for with his first foray into innovation in his early thirties.

His says the realisation struck him that funding was readily available for innovation when he visited a failed start-up in Washington DC in the late 1990s. This particular start-up had absorbed something like US\$50-million before it went belly-up!

Despite witnessing this American start-up's woes, the experience was a defining moment for him. He returned to South Africa with a sense of the excitement, fun and intellectual stimulation that go hand-in-hand with the risks that are inherent in innovation.

On his return to SA, Tapson was approached by a major player in the steel industry, who asked him to apply his mind to an industry-wide problem of machinery failure. "Basically he asked us to come up with a solution for the early detection of failing machinery components," Tapson recounts.

He realised that a creative solution to this problem could potentially save manufacturers millions of rand. At that time, in South Africa, a steel manufacturer could lose R300 000 an hour due to downtime – today that figure would probably be closer to R1-million an hour.

"The obvious solution would be to have technicians regularly checking components, but the salary costs would be prohibitive," he explains. "So we came up with the idea of putting sensors on site and feeding the information back to a

central database.”

After a relatively brief period of research and development, Tapson and his co-researchers devised a web-based industrial condition monitoring system, creating software that automatically analyses component parts of large-scale industrial machinery.

In a relatively short time Tapson went on to spin out his first start-up, successfully transferring the technology to the fledgling company, Motornostix. Today, just over a decade later, Motornostix has offices in Cape Town, Johannesburg and Cincinnati USA, as well as agencies in the UK and Korea.

Tapson believes that despite the company's relative success, management conflict has sometimes prevented it from realising its full potential. This conflict and a gruelling work load were the reasons he stepped down as a director of Motornostix in 2003.

“I was incredibly busy and was also about to spin-out Cell-Life,” he says, referring to his next excursion into innovation, which is featured in depth later in this publication.

“My experience with Motornostix gave me enormous insight and understanding of what innovation and entrepreneurship entail, and also of what a tremendous personal commitment it requires,” he says.

Looking back on his innovation experience so far, he observes that one of the biggest problems with effective technology transfer is that the key academic concerned usually has to leave the university to join the start-up during its establishment phase.

“This presents a huge risk for most academics. This means putting their academic career on hold, and choosing the unknown with regard to the start-up's long-term success and sustainability.”

He believes the University has helped solve this dilemma by granting academics a leave of absence in certain circumstances, adding that the experience and knowledge gained are mutually beneficial. He is quick to mention that he is grateful the University did see the merit in granting a colleague leave of absence to focus on the establishment of Hot Platinum and attributes the successful technology transfer to this.

He suggests that a three-year leave of absence would ensure that the department could find a suitable replacement, that the person could leave UCT with the assurance of resuming their academic career, whilst enabling them to dedicate their time to the start-up.

Tapson says the salutary lesson about innovation is that often the original technology can serve as a springboard for other applications. He uses the example of Associate Professor Ulrika Rivett's current research into water quality which uses similar cellphone data management systems to those used in Cell-Life to monitor water quality in rural areas.

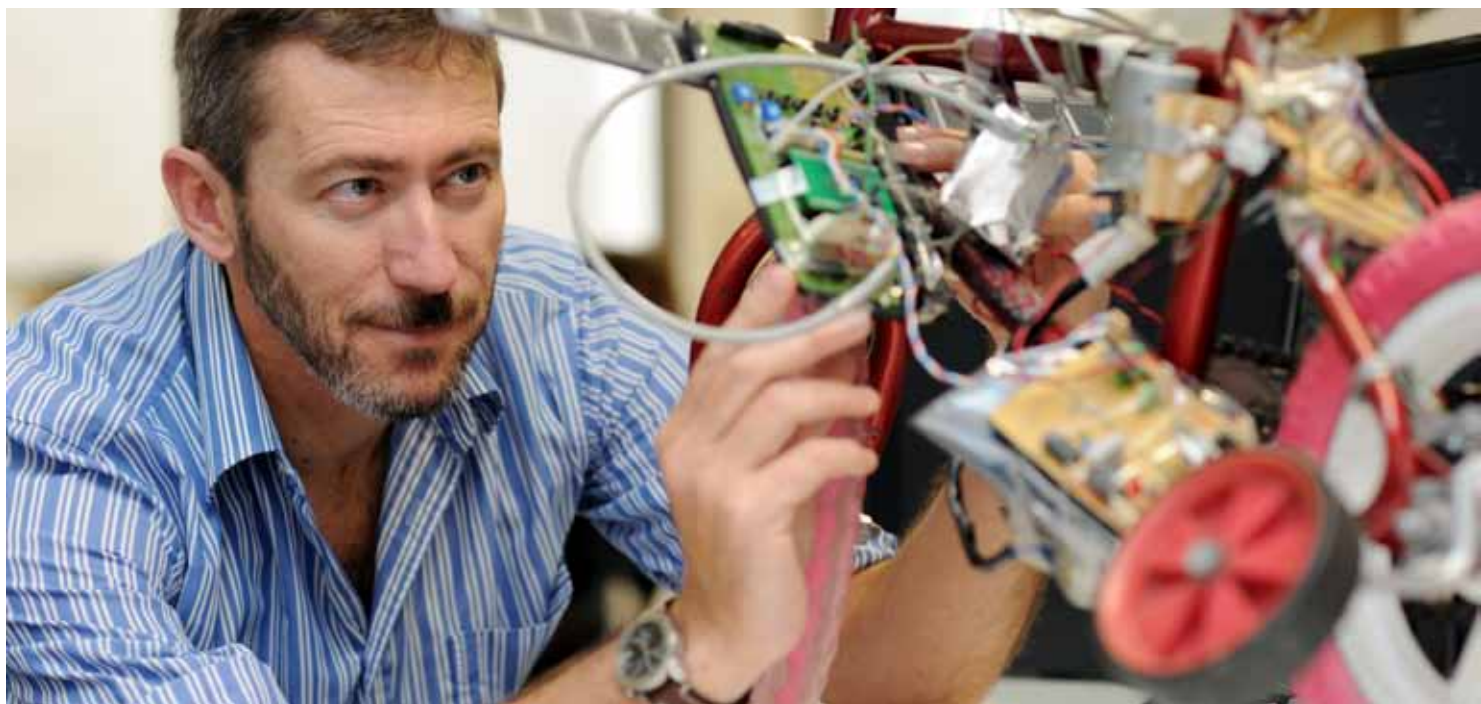
Tapson's third start-up company was Hot Platinum (see page 58), which has revolutionised the platinum jewellery industry, by developing a commercial induction casting system for platinum jewellery that can be used by small and medium manufacturers.

Tapson points out that while the excitement of innovation spurs him to continue along this path, it is not without its negatives too. “The positives are that it is very educational and in some ways has helped advance my career. But by the same token, I have not been able to conduct as much ‘conventional’ research which would have been officially recognised by the NRF,” he said. Tapson's recent nomination as Distinguished Lecturer by the IEEE – the world's largest professional association for the advancement of technology – illustrates his standing amongst his peers internationally. IEEE Distinguished Lecturers are engineering professionals who are considered world leaders in their discipline, and whose peers believe are leading the field in new technical developments shaping the global community.

Given another chance, Tapson would not have played his cards differently. “At its best, innovation is incredible fun and very rewarding. I am fascinated by marketing, sales and really enjoy the process of working with industrial designers.”

“Start-ups can be magic, particularly to when you inspire people enough for them to share your vision and to take that risk to fall into step alongside of you,” he says. “Now that's a humbling experience!”

Despite his love for innovation and his obvious entrepreneurial calling, Tapson says that after the initial excitement of spinning out a company has subsided, there is simply not enough intellectual stimulation in it for him to choose business over a university career. “I thoroughly enjoy academia and research, as well as being involved in innovation, and I am fortunate to be able to experience them all,” he smiles. **i**



Cell-Life Project Revolutionises HIV Treatment and Support



The Cell-Life project has become a perfect example of how technological innovation, when harnessed for the public good, can transform into social innovation.



Technology, developed in collaboration between scientists at UCT and the Cape Peninsula University of Technology, has transformed the lives of thousands of HIV-positive South Africans, by helping them to adhere to their medication regimens, and enabling hundreds of healthcare practitioners to better monitor and evaluate their patients' progress.

Its inception can be attributed to Associate Professor Ulrike Rivett's encounter with a high school student at a careers talk. Rivett, who was the guest speaker, was asked by a student what engineers were doing to address HIV and AIDS-related issues. It struck a chord within her and made her realise that local

engineers were not at the forefront of the HIV/AIDS response.

Back on campus she approached Prof. Jon Tapson to ask about the possibility of creating an intelligent pill dispenser that would remind people living with HIV when to take their ARVs.

Tapson recalls that while he also believed there needed to be an urgent and meaningful response to the pandemic from engineers, his gut response to the pill dispenser was that it was not what was needed in midst of the South African epidemic, because it would take too long to develop.

The colleagues then alighted on the idea of using cellular technology to help people living with HIV adhere to their antiretroviral regimen and the idea for Cell-Life was borne.

Bringing together technology experts in IT, health and engineering to solve the health management problem of HIV/AIDS, Cell-Life uses pre-programmed cell phones to record the medication details of people living with HIV.

For the first few years Cell-Life had research focus, but as the years went by, its focus changed to one of activism. It became very vigorously involved in HIV networks – paving the way for cell phones to be used as information channels to exchange information about HIV via a variety of methods such as Mixit.

“In order for this idea to be effective, we first had to establish the market penetration of cell phones in SA, and in particular we needed to find out whether township households were using cells. At that time, we discovered that an average household in high prevalence areas had access to two cell phones, and that has very likely increased significantly,” Tapson recalls.

A Medical Management System was developed by merging the cell phone

technology with Internet and database systems, creating a “virtual” infrastructure to support HIV positive patients with their antiretroviral treatment.

Initially the first incarnation of the Cell-Life system was devised solely as a therapeutic tool for HIV health workers and counsellors – which proved incredibly useful for counsellors who usually had a case load of at least 20 patients.

While visiting their patients, healthcare counsellors use their cell phones to report on their patient’s progress and to monitor their treatment adherence. This information is sent via short messaging service (SMS) to a central database, which can be accessed by the patient’s doctor or nurse.

An alert function was also developed to allow the home-based carer to alert the doctor or nurse on duty, via SMS and beeper, when an emergency arose.

Cell-Life’s development came at a critical time in South Africa’s history, coinciding with the beginning of public antiretroviral rollouts and also, ironically, when an atmosphere of AIDS denialism pervaded national leadership.

As much of the focus at that stage, was centred on the cost of providing treatment and the toxicity levels of the drugs, Tapson and Rivett maintain that the development of their technology signalled a significant breakthrough in the provision of anti-retroviral treatment and addressed in part the sophisticated management required for providing the therapy.

“Since the HIV virus mutates at a very high rate, the medication is only successful if taken as part of a complex time-and-diet regime. If the schedule is not adhered to with 95% compliance, the virus will start mutating and resistant strains to the specific drug will develop,” explains Rivett.

The political and socio-economic landscape has changed since the first seeds of Cell-Life were sown. “At that time it was a crisis situation. The government were in denial and the entire sector was dominated by NGOs,” Tapson recalls.

The fact that the country was in crisis may have indeed sped up the creation, by both students and independent software developers, of the first working system. Tapson pays tribute to the independent software developers and students who did not ask for a cent of compensation for their time and

expertise. To this day, whenever he has to do a presentation about Cell-Life, he lists each and every person who contributed to its creation.

In those early days Cell-Life was competing for the same funding that could potentially sponsor ARVs. Rivett and her team thus felt the full moral weight of creating a system that had the ability to deliver.

Rivett, and monitoring and evaluation expert Dr Donald Skinner, rigorously assessed the efficacy of the Cell-Life system and discovered it was indeed highly effective.

“The proof that we were spending donor money wisely was a great relief,” says Rivett.

“Thanks to this group of individuals we were able to focus on a problem and quickly come up with a viable solution. I have enormous respect for my colleagues and value the effect their hard work has had, in helping people living with HIV to manage their treatment,” Tapson says.

Importantly for the Engineering & the Built Environment Faculty, the project has also moved the faculty into a “different era”, says Rivett. Many students were also involved in developing the systems for the project. “This is the first time our students have been directly involved in the fight against HIV/AIDS and where they have been able to see the direct impact of their work.”

Since research funding could not cover large-scale implementation, the team sought a major funder. At the time, Vodacom was the only mobile provider capable of supporting the essential high-security software, developed for Cell-Life with the assistance of Fundamo (a company working with mobile solutions, mainly for cellphone banking).

As it turned out, Vodacom and the Vodacom Foundation ended up contributing much more than just funding, with Vodacom assisting the team with devising business strategy and marketing plans.

These strong working relationships also resulted in Vodacom partnering with



The spin-offs offered by this technology are significant as it can be used in the wider health arena. “We don’t have the resources to build the roads, hospitals and clinics that engineers devote their energies to, but we can build virtual infrastructures, with databases of patients, where one doctor can advise hundreds of patients all over the country,” Rivett concludes.

Cell-Life on technology-related projects. One example of mutually beneficial partnership resulted in a system of reverse billing being developed, enabling health workers to send information without having money loaded on their phones.

The University and Cell-Life entered into a licensing agreement, through which Cell-Life enjoys a royalty-free licence



to use the technologies developed at UCT for non-commercial purposes. The licence also allows Cell-Life free access to appropriate future technologies developed at UCT, which will augment and extend its business and ensure that it embraces and keeps pace with changing technology.

The agreement is in alignment with UCT's social responsiveness objectives. It demonstrates social innovation in action, showing how a pipeline of technologies within the UCT environment can feed into and grow spin-offs, developing them beyond the bounds of their initial start-up IP.

"Cell-Life was spun out as a Section 21 company, a not-for-profit organisation, but RCIPS made the wise choice of retaining ownership of the IP, whilst allowing the company to continue with the technology transfer," Tapson narrates.

"In the face of a devastating epidemic, it was a compassionate and pragmatic decision, and it has become the poster child for UCT innovation – receiving social responsiveness awards and excellent media coverage throughout the world."

"As a Section 21 company, it is able to access several sources of funding unavailable to for-profit companies and its continuing success convincingly demonstrates that spin-out companies do not need to focus on profit alone in order to build on their success," says Rivett.

During its start-up phase, Rivett served

as Managing Director, with all the responsibilities of her 'day job' at the university! Cell-Life grew rapidly and now has a presence in seven provinces. As the company expanded and time commitments increased, Rivett moved into a non-executive role on the board and back to UCT and Peter Benjamin was appointed as MD.

A large number of postgraduate students from the Faculty of Engineering and the Built Environment, have not only qualified through their involvement in this project but have stayed on to work for Cell-Life after graduating. Students (mainly engineering and IT students) are also encouraged to undertake paid vacation work at Cell-Life.

While the core focus remains on Antiretroviral Treatment (ART), Cell-Life has developed further innovative customised solutions to meet specific requirements. Core systems and technologies include:

- Electronic Medical Patient Record – the central database that houses patients' electronic medical records.
- Clinic Information System for ART
- Patient Aftercare
- Intelligent Dispensing of Anti-Retroviral Treatment (iDART) – a simple pharmacy drug management tool that enables easy dispensing of triple therapy ARVs on a large scale, and has integrated reporting capabilities such as patient collection times and drug stock levels.
- Remote Booking for Voluntary Counselling and Testing (RBVCT) – a system that allows people to remotely and anonymously book for VCT sessions over the Internet or through their cellphones.
- Monitoring and Evaluation Reporting – Cell-Life's monitoring and evaluation (M&E) tool, EMIT, is one of the latest iterations of the initial technology that help health workers evaluate how an individual's therapy is progressing. EMIT's new-generation mobile data collection system and the M&E tool can also be used for large scale therapy programmes, like those administered by Medicins Sans Frontieres. It allows fieldworkers to fill in forms on their cellphones from any location and because EMIT is mobile and web-based, data is captured and can be analysed immediately, offering faster feedback and greater accuracy.



Cell-Life's accolades

Over the years Cell-Life has been recognised for excellence in social innovation:

- 2004 – winner in the Handheld Competition organised by Bridges.org for demonstrating innovative strategies for harnessing the power of handheld computing devices for application in the areas of health (HIV/AIDS), education and agriculture.
- 2005 and 2006 – recognised as the Most Noteworthy Achiever in the Emerging Enterprise section of the TechnologyTop100 Awards Programme.
- 2006 – an Innovation Award conferred by Impulelo.
- Technology Top 100 Awards winner 2005
- Technology Top 100 Awards winner 2006
- Impumelelo Innovations Awards Trust 2007
- Technology Top 100 Established Enterprises Qualifier 2007
- SANGONeT Web award for the best use of mobile technology 2009

Hot Platinum Innovation Revolutionises the Jewellery Industry



It all started in 2002, when a UCT-led consortium, including Cape Peninsula University of Technology (CPUT) and Mintek, was awarded an Innovation Fund grant of R5.6-million. The main objective of the three year project, headed by Professors Candy Lang and Jon Tapson, was to develop both a commercial induction casting system for platinum jewellery, and a scratch-resistant platinum alloy.

“At the time most manufacturing jewellers used a blowtorch to melt platinum. This is far from an ideal method as there is no way of controlling the heat and can contaminate the metal. Furthermore most induction jewellery casting systems were targeted at large scale manufacture. Our objective was to develop a compact system that would use single-phase power and would be targeted at the small to medium-sized jewelers,” explains Brey who also holds an MBA from UCT.

After researching the market they discovered that many companies were investigating the development of smaller units. “We went overseas to research the technology that was available and realised that the real opportunity for commercialisation lay in the small to medium jewellers market because all other technology, for melting and casting platinum, was aimed at the bigger manufacturers.”

“We could fill a gap if the product we offered was small, efficient, versatile and easy to use,” explains Brey. But their market research also indicated that the three years they had budgeted to develop the product and get it to market was too long. “We realised we’d miss the opportunity if we stuck to that timeline, so we expedited the development and commercialisation process in order to get to market as soon as possible,” recalls Khan.

The Innovation Fund grant paid for development of the prototype, not its commercialisation, so the team rigorously managed the cash flow to finance the

When Ali Brey and Irshad Khan, who both have a Masters degree in Electrical Engineering, first became friends during their student days, they could never have imagined that they would end up heading a multi-million rand company that manufactures and sells unique technology throughout the world.



Brey and Khan are the Managing and Technical directors respectively, of the spin-out company Hot Platinum whose primary focus is on the development and manufacture of innovative induction technology for processing and analysing base and precious metals.

machines' construction.

In 2004 the project team successfully secured the contract to manufacture all the platinum components for the new parliamentary mace which was commissioned by the South African Government to celebrate 10 years of democracy in South Africa (see side bar). "Securing this contract gave us the opportunity to put our technology to the test, and was a significant milestone, as we now had a reference for the capability of our technology," Khan adds.

Early in 2005 Hot Platinum's first product – a compact induction spin centrifugal casting system for platinum jewellery production, was ready for market. Called the ICON3CS, the system is one of the most versatile, compact and integrated solutions available internationally and its patented casting system requires 40% less metal than competing systems to produce the same yield. Roughly the size of a conventional microwave. The ICON3CS utilises a controlled high-frequency magnetic field, similar to a microwave, to induce electrical currents in the platinum, resulting in rapid heating and melting.

The miniature induction furnace can also be used for melting and casting of other metals such as palladium, gold, silver and stainless steel using standard single-phase power; making it an accessible and cost effective solution for small manufacturing jewelers, as well as dentists.

"It allows for more than triple of the amount of platinum to be melted and is cleaner, safer and much less wasteful than the blowtorch method," Khan commented.

It has also been designed to be incredibly energy efficient. Melting 150 grams of platinum uses less electricity than boiling a kettle. The ICON3CS system has been designed to produce high-quality platinum castings and can cast from one to 25 rings simultaneously.



UCT innovators integral to Hot Platinum's success



Professors Jonathan Tapson and Candy Lang were key players in the success of Hot Platinum and continue to play an integral part in the company's achievements.

Lang was Project Co-ordinator for the Innovation Fund Project and headed up the development of the novel scratch-resistant platinum alloys. This aspect of the research project is still continuing.

A renowned expert in instrumentation and Control, Tapson was involved in the project as a strategic advisor from both technical and commercialisation perspectives. His research interest stems from his time as a lecturer at the then Cape Technikon during the early 1990s.



Irshad Khan joined Tapson's research group there in 1996 and Tapson recounts that he was the first student who really made progress on the induction heating project. When Tapson joined UCT in 1997, Khan followed him there to continue his research in Induction Heating. In 2000 they developed a working prototype and after that started looking for ways to commercialize the technology.

Tapson and Lang pay tribute to the entire team that launched Hot Platinum, and specifically mention the contribution of Dr Duncan Miller of UCT's Centre for Materials Engineering. He was an invaluable member of the platinum alloy development team and also developed the platinum-casting protocol for the induction furnace, explains Lang.

"Duncan is a brilliant metallurgist," says Tapson. "His incredible knowledge of casting and jewellery making, combined with his rigorous testing, meant we got excellent results. He insisted that it be a useful, professional machine and thereby added enormous value."

Tapson and Lang applaud the particular strengths Brey and Khan brought to the table. They refer to Khan's technical excellence and determination to make the technology succeed and Brey's entrepreneurial spirit and his excellent business skills in building a successful spin-out.

"It was a very long process. It's important to understand that I enjoy the entrepreneurial process, otherwise it would have been a nightmare," laughs Tapson. "My entrepreneurial experience and Ali Brey's skills helped to get funding and set up the spin-out company, but it was primarily the technical excellence of Irshad's work which made it possible."

"It has been fulfilling getting a research project "out of the door" and it adds a lot of value to the rest of our research to have this as an endpoint. However, success depends on having a technical or research person who is willing to transition into the start-up, and also a commercialisation person who wants to lead the start up."

Tapson and Lang agree that pivotal to the project's success was the composition of the team. "We were very lucky to get Ali Brey involved at an unusually early stage, so that he could give commercial direction to the research process and get the funding necessary to get us to a financial break-even point," says Tapson.

Lang has advice for other academics and students who want to embark on an innovation project. "Some people have a talent for innovation. Some academics have a talent for research, while some have a talent for both research and innovation like Jon. My advice is, put together a team with some of each!"

The academics have continued their association with Hot Platinum. Tapson serves as a non-executive director on its board, while Lang retains close contact, providing metallurgical advice on an informal basis.

***“The defining characteristic of our device is that it enables small-scale jewellers to produce precision castings comparable to those of their large-scale competitors. It allows them to produce a once-off ring while minimising wastage.*”**

“Irshad and I felt there was commercial potential for the product and then decided to spin out the company from the University of Cape Town and started trading as Hot Platinum (Pty) Ltd.

“The process was not easy,” recounts Brey. “Securing the licensing agreement took more than a year, as spinning out technology from a university was not common at the time, and raising capital took time as well, as not many investment firms focus on start-up businesses. We therefore had to initially boot-strap the business, prove there was demand for the product, and then secure funding.

Khan adds that it was also challenging from a technological perspective. “Although we had identified a niche market, competitors internationally were starting to move into that niche, and we therefore had to cut our development time by a year, to ensure we did not miss the window of opportunity.”

“We secured the exclusive license to the patent which was owned by UCT, and started trading in mid-2005, selling our first unit then. With a proven manufacturing and sales record, venture capital was sourced and in 2006 we secured funding from Brimstone Investment Corporation Limited, which was used to establish operations in Cape Town.” Finally, Hot Platinum was on its way!

As MD, Brey concentrates on the commercialisation side of the business and getting their products into the marketplace. Khan on the other hand focuses on the technology development and getting products through their development cycles – from prototype to the commercial stage.

The partners and friends, believe their successful business relationship is based on the mutual levels of trust, respect, and openness they have cultivated over the years, rather than on their friendship alone.

“We share a common vision, value system, and passion to grow and develop our business. We excel and focus on different areas. Irshad focuses more on the technical aspect, and I focus more on the business development side,



The Parliamentary Mace

While the parliamentary mace is a symbol of democracy and freedom for many South African's, for Ali Brey and Irshad Khan it represents years of collaborative research culminating in technological innovation that has found success in the international market.

In 2004 the South African parliament commissioned a new mace to celebrate ten years of democracy and the winning contractor was faced with the problem of casting several decorative components in platinum.

That's where the expertise of Brey, Khan and key UCT academics was sought to cast the 850 platinum beads and three large platinum rings needed to create the new mace.

Securing the contract to cast the mace's platinum pieces represented a turning point of sorts for the duo and their UCT associates.

“This fantastic opportunity not only gave us the chance we'd been waiting for to test the prototype using platinum, but it also gave us the chance to create a lasting reference and showcase of the high standard achieved by our technology,” says Kahn.

and it is this complement in expertise and focus that has assisted us in growing the business,” says Brey.

***“We are both passionate about applying our knowledge and expertise in order to develop technology that addresses a real need and that has a direct impact on industry,” Khan interjects.*”**

The duo are enjoying the opportunity and challenges presented in establishing and growing a company that creates jobs, and produces world-class products that add real value to the lives of others.

“The process of identifying an opportunity; and working with a highly motivated and passionate team to develop solutions that exceed the customers' expectations is a very exciting and rewarding experience,” says Brey.

“We have developed very good relationships with our customers and key industry players,” agrees Khan. “This is been extremely valuable to us not only from expanding our business, but has also opened up numerous new opportunities for us. We regularly engage with our customers as this provides you with valuable information on your products, and optimization of your solutions.”

The partners agree that embarking upon the innovation process and starting a business from scratch are not for the fainthearted. “However it is extremely rewarding to see the response of customers to our innovation and to

see the company grow from strength to strength,” maintains Brey. “What is critical with innovation or creating a new company is to ensure you build a team of people that share your vision, commitment and passion.”

They have sage advice for others who are about to travel along the innovation pathway: “From a technology point of view try to get to test the market, or engage with potential customers as soon as possible, as this provides you with very valuable insights into your product or service,” Khan cautions.

***“Understand from a market point of view how developed the market is for your product or service. Ideally you want to be entering the market at the early stages, as once the market is established it is more difficult to enter and it becomes all about price,” advises Brey.*”**

Hot Platinum is focussed on becoming the leading supplier of induction-heating systems in Africa, and is currently expanding its product range to include energy-efficient solutions for applications in mining, metal processing, foundries, automotive and infrastructure sectors.

The company has expanded its range of products to high-power systems for mining and commercial heating applications, and specialized high-temperature systems capable of reaching 2500°C in 60 seconds. Hot Platinum has also expanded into international markets and sold systems in Denmark, India, Thailand, the UK, Greece, Russia, and US. ❶

Innovative CapeRay to Revolutionise Breast Cancer Detection



rates related to breast cancer. However women in remote regions of the world, and especially in rural Africa, often cannot participate in screening programmes as clinics in remote areas are often not properly equipped with the appropriate mammography technology.

He is thrilled with the progress of the novel mammography device and the implications it has for women in Africa and elsewhere. ***"I am more convinced than ever that we have the technology with the potential to save many lives, both here in South Africa and elsewhere in the world," he exclaims.***

Now on the other side of 57, Vaughan demonstrates an inexhaustible energy and an insatiable curiosity about all things – factors that he feels have contributed to his well-catalogued success in the research and innovation arenas. He is enjoying the challenges and opportunities that his new business career are presenting him.

"I have realised that I am at heart an entrepreneur, and that I'm still young enough and have sufficient energy to pursue another career," he says.

Vaughan estimates that the product will be launched within a year to 18 months. He is grateful to the University and the IDC for their ongoing support. The IDC has initially invested R15-million in the new venture, which comes as a welcome boost at a crucial stage of the development process as the prototype is now being refined, with additional new IP created and advanced prototypes developed.

The intellectual property on which CapeRay is based stems in part from a project funded by Department of Science and Technology's Innovation Fund involving collaboration between UCT, De Beers and iThemba Labs with the aim of developing low dose x-ray technology further and applying it to mammography. De Beers had already developed IP relating to whole body imaging using low

A pioneer in medical innovation and a former senior UCT academic has been instrumental in establishing a company that is on the cusp of prototyping a ground-breaking medical device that is set to change the way that breast cancer is detected.



Professor Kit Vaughan, former head of Biomedical Engineering at UCT and an internationally acknowledged expert in medical imaging, took early retirement at age 56 to spin out the company, CapeRay Medical (Pty) Ltd, that is committed to developing world-class, but cost-effective methods of medical imaging. Together with his research and development team, Vaughan is developing, with financial support from the Industrial Development Corporation of South Africa ("IDC"), a revolutionary approach to breast cancer screening by using low-dose x-ray technology combined with ultrasound.


The Hyman Goldberg Professor of UCT Biomedical Engineering from 1996 until his retirement last year, Vaughan explained that internationally there is ample evidence that screening programmes dramatically curb mortality

dose x-ray (LODOX) and they separately spun off a company called Lodox Systems.

There are strong synergies between Lodox Systems and CapeRay both in terms of current intellectual property as well as going into the future and learnings from this more mature start-up, which is also funded by the IDC, will be beneficial. There has already been close collaboration between the CapeRay team, whilst in the UCT environment, and Lodox Systems through a joint grant received from the National Institutes of Health in the USA that enabled the IP created during the Innovation Fund project to be developed further, resulting in the first mammography prototype.

While CapeRay is a spin out company, it still retains strong links with the University. The University not only owns shares in the company (along with Vaughan and the IDC), but two of Cape Ray's directors, Professor Tania Douglas and Professor Jonathan Tapson are from UCT. Douglas, who took over from Vaughan as head of the MRC/UCT Medical Imaging Research Unit, and Tapson from UCT's Electrical Engineering department contribute to continuing technical and product development. Tapson also brings with him a wealth of entrepreneurial experience through his own journey along the innovation pathway.

Interestingly, some shares are retained by an "employees trust" which will incentivise and reward employees for their efforts in building CapeRay. While not a direct shareholder in CapeRay, the Innovation Fund (now absorbed in the Technology Innovation Agency (TIA)) will benefit in the profits through a royalty payment.

CapeRay is also making use of Department of Trade and Industry's THRIP and TIPTOP programmes to leverage their research spend on further work with the university and in-house development. 

How the IDC Venture Capital Business Unit operates

The main objective of the Venture Capital Business Unit is to encourage and facilitate development and commercialization of novel, technology-rich, SA products that could be considered unique from an international perspective.

The IDC is a self-financing, national Development Finance Institution (DFI). The primary objectives are to contribute to the generation of balanced, sustainable economic growth in Africa and to the economic empowerment of the South African population. The IDC achieves this by promoting entrepreneurship through the building of competitive industries and enterprises based on sound business principles.

The Fund makes the distinction that the uniqueness must lie with the product itself, not in the way the business operates, and only considers investing in companies that own their Intellectual Property.

The Venture Capital unit invests in early-stage projects. Unlike standard venture capital investments, the IDC does not have to exit within a specific period, providing equity funding of between R1-million to R15-million per project, in exchange for a minority equity stake of between 25% and 50%.

CapeRay is the first UCT venture to receive this funding, although the IDC has invested in the commercialisation of several other universities' technologies.

The IDC's Dr Paul Johl explains the Venture Capital Business Unit requires a "meaningful financial contribution" by participants. For universities this contribution may be a capital investment or the sponsorship of research for a certain period.

Visit www.rcips.uct.ac.za/fundinnov/funding/idcventurecapital/ to read more about the IDC VC funding or see the IDC website www.idc.co.za/Venture%20Capital.asp

Cape Carotene



Cape Carotene, a UCT biotechnology spin-out based in the Northern Cape, has become the first company in South Africa to pilot algal technologies to produce astaxanthin, a powerful antioxidant and dietary supplement used in aquaculture and a nutraceutical for human consumption.



CEO of Cape Carotene and UCT alumnus, Dr Njodzi Zizhou is busy commercialising the technology that he developed during his PhD studies in the Chemical Engineering Department's Centre for Bioprocess Engineering Research (CeBER).

Through the establishment of Cape Carotene, he and his staff are spearheading entrepreneurship in the Upington area by scaling up an algal process that produces astaxanthin, to commercial production capacity. The company were granted R3,8 million in funding by the Cape Biotech Trust, formerly one of the Department of Science and Technology's Biotechnology Regional Innovation Centres and now integrated into the Technology Innovation Agency (TIA).

Cape Biotech Trust invested in the project as part of its mission to boost its nutraceutical cluster of biotech companies in the Northern Cape, where other algal-based carotenoid ventures

are under way. Zizhou explains that the operation is based in Upington because it provides ideal weather conditions for algal processes with the best combination of maximal sunshine and light intensity coupled with minimal rainfall. "Algae, the basis of the product, need lots of sun to grow and flourish," he says.

Algal production is conducted in open-air, 'raceways' which are shallow ponds with paddles to promote gentle circulation. For the nutraceutical market, astaxanthin is then recovered from the algae using a solvent extraction process and care needs to be taken once it has been removed from the algae as it is readily degraded by light and oxygen.

He adds that the establishment of the company in the Upington region also addresses the need for job creation in the immediate area, allowing the company to access semi-skilled labour required for overseeing the algal processes.

Astaxanthin is an organic antioxidant which is also a colourant. The molecule is one of the most powerful of the 600 naturally occurring carotenoids – fat-soluble antioxidants – and is responsible for the colouration of many species. An example is β -carotene, which gives carrots their orange colour. Carotenoids also give colour to animals such as salmon, lobsters and prawns and ensure their proper development, making it useful in salmon and trout aquaculture to ensure that the farmed fish with the intense pink flesh of those caught in the wild. Flamingos receive β -carotene in their diet, mainly through eating shellfish, which explains the origin of their pink plumage.

Astaxanthin's antioxidant activity has been found to be 10 times more potent than beta carotene and up to 500 times more powerful than vitamin E. It is already being marketed as a nutraceutical in the United States, where it is being used to treat age-related macular degeneration, a common eye condition.

Pilot-scale development is underway and the challenges facing process development and scale-up are being resolved. The preliminary target is to produce 1,600 kg of astaxanthin in the demonstration-production phase



and with limited global production there is strong market potential for the company. Once the development work has been completed, a commercial production facility will be built and Zizhou hopes to eventually export the astaxanthin to European fish farmers and feed manufacturers. The barriers to entry for fish feeds are lower than the pharmaceutical applications to which the company's product is ultimately destined, providing an initial return on investment whilst the more high-tech products are developed and the regulatory requirements are met. ❶

Centre for Biochemical Engineering Research Supports Biotech Start-Up



Zizhou and Cape Carotene maintain strong links with CeBER and its head, Professor Sue Harrison, who supervised Zizhou's PhD research. CeBER provides Cape Carotene with inocula (starter algal cultures). They also maintain the original algal culture, to mitigate the risk of contamination at the Upington site, and also provide routine analytical support.

This relationship exemplifies the ways in which universities can foster a start-up company by granting it access to a technology base, thereby minimising the cost of specialist resources.

It is hoped that this will be the first commercialisation of a pipe-line of algal technologies that are being researched by CeBER, providing the potential for future product diversification.

Products Based on UCT Intellectual Property

PeptoSport®



One of the latest UCT license agreements signed with DSM Nutritional Products South Africa (Pty) Ltd sees the launch of a new sports nutrition product, "PeptoSport®", based on a formulation developed by Assoc Prof Andrew Bosch, University of Cape Town / MRC Research Unit for Exercise Science and Sports Medicine. The product has demonstrated a reduction in post-training muscle soreness in the calf and quadriceps muscles during periods of high training load and is intended to enhance recovery of sportsmen and women. Bosch tested the product on 26 elite rugby players during 2009.

The key to success has been a combination of the type and ratio of carbohydrates included in the formulation, which improves the rate amino acid entry into the muscle from the protein component of the drink, "PeptoPro®" another DSM product. Both of these products are registered with Informed Sport (www.informed-sport.com) which is a banned substance screening programme that tests supplements and their ingredients for inadvertent contamination with substances prohibited by the World Anti-Doping Agency (WADA) – a considerable reassurance for top professional athletes, who choose supplement products that are made to the highest quality standards.

DSM Nutritional Products is the world's leading supplier of vitamins and other fine chemicals to the food, pharmaceutical and personal care industries. DSM's competencies range from discovery of bioactive ingredients through to synthesis and formulation, safety, and efficacy. It is DSM's philosophy as an ingredient supplier to maintain scientific integrity, as well as to continually invest in both internal and external research in order to support and grow their ingredient claims.

High Temperature High Pressure Magnetometer

A fine example of successful collaboration between Sasol and UCT's Centre for Catalysis Research has yielded the invention of a device that will add great value to research in a variety of fields including nano-technology.

The device, called a Magnetometer, is fully computer controlled and is the first of its kind in the world and was invented by Professors Michael Claeys and Eric van Steen of UCT and Jan van de Loosdrecht and Kobus Visagie of Sasol Technology. Sasol kindly assigned their interests in the intellectual property to UCT, who have filed an international application to patent this product of the longstanding collaboration between Sasol and UCT in the field of catalysis research. Following the positive patent examiner's assessment, UCT plans to file patent applications in a number of international territories in addition to South Africa.

The Magnetometer enables scientists to examine ferro-metallic catalysts "in-situ". Catalysts such as Cobalt are used in the production of a variety of fuels and play a key role in terms of product performance. The device uses a large electromagnet to magnetise the catalyst which is placed in a small reactor in which industrial conditions with high pressure and temperature can be realized. The purpose of this area of research is to examine the physical changes that catalysts undergo during process situations which have an effect on catalyst performance. The Magnetometer exploits the magnetic properties of these catalysts to obtain the required information.



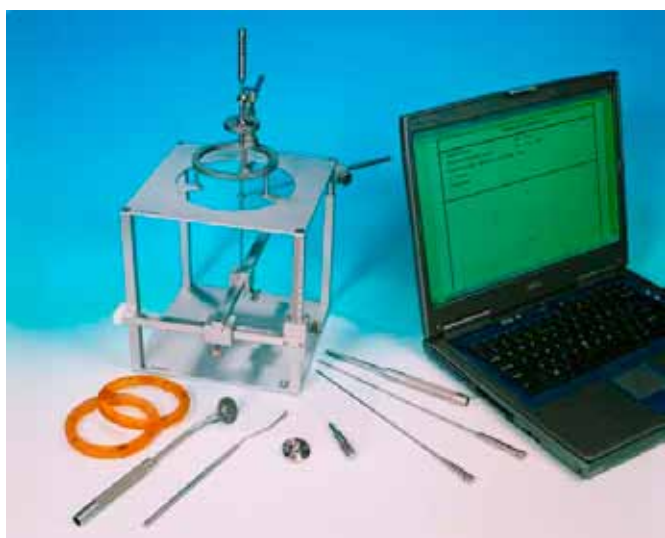
Professors Michael Claeys and Eric Van Steen with the in-situ magnetometer

The Magnetometer has been well-received at international conferences and a motion of congratulations was passed in the National Assembly in August 2010. UCT has been asked to build units for other international organisations. Routine manufacture of equipment falls outside the university's core business, especially in terms of providing ongoing maintenance and support, and a commercial partner is currently being sought

to license the intellectual property and make the magnetometer available on a commercial basis. Additional information and contact details can be found on Tektique (www.tektique.co.za) a website being used by South African universities and science councils to showcase technologies available for licensing.

Since its commissioning, the study team has performed numerous experiments from which important conclusions have been drawn in the field of catalyst research. The development of the magnetometer by the joint study team presents a fine example of successful collaboration between Sasol and academic partners. This remains a vibrant area of research at UCT and there is ongoing development of the magnetometer to enhance its analytical features.

Cape Town Stereotactic Pointer



Originally designed and prototyped in 1997, the Cape Town Stereotactic Pointer (CTSP) – a device used to pinpoint tumours during brain surgery – has proven to be an enduring technology that is being used by neurosurgeons around the world.

The award-winning device was developed by a team headed by the now retired Professor Laurie Adams, of the Department of Biomedical Engineering and comprising collaborators from UCT's then Department of Neurosurgery and the Medical Research Council (MRC).

UCT's Faculty of Health Sciences, the MRC and Technifin funded the development of the pointer and the device is now being manufactured and marketed by Fibretek Developments.



The Stereotactic Pointer uses the principle that any 3-axis (x,y,z) co-ordinate system can be used to locate a unique point in space. It is then able to translate the measurements taken using computed tomography (CT) or magnetic resonance imaging (MRI) to enable brain tumours to be located during neurosurgery.

The CTSP is based on the

same stereophotogrammetric principles used in landsurveying, but it uses computed tomography as the imaging and measuring medium. The frameless navigation system can be attached to the scalp using sutures and the inbuilt tripod helps guide the surgeon's biopsy needle to locate the tumour. The invention clearly demonstrates the benefits of applying knowledge from one field to address problems in another, with Prof Adams translating concepts used in the Department of Geomatics to brain surgery.

Stereotactic methods have been successfully used for the treatment of a wide range of neurological disorders, however there were drawbacks with those original systems – including their cumbersome frames and their time consuming positioning procedures. Adams and his UCT and MRC colleagues overcame the problems associated with the traditional stereotactic guidance frames and developed a very simple probe pointing device that is relatively inexpensive.

The CTSP won a prestigious South African Bureau of Standards Design Institute Award in the year it was launched. It is used in hospitals across Africa, as well as in India and South America and royalties are paid to both UCT and the MRC.

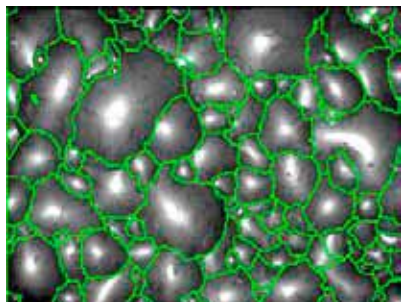
SmartFroth®



In the UCT IP portfolio, SmartFroth® stands out as having made the most extensive use of the different intellectual property protection tools available, with five patents and one being drafted, a registered design and even a registered trademark! There are no fewer than 15 inventors associated with the patents.

The patents have stemmed from research that started in 1998 into the application of machine vision as a process control tool to optimise the performance of minerals flotation for the beneficiation of valuable metals from mining. The research has been driven by the Centre for Minerals Processing Research, in the Department of Chemical Engineering with close collaboration with the Department of Electrical Engineering.

Conventionally, operators on mineral flotation plants have relied on visual inspections of the froth surface when making adjustments to process set points. These qualitative inspections are dependent on the particular operator's personal interpretation of the process performance at that time. The arrival of digital image processing into the arena of froth offers a means of obtaining machine vision descriptors pertaining to froth surface characteristics, which can be consistently measured in real time. By investigating the impact of various



selected operating variables on both froth surface characteristics and metallurgical performance, it is possible to develop a management strategy for the control and optimisation of the process. An optimum froth structure can

then be defined in terms of the machine vision descriptors. This condition can then act as a 'goal condition' for day-to-day operation.

The research programme has been sponsored by Anglo Platinum Ltd since 1998 and Rio Tinto since 2000, and has received supporting funding from the Technology and Human Resources for Industry Programme (THRIP), National Research Foundation (NRF) and the Department of Trade and Industry (dti). There has also been research collaboration has been with the Imperial College London (UK).

NeoFan



Dr Alan Horn has worked tirelessly on the development of successive prototypes of the NeoFan, which ameliorates brain injury due to hypoxia and ischaemia caused during problematic labour. It is well established that damage can be reduced in infants, following such an event, by cooling them to below normal body temperature. This is conventionally achieved by using cooling caps or coolant-filled mattresses, but these are expensive units requiring a refrigerator to circulate coolant. Often too there is significant hysteresis which causes overshoot and over-cooling of a baby which is equally undesirable; they may also cause the babies to shiver.

Horn's device is remarkably simple, utilising a computer-controlled fan unit to adjust the fan operation, based on the measurement of infant core temperature, to maintain a desired set-point. The control algorithm or strategy that has been developed significantly reduces overshoot and in this regard it outperforms competitor systems. The advantage of the NeoFan is that it can operate effectively using ambient air so no expensive refrigeration unit is required. The system is light and portable and it can operate in tandem with an incubator crib, although the crib controls need to be modified as generally a below normal setting for body temperature would not be tolerated by the system.

UCT's PreSeed "Concept" Funding was used by Horn to create the second version prototype and to create additional units so that his clinical study could be broadened. The last of the funding will be used in 2011 for a two-year follow-up evaluation of babies who were treated using the NeoFan.

There is perhaps one last round of prototyping required, although the NeoFan is being used routinely now at Grootte Schuur Hospital to continue building up patient data. UCT is currently seeking a partner to commercialise the units. A full South African patent application has been granted this year.

Catalysis Test Units



Catalyst Test Units have been manufactured in the Centre for Catalysis Research in the Department of Chemical Engineering for a number of years. The streamlined, professional-looking units are mobile, skid mounted and modular and are a far cry from the 'rigs' that one would typically find in a research student's laboratory, which are generally a "Heath Robinson" amalgam of piping and wiring!

What started as an internal requirement has spread to the production of test units for industry as well as other universities in South Africa. Their modular construction has allowed a level of standardisation and also the rapid interchange of malfunctioning components, with off-the-shelf spares, minimising research downtime. Of note are the enquiries that are being received from Europe and the UK.

Routine manufacture is not the mainstay of a university and currently a potential spin-out company is being incubated within the university to test the long-term viability of the operation. The team behind this, Prof Jack Fletcher, Dr Rein Weber and Stephen Roberts are excited by the opportunity and initial assessment of the opportunity is very positive.

There are also challenges relating to the long lead times associated with imported components, management of working capital for these expensive items as well as cost-effective bulk purchasing. The fabrication of many of the components are outsourced locally within the Western Cape, taking pressure off departmental workshops, but also sustaining small businesses in their network. Getting everything together in a co-ordinated fashion to meet the construction targets takes project management skill and orchestration, which is ably managed by Cobus van der Merwe. **i**

Social Innovation Based on New Business Models Shapes SHAWCO's Future



Varkey George is on a mission. That mission is to spread the gospel of social innovation and social entrepreneurship far and wide to ensure that SHAWCO, and other local non-profit organisations, move from a position of financial dependence into a future of sustainable financial independence.

Since becoming Director of SHAWCO in 2004, George has successfully rolled out a number of social innovation initiatives that immediately began to draw in revenue and now, a mere six years later, South Africa's iconic student social responsiveness organisation has achieved a financial sustainability of just over 50%.

This is a stunning reversal especially considering that SHAWCO was ailing when George took the helm and there had already been acknowledgement that it may just be the end of the road for South Africa's oldest student-run not-for-profit.

Student Health and Welfare Centres Organisation, better known as SHAWCO, was long considered one of the world's largest student-based charitable organisations. It was established in 1943 by UCT medical student, Andrew Kinnear, after witnessing the social and health needs in poverty-stricken communities around the Cape Peninsula.

"One learns from deep experience. I learnt some hard lessons when I took

over in 2004 and was faced with a decision to either close up shop or to innovate, streamline and find more sources for funding," George says.

It was George's philosophy of social innovation and his belief in its ability to foster financial sustainability that would be SHAWCO's lifeline. At the same time he set up sustainable income-generating projects to supplement donor funding, a social innovation which he believes many other NGO's will have to adopt to survive and one which has characterised SHAWCO's regeneration.

The recent global recession only exacerbated a problem that had already been brewing for quite some time as non-profit organisations scrambled for ever-decreasing resources.

"As funding decreased the practise of social enterprise became more dominant, as pioneering social entrepreneurs in the social sector strived to nudge their organisations from a position of financial dependence towards greater independence. SHAWCO has also followed this pattern."

George is quick to point out that many of his predecessors did sterling work, and that when the late Ivan Toms took the helm in the politically turbulent 1990s he already saw that the new socio-economic and political landscape had changed and accordingly navigated SHAWCO from a purely welfare model into a development model. "That move is what I call social innovation," Varkey says. "Toms ushered in a new era for the organisation."

George believes successful social innovators and entrepreneurs find unique, sustainable solutions to social problems and are able to operate in all three tiers of the economy.

"In the Public sector, social innovators create the ideal environment and framework in which the private and social



With SI's establishment came an impressive revenue stream that has continued to contribute to the organisation's financial health and sustainability. From its humble beginnings six years ago, it netted R2.6-million in 2009. This is much needed money to meet the administrative costs of the organisation. "Through our various entrepreneurial activities, we are blazing a trail and setting an example of how a non-profit could become financially self-sustainable," says George.

A corresponding social entrepreneurship course evolved from this programme and has become increasingly popular. **"After the recent global recession and experiencing the continuing fallout from the economic situation, many youngsters are looking for ways to balance entrepreneurship with doing something 'good' in the world".**

sector can operate. In the private sector, they find unique solutions to social and environmental problems and also make a profit. In the social sector, they find unique solutions to social problems, but are driven by social benefit," he maintains.

"All social businesses are managed by social entrepreneurs but not all social entrepreneurs need to run social businesses!" he exclaims vehemently.

"Social innovation can create better projects, but if there is no money to put these innovative practises into operation, expand them, and carry out research and development and on-going professional evaluation, what is the point of being socially innovative?" poses George.

He believes 'multi-stream fundraising strategies' are the answer and this self-coined term has become his and SHAWCO's mantra. He regularly consults with other local not-for-profit organisations to help them understand how social innovation holds the key to their sustainability too.

Each of the SHAWCO projects use one or more of five strategies for income generation to keep the organisation sustainable. George refers to the first strategy as "mission-related income" in which increasingly professionalised services are offered to an open market at a market-related rate.

His first foray into revenue-generation took place early in his directorship. He asked his Board to take a leap of faith in this new direction, but assured them that there would be no financial risk in

what he was about to propose. With their blessing, SHAWCO International was born – a student exchange programme which was run in collaboration with UCT's International Academic Programmes Office (IAPO).

SHAWCO International (SI) started out offering only service learning programmes to mainly European and American students during the June holidays, but has since expanded to incorporate specially designed social entrepreneurship internships throughout the year.

"Visiting students tutor SHAWCO learners in the different communities, whilst our UCT volunteers are on vacation. These tailor-made programmes also offer experiential learning in the line of research, working with small business in the community, field visits and so much more."

The international program allows international students to learn about social entrepreneurship and engage with service learning and George considers the associated revenue as mission-related income, as it allows students to engage with development issues in South Africa and pay for the opportunity.

"This initiative benefits all parties concerned – the visiting students as they receive credits and learn about development issues, the community in which children are kept meaningfully engaged during holidays – whether by being tutored or by playing sport with the visitors, and SHAWCO itself the income generation it enjoys during its traditional 'downtime' of the university vacations," he explains.

The course is examinable with the host institution vetting it and providing the credit. Its popularity has led to the first full undergraduate course being offered at UCT later this year under the auspices of the Sociology Department and with course work and lectures given by George.

The second category of income generation that George employs is what he refers to as 'Cash cow' or 'for-profit' entities which are legitimate businesses directly affiliated to SHAWCO. An example of this is illustrated by the official registration of the SHAWCO Community Transport Services just over three years ago. This for-profit company utilises a SHAWCO asset – in this case its fleet of vehicles – and subcontracts transport services to a number of paying clients, including UCT faculties and community organisations.

In this instance George as capitalised on an existing asset and provides a much-needed service instead of allowing the vehicles to remain parked. It has proved a boon to the SHAWCO coffers, bringing in impressive annual revenue.

One of SHAWCOs other successes is Rags to Riches which exactly reflects both its outcome and its modus operandi. George explains this novel used clothes bartering system uses both cash cow and mission-related income modes.

It provides affordable clothing to township residents as well as creates employment and income for the vendors who sell the clothes and generates income for a non-profit. Started in 2008 Rags to Riches currently generates about



George says this ethos of taking ownership is especially gratifying when watching students as they gain confidence and embark on a journey of individual growth. He suggests that proof of this growth can be seen in the fact that in the past five years every SHAWCO president has been awarded a Mandela Rhodes Scholarship and has gone on to study at Oxford.

“SHAWCO’s biggest asset is the UCT students who willingly give up their time and energy. We want to send humane and considerate graduates into the world who understand the needs of the vast majority of our people. SHAWCO strives to gear students to be the kind of leaders and social innovators and entrepreneurs who will make South Africa a better place for all who live here.”

“We like to believe that we help students achieve ‘total’ intelligence – that increasingly valued combination of academic intelligence combined with being emotionally smart and socially aware” he adds.

In short, the kind of students who as future leaders will understand that social innovation is indeed the smart choice. **1**

R 40,000 turnover per month which go directly toward funding SHAWCO. By George’s calculation it would just need every student on campus to donate four items of clothing per year to generate over a R1-million annual turnover.

By integrating this funding strategy with an organisational culture of social innovation and entrepreneurship, as well as by articulating clearer goals and focussing on SHAWCO’s core mission of providing education and health services, George turned a R1-million deficit into a R290 000 surplus – all within the first year and without retrenching staff.

Accordingly he sought out new business models of income generation that would help SHAWCO to not only survive in the short-term, but that would be sustainable and eventually lead to it financial freedom.

“The development of new social innovation programmes is governed by three questions and new ideas do not see the light of day unless the innovator is able to answer the following three questions in the affirmative: Does it benefit the community? Does it take away from existing projects? Does it come with its own resources and personnel?” says George.

New programmes have to show a track record of sustainable profitability before they are officially adopted.

SHAWCO continues to further develop its social innovation initiatives and improve projects and services to deliver more effective community development and secure greater financial independence.

“Social innovation continues in our various projects, and so the recipients benefit. There is more professional monitoring and evaluation and the mobile clinics are more efficient, providing a platform for learning and serving. Do we wait for donors to decide on what we should be doing, how we should do it and to what extend it should be done? No, not at SHAWCO!” he says emphatically.

As SHAWCO’s culture has changed, the ethos of its staff has also changed. “Whereas before there was an expectation that the centre would provide – which had previously been a pervasive attitude – we broke away from that hierarchical structure and became much more participative and organic,” he recounts.

MPTech Consulting



“The continuing good relationships with UCT Chemical Engineering / MPTech / RRF [Reagent Research Facility] has given Lonmin access to a pool of expertise in a number of key areas. Particular benefit has been derived from UCT’s involvement, through personnel and students, in on-site pilot flotation testwork, the surveying and improvement of comminution and classification circuits through simulation and modelling, the characterisation of ore types and flotation reagents, and investigations into new comminution technology. A significant contribution has also been made to the development of Lonmin metallurgists through their attendance of training courses and workshops on comminution, flotation, mineralogy and simulation”

Dr Victor Ross, Lonmin

Where specific patents are not involved, consulting outputs are often hard to quantify and their positive impact goes ‘under the radar’ when the technology transfer of a university is assessed.



Consulting is an important means of technology transfer by a university. It often involves rapid application of cutting-edge intellectual property that enhances commercial operations and effectively grows the economy.

Whilst consulting activity typically involves short-term intervention to troubleshoot or advise on specific issues that a particular industry partner may be experiencing, MPTech Consulting has found that the ongoing close association with industry, where long-term relationships are developed, provides a rich opportunity to inform and guide fundamental research projects that are conducted in the Centre for Minerals Research. This gives the Centre’s research a clear focus that is directed at solving real-world problems in the minerals processing industry. MPTech operates within the Centre as a grouping that professionalises the technology transfer provided by the core team. Researchers from the Centre are called in for specific projects on an ad hoc basis.

MPTech has certainly racked up a number of successes, especially in the area of comminution, such as:

- A 20% increase in throughput on primary ball mills after correcting a mill dilution problem arising from the use of a flash flotation unit in the circuit.
- A throughput limitation on a two-stage circuit that was thought to arise from the Semi-Autogenous Grinding (SAG) mill, was traced to the ball mill ball load. A major error in the SAG mill inlet water measurement was also identified and by correcting these two issues, the plant achieved its highest ever throughputs. This also meant that a second ball mill did not need to be installed at the plant to achieve the desired increase in throughput.
- Over 15 sites’ mill shell liner designs have been improved to reduce throughput and wear issues. A liner profile gauge has been developed by MPTech that is now widely used by sites and liner suppliers to track liner wear and predict relining requirements more accurately.

MPTech also provides ongoing training to graduates in industry, responding to the local demand for high calibre technical staff. Both longer-term programmes and short, week-long courses delivered



on site have improved the internal research and development strategies of industrial partners.

There is strong collaboration with a similar operation in Australia, JKMRRC and its consulting arm JKTech, with MPTEch being accredited trainers and appointed as southern African agents for JKTech's process simulation software JKSimMet and JKSimFloat. MPTEch has been heavily involved in the development of JKSimFloat and through its consulting activities has surveyed local industry and generated custom parameters specific to the characteristics of the South African industry. **i**

Contact Nicky Davies of MPTEch:
che-cmr@uct.ac.za
Tel: 021 650 5510