

# 100

1912 – 2012

## CELEBRATING ONE HUNDRED YEARS OF HEALTH SCIENCES AT UCT

In 2012 the Faculty of Health Sciences celebrated a century of extraordinary growth, achievement and excellence in advancing health, nationally and globally. This milestone marked the passing of one hundred years since the opening of the first medical school buildings on the Hiddingh Campus on 6 June 1912. UCT has the oldest medical school in sub-Saharan Africa, and has educated some of the finest minds in the country. We have also produced some of the greatest medical advances to arise from Africa, such as the first test of its kind for pregnancy, the first successful heart transplant, and the research that led to the development of the computerised tomography (CAT) scanner.

**T**he Medical School of 1912 has grown into a 21st-century Faculty of Health Sciences, comprising a range of health disciplines including basic, clinical, rehabilitation and public health sciences. The current-day mission of the faculty is to address health challenges by promoting quality and equity in healthcare services, educating health practitioners for life and undertaking cutting-edge, relevant research. The reach and impact is extensive as the faculty keeps pace with global approaches to academic health sciences, accelerating efforts to improve health on our continent, and building a future through which we will sustain our contributions to health throughout the world. With a modernised curriculum, the demographic profile is transformed and the admissions of students from all corners of our country and beyond have increased substantially. Increasingly, the faculty's staff, like that of the rest of the university, enjoys an international reputation for excellence, and graduates continue to make their mark in the world.

---

**The reach and impact is extensive as the faculty keeps pace with global approaches to academic health sciences, accelerating efforts to improve health on our continent, and building a future through which we will sustain our contributions to health throughout the world.**

---

Amongst the more than 70 centenary-branded events held during 2012 were a number of research-related activities. These included the inaugural Wolfson Memorial Colloquium, with a keynote address titled *A New Agenda for Global Health* by Baron Peter Piot, Professor of Global Health and Director of the London School of Hygiene and Tropical Medicine. A centenary academic debate was held on the topic '*Cholesterol is not an important risk factor for heart disease and*



*The late Emeritus Professor Chris Barnard who performed the world's first successful heart transplant in 1967 at Groote Schuur Hospital.*

*current dietary recommendations do more harm than good*', with arguments from UCT's Professor Tim Noakes (proponent) and Dr Jacques Rossouw of the National Institutes of Health in the USA. A community partnership event and a more focused community-collaboration event highlighting the faculty's work with the Masiphumelele region, titled *Masiphumelele – Bringing science to the community*, and hosted by the Desmond Tutu HIV Centre. A centenary edition of the *South African Medical Journal* was created to showcase some of the academic highlights from the faculty over the last century, as well as its more recent research.

One of the key messages that the centenary celebrations conveyed was that the faculty has 'a prestigious reputation for medical achievement and cutting-edge research that has impacted on health globally'. Over the next pages, we share achievements of the Faculty of Health Sciences and flagship university health-related research initiatives.

## The Institute of Infectious Disease and MOLECULAR MEDICINE

The Institute of Infectious Disease and Molecular Medicine (IIDMM) is the largest research entity at the University of Cape Town. As a trans-faculty postgraduate research institute, its focus is on infectious diseases, particularly HIV/AIDS and tuberculosis; non-communicable diseases, such as prevalent cancers; genetic medicine; and molecular medicine, including drug discovery. In 2012, the IIDMM was home to 27 full members, nine associate, 12 affiliate (early/mid-career researchers) and nine adjunct members. 150 master's and PhD students were hosted, as were 76 postdoctoral research fellows and 140 research-funded staff.

**T**he goals of the institute are focused on high-quality, internationally competitive research, relevant to Africa. Additionally, the institute aims to influence health policy and practice, and to be a major training hub in Africa for biomedical, clinical and public health researchers. It is particularly important that the work of the institute is translational – that the discoveries and pursuits are taken from the laboratories and applied in our communities. Importantly, the IIDMM's research themes, which are determined by members' specific interests, align closely with national health priorities.

Consistent with its established reputation, the IIDMM has continued to grow in research excellence and output. Journal publications for the institute at the end of 2012 totalled over 200, and included papers published in *Nature Medicine* (impact factor 22.5), *Lancet* (impact factor 38) and *American Journal of Respiratory and Critical Care Medicine* (impact factor 11). Collaborative research continued with colleagues based at 15 South African institutions, 17 African institutions in 12 other countries, and 122 institutions in 27 countries further afield, and included 42 consortia.

The vision of the IIDMM is to be a centre of excellence where researchers work together to tackle diseases of major importance in Africa. As a postgraduate research institute that fosters world-class research at the intersection of the basic, clinical and public health sciences, the IIDMM has become home to some rising stars whose work is attracting major attention in the global arena.



## Tackling Critical Questions in TB Vaccine Research in SATVI

To implement the mission of the South African Tuberculosis Vaccine Initiative (SATVI) – "Innovative and high-quality TB vaccine research in Africa, to impact the global epidemic" – a research group, led by Professor **Willem Hanekom** and Dr **Tom Scriba**, has been testing six new TB vaccine candidates in 15 completed or ongoing clinical trials. SATVI also addresses other critical clinical, epidemiological, immunological and human genetic questions in TB vaccine development.



A large focus of the latter research is identification of markers in blood to indicate whether a person is at risk of developing TB disease, or protected against TB disease: so-called correlates of risk of disease or of protection. SATVI has emerged as a world-leading research group in this area, evidenced by multiple grants awarded from the National Institutes of Health, the European and Developing Countries Clinical Trials Partnership (EDCTP), and the Bill and Melinda Gates Foundation. For example, in 2012, the Director of SATVI, Professor Willem Hanekom, was awarded a \$4.77 million grant from the Gates Foundation, while SATVI's Deputy Director for Immunology and Human Genetics, Dr Tom Scriba, was awarded an EDCTP Senior Fellowship. The longitudinal correlates studies focus on correlates of risk of TB disease in various settings: after BCG and novel vaccination against TB in infants, after community-wide TB exposure in adolescents, and after household exposure to a person with lung disease in adults. Preliminary results point to marked heterogeneity in mechanisms of risk of TB disease and, secondly, to importance of inflammation. These results have already challenged current paradigms in TB pathogenesis.



## Research at the Intersection of TB and HIV

HIV has driven a dramatic resurgence of the TB epidemic and a quarter of all HIV-associated TB cases globally are diagnosed in South Africa.

The research of early-career scientists **Graeme Meintjes** and **Wendy Burgers** is focused at the intersection of HIV and TB. Associate Professor Graeme Meintjes is an infectious-diseases physician whose research is targeted at improving understanding and clinical management of conditions affecting patients with advanced HIV disease. He was awarded a five-year Wellcome Trust Intermediate Fellowship in 2012 that will support a prospective cohort study of 660 patients admitted to hospital with HIV-associated TB. This study is aimed at defining contributors to the high mortality in these patients and improving treatment strategies. He is also principal investigator of a randomised controlled trial of prednisone for the prevention of the TB-associated immune reconstitution inflammatory syndrome, a frequent complication occurring during early antiretroviral therapy in patients with HIV and TB. This trial is funded by an EDCTP Strategic Primer Award made in 2012. Dr Wendy Burgers is a UCT and University of Cambridge-trained immunologist who holds a five-year Wellcome Trust Intermediate Fellowship. She leads a growing research group of three postdoctoral research fellows and four postgraduate students, seeking to understand why HIV infection leads to a greater susceptibility to TB. Also funded by a Senior Fellowship Award from the EDCTP, her work takes the unique perspective of attempting to understand immunity to TB and the effect of HIV at the site of disease, the lung. She is also principal investigator on an NIH grant focusing on identifying the mechanisms of excessive immune activation during HIV infection, a process that drives progression to AIDS. These studies could reveal important new targets for immune intervention during HIV infection.

## Building Capacity in Bioinformatics and Computational Biology

In 2012 Associate Professor **Nicola Mulder** and Dr **Darren Martin** from the Computational Biology (CBIO) Group at the IIDMM together published 27 papers or chapters in the international peer-reviewed literature.



These papers covered a remarkable diversity of topics, from the development of advanced computational methods for analysing bacterial and viral protein and nucleic acid interaction networks to the application of these and other computational tools to detailed analyses of many of Africa's most prevalent infectious diseases. While the foundation of CBIO's research strategy has been the development of extensive networks of local and international collaborators (many of whom work at the cutting edge of either infectious disease or computational biology research), its success has been primarily based on the training and excellent work of a constant stream of top master's and PhD students and postdoctoral research fellows from across Africa. A particular highlight for the group in 2012 that enables this is the award to Associate Professor Mulder of a \$12-million NIH-funded Human Heredity and Health in Africa (H3Africa) grant aimed at nurturing and growing computational biology-based research collaboration and student training networks across Africa. The CBIO group is co-ordinating bioinformatics groups in more than 30 institutions across 15 African countries through the H3ABioNet project. (Also see page 65.)

## Tackling Critical Questions in HIV Prevention and Pathogenesis

In 2012, Professor **Carolyn Williamson** (HIV Diversity and Pathogenesis Group) and Associate Professor **Jo-Ann Passmore** (HIV Mucosal Immunology Group) together published 20 papers in international peer-reviewed journals and one book chapter focusing on HIV prevention and pathogenesis.



A highlight was a paper in *Nature Medicine* which demonstrated that HIV mutation, in an attempt to avoid host immune detection, was required for the evolution of potent HIV-specific broadly cross-neutralising antibodies. Understanding how to elicit broadly cross-neutralising antibodies though vaccination is a major question in Professor Williamson's field and her laboratory played a leading role in this discovery. She and Associate Professor Passmore also co-authored two important studies in the *Journal of Infectious Diseases* highlighting the failure of the syndromic management approach to adequately treat sexually transmitted infections in women in communities with high HIV incidence rates. After the acquisition of HIV, genital inflammation remained a significant predictor of worse clinical HIV disease outcome. In recognition of their notable track record in mucosal immunology and HIV transmission, Professor Williamson, Associate Professor Passmore and four other members of the IIDMM were awarded a competitive R5-million EDCTP Strategic Primer grant aimed at bringing together a multicentred mucosal immunology consortium of investigators committed to establishing scarce skills capacity for mucosal research surrounding HIV prevention trial sites in South Africa.

## Biomedical TB RESEARCH

The major focus of the UCT node of the DST/NRF Centre of Excellence for Biomedical TB Research (CBTBR), which was established in 2011, is on strengthening the node's research thrusts in fundamental research in the physiology and metabolism of *Mycobacterium tuberculosis* of relevance to drug discovery and drug resistance. The node is engaged in three inter-related drug-discovery projects. Two of these form part of large international TB drug consortia funded by the Bill and Melinda Gates Foundation and the European Union Seventh Framework Programme respectively. The third project is being carried out under the auspices of the South African Tuberculosis Research and Innovation Initiative, funded by the Technology and Innovation Agency. This project has formed the basis of a new university-wide collaborative partnership with Professor Kelly Chibale's group in the H3-D Centre for Drug Discovery.

**F**urther efforts in 2012 have focused on identifying opportunities for new collaboration with other TB research groups in the IIDMM, including the Desmond Tutu HIV Centre, the Clinical Infectious Diseases Research Initiative and the South African Tuberculosis Vaccine Initiative, in studies that can capitalise on the CBTBR's expertise in mycobacterial genetics, genomics, biochemistry and physiology. Encouraging progress has been made in this area, with several new projects under discussion.

A major research output in 2012 was a publication in *Chemistry & Biology* by Dr Garth Abrahams, Professor Valerie Mizrahi and international collaborators at the US National Institute of Allergy and Infectious Diseases, Seattle BioMed and Cambridge University describing the development and application of engineered strains of *Mycobacterium tuberculosis* as novel tools for TB drug discovery. In another important development, Dr Krishmoorthy Gopinath and Dr Digby Warner succeeded in identifying the protein responsible for uptake of vitamin B12 by *Mycobacterium tuberculosis*. This work, which was carried out in collaboration with colleagues at the Swiss Federal Institute of Technology in Lausanne with funding from the Swiss-South Africa Joint Research programme, was presented at two international conferences in France, and has been submitted for publication.

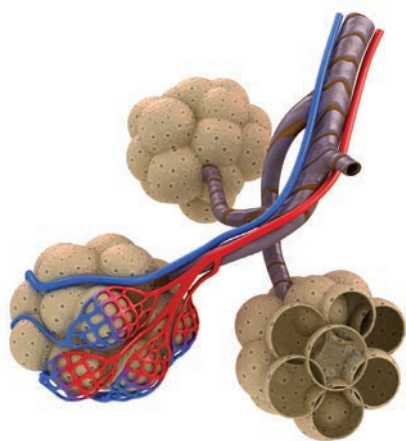
Professor Mizrahi was selected as a Senior International Research Scholar of the Howard Hughes Medical Institute (HHMI) in 2012. Her five-year grant from the HHMI will support programmes in fundamental TB research and advanced postgraduate training at the UCT node.





## Research in CHILD LUNG HEALTH

Driven by the large burden of childhood respiratory illnesses in South Africa and Africa, Professor Heather Zar of UCT's Department of Paediatrics and Child Health has built a strong clinical translational research programme focused on developing strategies to improve child lung health. This has been underpinned by the growth of a busy clinical research unit at the Red Cross War Memorial Children's Hospital and training of several master's and doctoral students. She is currently leading a new initiative that will see an expanded paediatric clinical research unit completed this year, with satellite sites in community settings, enabling growth of clinical research and building much capacity in child health in South Africa and Africa.



**T**his research addresses the leading causes of childhood illness and death in African children – tuberculosis, pneumonia, HIV-associated respiratory illness and asthma. A strong focus has been on evolving new strategies for diagnosis, prevention and treatment of pneumonia – the major killer of children under five years of age – including those for HIV-infected children. A recently completed project included a study of the impact of the new pneumococcal conjugate vaccine (introduced in 2009 in South Africa) on hospitalisation for childhood pneumonia and on the cause of pneumonia. Tuberculosis, the major cause of death in South Africa and a relatively neglected, important cause of childhood illness, has been another focus, particularly the development of better ways to diagnose and prevent childhood TB. This work has been supported by grants from the National Institutes of Health (NIH) and the European Developing Country Clinical Trials Partnership.

Together with Professor Mark Nicol (Head of Microbiology at UCT) and a research team, Professor Zar recently published the first landmark papers showing the usefulness of GeneXpert – a rapid way to diagnose TB that simultaneously diagnoses drug-resistant disease – when used in children. The studies, published in the leading journals *Lancet Infectious Diseases* and *Clinical Infectious Diseases*, showed that TB could be rapidly detected on induced sputum or on nasal mucus in 75% of children with culture-confirmed disease. Such findings have changed global practice, with potential major impact for improving diagnosis and treatment of childhood TB; the World Health Organisation has recently recommended this as the standard of care for children with suspected TB living in areas of high HIV prevalence or drug resistance.

---

**Such findings have changed global practice, with potential major impact for improving diagnosis and treatment of childhood TB; the World Health Organisation has recently recommended this as the standard of care for children with suspected TB living in areas of high HIV prevalence or drug resistance.**

---

Prevention of TB in HIV-infected children has been another strong area of research. Professor Zar and her group have previously shown that isoniazid (INH), a drug used to treat TB, was highly effective in reducing mortality and preventing TB in HIV-infected children with advanced HIV/AIDS. Building on this, a key recent publication showed that INH had an additive effect to antiretroviral therapy in preventing TB in such children. In 2012, Dr Lisa Frigati, a MMed student supervised by Professor Zar, received the best-publication award in the Department of Clinical Sciences for a young investigator for this work, which was published in the prestigious journal *Thorax*.

In a first for the African continent, Professor Zar recently set up a birth cohort study (the Drakenstein Child Lung Health Study), which is funded by the Bill and Melinda Gates Foundation. This multidisciplinary study investigates the determinants of pneumonia and the long-term impact on child health with focus areas including nutrition, infectious diseases, environmental exposures, psychosocial factors, maternal and paternal health, and genetic and immunological factors. To date, almost 500 pregnant women have been enrolled and 260 babies born. There are 13 postgraduate students working on different aspects of the study; several have been awarded prestigious



national and international grants for sub-studies nested in the Drakenstein cohort. Exciting preliminary results have emerged from some of these areas, particularly those led by Professor Mark Nicol (microbiology aspects), Professor Landon Myer (epidemiological aspects), Professor Dan Stein (psychosocial aspects) and Dr Aneesa Vanker (environmental aspects). Another first for the African continent is the use of infant lung function in this study, which has been led by Dr Di Gray, a PhD student, for which she received a Wellcome Trust training award. The pilot results from infant lung-function testing indicate excellent success in performing this, and substantial differences in lung function in six-week-old infants compared to their European or North American counterparts, suggesting an innate vulnerability to pneumonia.

More recently, the research focus has expanded to include a study of the health of HIV-infected adolescents, a growing population with unique, but poorly understood, health needs. Together with co-investigator Professor Landon Myer, Professor Zar was awarded a large five-year grant from the NIH to study the development and progression of respiratory, cardiac and neurocognitive disease in a cohort of HIV-infected adolescents. This multidisciplinary research involves collaborators in the Departments of Paediatrics and Child Health, Medicine, Public Health, and Psychiatry, and the IIDMM, and has the potential to identify mechanism of disease and novel preventative and treatment strategies.

## Genomic and Proteomic Research UNLOCKING THE SECRETS OF DISEASE

Genomic and proteomic researchers at UCT's Faculty of Health Sciences are pushing the boundaries of science and unlocking new knowledge, with the potential to develop new cures and more effective treatments for diseases common in the developing world, such as tuberculosis, HIV/AIDS and cancer. The potential for commercial application of this knowledge is also extensive.

**F**unctional genomics research has the potential to yield the sort of information, discoveries, and inventions that translate into future biomedical advances and commercial activity. For instance, a functional genomics programme that studies patterns of protein and lipid expression in peripheral fluids taken from a group of tuberculosis (TB) patients could lead researchers to discover molecular markers that diagnose TB. These would then form the basis of a new point-of-care diagnostic test for TB that works in low-resource settings. This would be a major healthcare innovation in the developing world, and generate commercial activity worldwide.

This field of speciality requires state-of-the-art, high-throughput analytical technologies. Fortunately, these are now available locally and Department of Science and Technology investments in the Centre for Proteomic and Genomic Research, along with capital equipment acquired by UCT and partner universities, is transforming the Western Cape into an oasis of genomic and proteomic research.




---

The future prospects for major breakthroughs at UCT in both infectious and non-communicable diseases are bright, even though it is a long and often rocky road that leads to discovery and validation of the sort of disease-associated biomarkers that can be translated into lifesaving health care innovation.

---

Research programmes in this area are heavily dependent on the availability of sophisticated bioinformatics tools and the expertise to analyse and make sense of the vast quantities of raw experimental data generated – an area of increasing strength for UCT.

South Africa provides a remarkable wealth of clinical resources, including a population that represents more than 95% of the world's human genetic diversity, along with

a heavy burden of existing and emergent diseases. However, programmes are notoriously expensive, due to the scale of research – many thousands of genes, proteins, or small molecules are measured in parallel, through time and under different environmental conditions, in a large number of biological samples, in order to enable statistically significant quantitative conclusions.

---

**Research is heavily dependent on the availability of sophisticated bioinformatics tools and expertise to analyse and make sense of the vast quantities of raw experimental data generated – an area of increasing strength for UCT.**

---

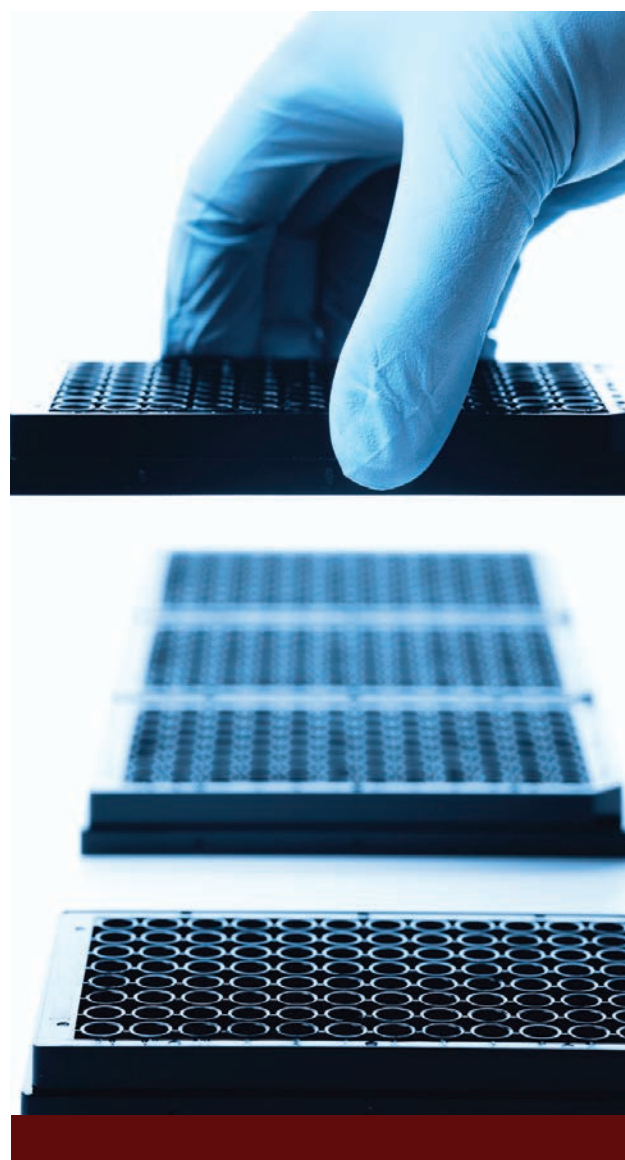
This is beyond the scope of traditional South African funding agencies. Fortunately, major international donors are increasingly committing to funding functional genomics research at UCT. Examples of these partnerships include the National Institutes of Health and the Wellcome Trust that, together with the African Society for Human Genetics, fund the Human Heredity and Health in Africa initiative (H3Africa); the Bill & Melinda Gates Foundation (BMGF); the European and Developing Countries Clinical Trial Programme (EDCTP); and the Canadian Institutes for Health Research (CIHR).

---

**South Africa provides a remarkable wealth of clinical resources, including a population that represents more than 95% of the world's human genetic diversity, along with a heavy burden of existing and emergent diseases.**

---

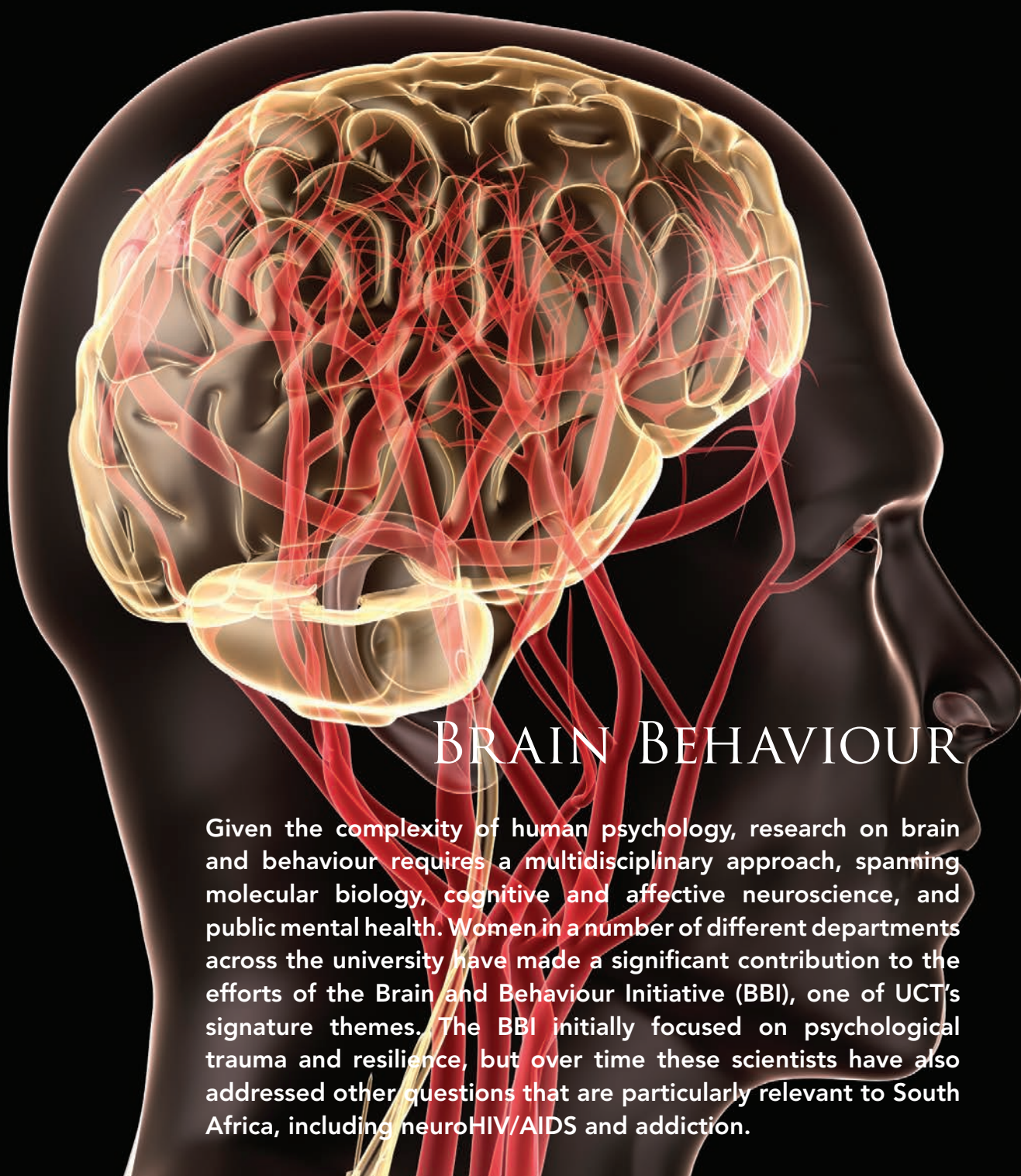
The H3Africa initiative studies the genomic and environmental determinants of disease in Africa, supporting African population-based genomic studies of common, non-communicable and communicable diseases. It also aims to build capacity for genomics research; create and expand genomics research infrastructure on the African continent, by supporting the development of a bioinformatics network and pilot biorepositories; and fund studies of the societal implications of genetic and genomics research.



African population-based genomic studies of common, non-communicable disorders, such as heart and renal disease, and communicable diseases like tuberculosis, is critical and is being led by African scientists – many of whom are at UCT.

Researchers typically work in multidisciplinary collaborations across a number of experimental platforms, which are made possible through established collaborative networks within UCT and beyond.

The future prospects for major breakthroughs in both infectious and non-communicable diseases is bright, even though it is a long and often rocky road that leads to discovery and validation of the sort of disease-associated biomarkers that can be translated into lifesaving healthcare innovation.



## BRAIN BEHAVIOUR

Given the complexity of human psychology, research on brain and behaviour requires a multidisciplinary approach, spanning molecular biology, cognitive and affective neuroscience, and public mental health. Women in a number of different departments across the university have made a significant contribution to the efforts of the Brain and Behaviour Initiative (BBI), one of UCT's signature themes. The BBI initially focused on psychological trauma and resilience, but over time these scientists have also addressed other questions that are particularly relevant to South Africa, including neuroHIV/AIDS and addiction.



**P**rofessors Nicola Illing and Vivienne Russell investigate the molecular aspect of brain-behaviour studies. Professor Illing has a particular interest in gene expression, with an interest in how psychological stress changes gene expression in the brain. In order to begin to address this question, she mentored a student project that focused on comparing gene expression in white cells and in the brains of rodents exposed to stress. The data were the first to be published in this area, and have led to a patented test. She is currently working with a postdoctoral research fellow on gene expression in white cells in people who abuse methamphetamine.

Genes are ultimately translated into proteins. Professor Russell and postdoctoral research fellow Dr Jacqueline Dimatellis have focused on protein expression in animal models of stress and of substance use. Their work suggests that the combination of early-life adversity and later methamphetamine use results in more alterations in protein concentration in a key area of the brain – the nucleus accumbens – which is involved with reward



processing. Ultimately, the hope is that, by understanding such molecular processes in more detail, new targets for treatment can be developed.

Professor Ernesta Meintjes is the DST/NRF SARCHI Chair in Brain Imaging, and has played a particularly important role in conducting clinical research relevant to the BBI mission. Her work has included studies of children with fetal alcohol syndrome, as well as children with neuroHIV/AIDS, and involves collaborations with clinician-scientists abroad and locally. Much of her research is funded by the National Institutes of Health. As children are not easily able to lie still during imaging, she and her collaborators at the Massachusetts General Hospital have developed new MRI sequences, which facilitate motion correction during the analysis of scans.

---

**Professor Dan Stein, Director of the BBI, says that he is pleased that women scientists are making such a large contribution to the BBI, and notes that, when it comes to BBI postdoctoral research fellows and doctoral students, women are again taking the lead.**

---

Dr Katherine Sorsdahl, the project manager of the BBI, represents the public health aspect of brain-behaviour studies. Together with her mentor, Honorary Associate Professor Bronwyn Myers, she has been involved in intervention studies for people suffering from substance-use disorders. Given the resource constraints that local

mental-health services face, she has focused on using lay counsellors to provide the interventions, an idea known as “task-shifting”. Her preliminary findings indicate that such interventions can make a large difference. Dr Sorsdahl is enthusiastic about continuing to study treatments that are simple and inexpensive enough to be rolled out to the public on a large scale.

Professor Dan Stein, Director of the BBI, says that he is pleased that women scientists are making such a large contribution to the BBI, and notes that, when it comes to BBI postdoctoral research fellows and doctoral students, women are again taking the lead. Their research projects range from those focusing on molecular science (Shareefa Dalvie, Nastassja Koen and Jacqueline Womersley) to neuroimaging (Samantha Brooks, Jacqueline Hoare, Anne Uhlmann, Sarah Cotton, and Daniella Vuletic) and clinical and public mental-health aspects (Sonja Pasche, Nicole McAnda, Taryn Amos, Maxine Spedding, and Claire van der Westhuizen).

A number of young scientists have focused on translational science in particular, moving between “the bench and the bed”: Dr Fleur Howells, for example, has undertaken a series of animal and human studies in order to address the role of particular neurotransmitter systems in mental disorders.

“Our aim,” Professor Stein says, “is to go from bench to bed and beyond, in order to begin to address key questions in the brain-behaviour sciences, and to find new approaches to the diagnosis and treatment of mental disorder.” The BBI is keen to attract more staff and students to work in this area.



## The importance of EXERCISE



Physical activity and exercise are the fulcrums around which the UCT/MRC Research Unit for Exercise Science and Sports Medicine (ESSM) research is conducted, and the unit adopts an integrated approach to research. Broadly, the unit's research falls into three focus areas, covering the spectrum from physical activity for health, to clinical sports medicine, to exercise for performance. These focus areas are inter-linked by a multidisciplinary approach that borrows from the disciplines of, among others, genetics, molecular science, nutrition, physiology, biochemistry and biomechanics to better understand every aspect of physical activity and exercise. That broad strategy, delivered through the application of basic and applied sciences, has resulted in a number of key research projects in 2012.

## The Study and Promotion of Physical Activity for Health

The goal of this project is to study barriers to and factors that facilitate health-seeking behaviours such as physical activity, in various settings and populations, in order to develop and then measure the effectiveness of interventions aimed at improving these lifestyle behaviours and health status. This project is led by Dr Tracy Kolbe-Alexander, who leads ESSM's public health and physical activity research, along with Professor Vicki Lambert.

Working in conjunction with Discovery Vitality, academics from the University of the Witwatersrand, and Emory University, Dr Kolbe-Alexander has helped to develop and evaluate the Healthy Company Index in South African companies. The first in a series of peer-reviewed publications was published in the *Journal of Occupational and Environmental Health*. In recognition of her research in this area, Dr Kolbe-Alexander was asked to serve as a panelist and speaker at the recent Global Healthy Workplace Awards and Summit in London. A similar project is the South African Fittest City Index, which compares the health and fitness profiles of eight metropolises. Finally, in an African first, Dr Kolbe-Alexander investigated the relationship between the built environment and physical activity in older adults, finding that neighbourhood safety was one of the main barriers to physical activity while the neighborhood aesthetics played a role in increasing activity among those over the age of 60 years.

Professor Lambert and her team have been focusing on the ecological determinants of adult and childhood obesity, as part of the five-country, NIH-funded, Modelling the Epidemiological Transition Study, spearheaded by the Department of Epidemiology and Community Health at Loyola University in Chicago, and including the Seychelles, Ghana, Jamaica, USA and South Africa. More recently, Professor Lambert has served as the in-country PI for the 12-country ISCOLE Study (International Study of Childhood Obesity, Lifestyle and the Environment). Data from this study will be used to formulate the third in a series of Healthy Active Kids South Africa Report Cards (2007, 2010, and now 2014), and forms the basis of two doctoral studies. Finally, Professor Lambert was a member of a prestigious writing group for *The Lancet's* Physical Activity Series of five scholarly peer-reviewed manuscripts which appeared in July 2012 in conjunction with the London 2012 Olympics, and had as the primary focus the global evidence for physical activity and health.



## Prevention and Management of Chronic Diseases

South Africa faces enormous challenges as a result of the rising prevalence of obesity and associated disease such as cardiovascular disease and diabetes. Paradoxically, these diseases of "excess" occur against a South African context of poverty, and the combination has significant implications for the health of our country.

For the last couple of years, Dr Lisa Micklesfield and Dr Julia Goedecke have explored various methods to measure visceral adipose tissue (VAT), the fat around the organs associated with metabolic disease. Waist circumference can be used as an indirect measure of VAT; however, there are a number of limitations with this method, and for this reason they have assisted with developing a method to more accurately estimate VAT using dual x-ray absorptiometry technology.

This work was subsequently published in the *Journal of Obesity*, and has subsequently received a fair amount of attention both internationally and locally. This methodology has since been included in the dual energy x-ray absorptiometry software (DXA) to allow for more accurate measurement of VAT using this technology. Future research will include examining the association between this DXA-derived measure of VAT and disease outcomes in different populations and hopefully will increase our understanding of this association.

## Sporting Performance, Medicine and Sports Injuries

The Paralympic Games of London in 2012 were the biggest, most successful and, by virtue of a comprehensive series of research studies conducted by ESSM in partnership with the International Paralympic Committee, the most researched Paralympics in history.



bodied athletes – more upper-limb injuries (shoulder, hand, wrist and elbow) occur in Paralympic athletes than in able-bodied athletes. “Interestingly,” explains Professor Derman, “this is true even in lower-limb amputees, and is likely because normal daily activities like getting in and out of cars places a greater load on the upper limbs, making them more susceptible to injury as a result of sports participation.”

The research also found that one in nine athletes developed an illness during the Paralympic Games, and that non-respiratory tract illnesses, including urinary tract and skin conditions, are more common than respiratory tract infections in Paralympic athletes. “The implication is that medical care for Paralympic athletes is very different from that of able-bodied athletes, and team physicians must be mindful of these differences when planning their intervention strategies for both prevention and treatment of illness and injury,” explains Professor Derman.

Sporting performance and injury research also has a genetic slant through the work of Professor Malcolm Collins and Drs Alison September and Mike Posthumus. Having previously identified various DNA sequence variants associated with tendon and ligament injuries, the group has continued this but with the ambition of expanding into a more mechanistic understanding of genes and injury. “It is important for us to move beyond simply associating gene variants with injury. We want to determine how these variants are involved in altering risk,” explains Professor Collins. This means borrowing from other techniques, including cell and molecular biology, to add to world-leading genetic research already conducted by ESSM.

ESSM have also, over the last year, developed a research-consultant relationship with SA Rugby’s safety programme, BokSmart, directed by Dr Wayne Viljoen, an ESSM graduate. “SA Rugby has set up an excellent infrastructure to log and monitor cases, and we are helping analyse the data to identify how to improve implementation and direct future policy,” explains Professor Mike Lambert, who has overseen the project from ESSM’s side, along with PhD student James Brown.

The 2012 London Paralympics showcased the performances of over 4,000 athletes from 164 nations. It was also the opportunity for a comprehensive evaluation of injury and illness from a team of ESSM researchers, led by Professors Wayne Derman and Martin Schwellnus, in collaboration with the International Paralympic Committee.

The research, published in a series of papers in the *British Journal of Sports Medicine*, described a web-based surveillance system that captured statistics of 3,565 athletes, from 160 nations, to provide a goldmine of data involving 49,910 athlete days.

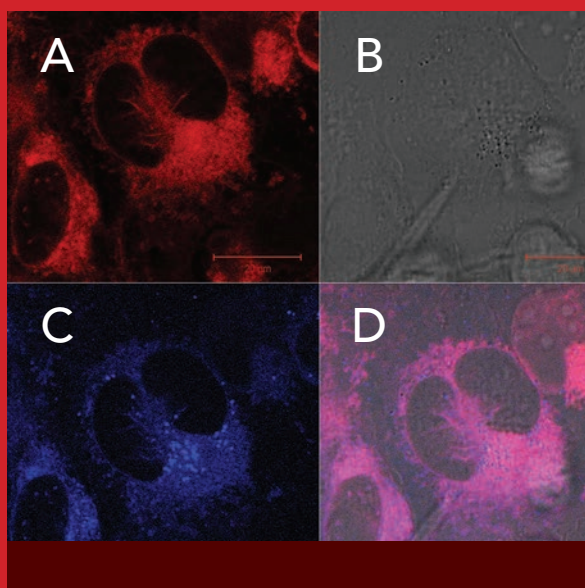
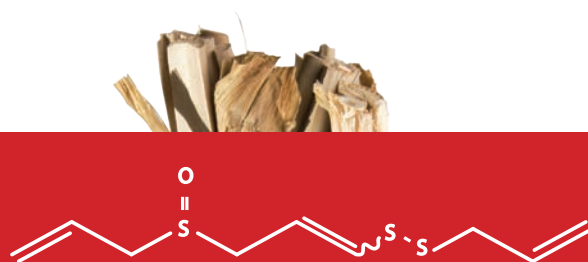
Among the intriguing findings was that the patterns of injury and illness are different from those of able-

## Developing the Potential of Garlic to Fight Cancer

Garlic (*Allium sativum*) has been used in folk medicine for centuries both as a food flavour-enhancer and for its beneficial health effects. Although the pungent garlic taste is not universally loved, the beneficial medicinal properties are widely known to fight infections, heart disease and cancer. These medicinal properties are attributed to the organosulfur compounds found in crushed cloves, of which the compound *E/Z*-ajoene is one of the major constituents ("ajo" comes from the Spanish for "garlic").

Traditional garlic extracts have yielded low amounts of ajoene as part of a mixture of products. Professors Roger Hunter and Iqbal Parker and Dr Catherine Kaschula have developed the first synthetic route to ajoene analogues, which has been patented by UCT. The researchers identified the ajoene anti-cancer "pharmacophore" (the group of atoms in the molecule of a drug that are actually responsible for the drug's action) to be the disulfide, with the vinyl and sulfoxide groups further enhancing activity. This facilitates the design and synthesis of more-potent ajoenes than the natural product. These are currently undergoing pre-clinical evaluation.

Recently, a fluorescent-tagged ajoene has for the first time enabled the UCT researchers to track ajoene's activity within the cancer cell, as shown in the photomicrographs. It is now thought that ajoene interferes with protein-folding in the cancer cell, which induces programmed cell death (apoptosis). This novel anti-cancer mechanism can be used in a multi-pronged approach with current anti-cancer therapeutics to kill cancer cells.



Fluorescent images of MDA-MB-231 breast cancer cells treated with a blue fluorescing-ajoene. Breast cancer cells (B) were stained with a dye which causes the endoplasmic reticulum (ER) of the cell to fluoresce red (A) and then treated with the blue-fluorescing ajoene (C). An overlay of both red and blue fluorescent signals shows a "pink" signal (D) indicative of the fluorescing ajoene localising to the ER (red + blue = pink).

## Research Groupings associated with this theme

### ■ Lung Infection and Immunity Unit

The Lung Infection and Immunity Unit (LIU) comprises approximately 40 students and staff embedded within the Division of Pulmonology in the Department of Medicine at UCT. The research focus is on lung infections and diseases of poverty, including tuberculosis, pneumonia and HIV. The unit also has a clinical trials division, which is located within the UCT Lung Institute. The unit's research focus areas include the pathogenesis, diagnosis and outcomes of multi-drug-resistant pulmonary infections, the development and evaluation of field-friendly diagnostics for TB and other pulmonary infections, and the immunology of pulmonary infections with special emphasis on regulatory T-cells and innate immunity.

The LIU is a WHO-associated African Network for Drugs and Diagnostics Innovation Centre of Excellence. The work of the unit has informed policy documents on drug-resistant TB and diagnostics, and seminal work has been published about the immunology of pulmonary TB.

Capacity-development activities have included the organisation of several popular annual courses attended by researchers from all over Africa, the establishment of clinical recruitment infrastructure at clinical trial sites in Cape Town, and the training and mentorship of clinician scientist PhD students. A recently filed patent has spawned a UCT spin-off company that is developing a diagnostic test for extrapulmonary tuberculosis.

*Director: Professor K Dheda*

*E-mail: [keertan.dheda@uct.ac.za](mailto:keertan.dheda@uct.ac.za)*

*Web: [http://www.lunginstitute.co.za/content/lung\\_infection.html](http://www.lunginstitute.co.za/content/lung_infection.html)*

### ■ Hatter Institute for Cardiovascular Research In Africa

The aims of the Hatter Institute for Cardiovascular Research in Africa are to facilitate national and international research collaborations, to consolidate and expand existing efforts to combat the most serious cardiovascular threats to health, and to improve overall prosperity in the region. Major research areas are cardiac disease and maternity, cardioprotection, cardiovascular genetics and Heart of Africa projects. In Africa, cardiovascular disease is the most common cause of maternal death in pregnant women. The objective of the institute's Cardioprotection Group is the delineation of novel cardioprotective pathways that can be activated to limit cell death in various pathophysiological conditions such as heart failure, myocardial infarction or diabetes. The Cardiovascular Genetics Group aims to discover the genetic basis of inherited heart diseases that cause sudden death. This work involves the study of rare families with monogenic disease (that is, inherited cardiomyopathies and arrhythmogenic disorders), and the delineation of the genetic architecture of complex traits associated with sudden death (such as cardiac hypertrophy). These studies hold promise of discovering the critical biological pathways that can be targeted by drugs to prevent sudden cardiac death. The Heart of Africa Pan-African Hypertension Cohort was established in 2010 to describe the epidemiology and characteristics of pulmonary hypertension in Sub-Saharan Africa.

*Director: Professor K Sliwa-Hahnle*

*E-mail: [karen.sliwa-hahnle@uct.ac.za](mailto:karen.sliwa-hahnle@uct.ac.za)*

*Web: <http://www.hatter.uct.ac.za>*



*Members of the Lung Infection and Immunity Unit*

### Adolescent Health Research Unit

Adolescents face a wide range of health problems, owing to a combination of biological, social, and psychological factors. There is thus a niche for a research facility that focuses specifically on the health needs of adolescents. The Adolescent Health Research Unit at UCT builds on existing research and collaborations to co-ordinate, promote and facilitate research into all aspects of adolescent health. The specific aims of the unit are to facilitate cutting-edge inter-disciplinary research that addresses key national public adolescent health priorities; to promote networking among adolescent health researchers, practitioners, and policy makers; to increase the profile of the Faculty of Health Sciences in the arena of world-class adolescent health research; to provide policy consultation at local, provincial, national, and international levels; and to increase and improve educational offerings in adolescent health at undergraduate and postgraduate levels.

*Director: Professor P de Vries*

*E-mail: [petrus.devries@uct.ac.za](mailto:petrus.devries@uct.ac.za)*

*Web: <http://www.health.uct.ac.za/research/groupings/adolescent/>*

### MRC/UCT Cape Heart Centre

This combined research entity is the largest heart research group in South Africa and forms part of the Cape Heart Group, which links research between UCT and the other universities in the region. The Hatter Institute, which is part of the MRC/UCT Cape Heart Centre, is involved in the study of the molecular and cellular biology of ischaemic heart disease, as well as the molecular and cellular pathophysiology of cardiac hypertrophy and heart failure. The goal of the research programme is to contribute to the fundamental understanding of the mechanisms in the development of ischaemic heart disease, cardiac hypertrophy, and heart failure. The Cardiovascular Research Institute, to which is allied the Medtronics Institute, is studying biocompatible materials for vascular and valvular prostheses. Lipidology is concerned with research into lipid and lipoprotein disorders in patients in the region and novel treatment strategies for these disorders. Its research also includes new diagnostic assays for local problems in health care and lipid peroxidation.

*Director: Professor P Zilla*

*E-mail: [peter.zilla@uct.ac.za](mailto:peter.zilla@uct.ac.za)*

*Web: <http://web.uct.ac.za/depts/chc/>*

### Cardiovascular Research Unit

The core research pursuit of the Cardiovascular Research Unit centres around the concept of regenerative medicine, with the goal of engineered regeneration of diseased structures through co-ordinated and site-directed signalling to facilitate gradual in-situ remodelling of surgically replaced hybrid biosynthetic devices. These offer patients an immediate dramatic improvement in quality of life through return to functionality of these diseased structures.

*Director: Professor P Zilla*

*E-mail: [peter.zilla@uct.ac.za](mailto:peter.zilla@uct.ac.za)*

*Web: <http://www.uct.ac.za/depts/cts>*

### Centre for Infectious Disease Epidemiology and Research

The Centre for Infectious Disease Epidemiology and Research (CIDER) aims to be an African Centre of Excellence in infectious disease epidemiology and related research. The centre has a strong base that spans a number of disciplines and conducts public health research, integrating laboratory, clinical, epidemiological, social science, and health systems research into infectious diseases that have high priority in Southern Africa (in particular, HIV and tuberculosis) in order to improve the prevention and management of these diseases. The centre maintains strong links with health services at all levels in order to identify research priorities, and assists policy makers, programme managers, and services managers with the implementation of the results of research. The centre aims to be a centre of excellence in the surveillance and monitoring of infectious diseases and infectious disease programmes and services, and in the conduct of robust observational research, based on routine data sources. CIDER provides extensive postgraduate level teaching and supervision in epidemiology.

*Director: Associate Professor A Boulle*

*E-mail: [andrew.boulle@uct.ac.za](mailto:andrew.boulle@uct.ac.za)*

*Web: <http://www.cider.uct.ac.za>*

### MRC/NHLS/UCT Molecular Mycobacteriology Research Unit

The Molecular Mycobacteriology Research Unit (MMRU) was established in 2000 as an extramural research

## Research Groupings associated with this theme

unit of the MRC, hosted jointly by the National Health Laboratory Service and the University of the Witwatersrand. In 2011 the MMRU was transferred to the University of Cape Town, where it is now based in the Institute of Infectious Disease and Molecular Medicine. The mission of the MMRU is to carry out fundamental research on aspects of the physiology and metabolism of relevance to tuberculosis drug resistance and drug discovery. By adopting a research strategy that is based on investigating specific aspects of the metabolism and physiology of *Mycobacterium tuberculosis*, the MMRU has positioned itself at the front-end of TB drug discovery research.

*Director: Professor V Mizrahi*

*E-mail: [valerie.mizrahi@uct.ac.za](mailto:valerie.mizrahi@uct.ac.za)*

*Web: <http://www.health.uct.ac.za/research/groupings/mmrui>; <http://www.mrc.ac.za/mycobacteriology/mycobacteriology.htm>*

### Desmond Tutu HIV Centre

The activities of the Desmond Tutu HIV Centre (DTHC) are underpinned by research and evaluation. It aims to impact on policy and practice, both nationally and internationally, through relevant research, peer-reviewed publications, and feedback to government, civil society, and the community at large. DTHC is driven by a passion for humanity and a vision of South Africa without AIDS. Over the years, it has become a source of advice for medical practitioners, support for people seeking testing or treatment, and leadership in preventative education. With an experienced and dedicated team of more than 165 doctors, nurses, researchers, and community-trained field workers, the Desmond Tutu HIV Centre offers a holistic approach to the HIV epidemic.

*Director: Professor R Wood*

*E-mail: [robin.wood@hiv-research.org.za](mailto:robin.wood@hiv-research.org.za)*

*Web: <http://www.desmondutuhivcentre.org.za/>*

### Institute of Infectious Disease and Molecular Medicine

Concentrating our research efforts on infectious diseases, particularly HIV/AIDS and tuberculosis, and on non-communicable diseases prevalent in Africa, the Institute of Infectious Disease and Molecular Medicine aims to be a centre of research excellence in Africa, and a major training hub for biomedical, clinical, and public health researchers. The institute provides its members, affiliates, and visiting scholars from around the world with an environment that is highly interactive,



allowing complex scientific problems framed in a public health context to be tackled in a multidisciplinary way. Collaborations, partnerships and networks contribute to our world-class scientific endeavours. Our strong scientific base spans many areas of modern, molecular-based enquiry, including molecular and cell biology, immunology, virology, microbiology, genetics and genomics, biochemistry, pharmacology, vaccinology, molecular epidemiology, and structural, high-throughput and computational biology. Our aim is to apply scientific discovery from the bench to the bedside and to the community through a dynamic interplay between basic, clinical, and public health research.

*Director: Professor V Mizrahi*

*E-mail: [valerie.mizrahi@uct.ac.za](mailto:valerie.mizrahi@uct.ac.za)*

*Web: <http://www.iidmm.uct.ac.za>*

### Drug Discovery and Development (H3-D) Centre

The Drug Discovery and Development Centre (also known as H3-D) was founded in 2010. The centre aims to bridge the gap between basic and clinical studies, and to train a new generation of African scientists with the key skills required for drug discovery

and development, thereby integrating medicinal chemistry, biology and pharmacology, as well as drug metabolism and pharmacokinetics studies, as reflected in the processes of absorption, distribution, metabolism and excretion. H3-D also focuses on the beneficiation of clinically used drugs, including generic medicines. Drug beneficiation, among other things, involves the selection of the optimum form of a solid drug candidate for pharmaceutical development and (re)formulation.

*Director: Professor K Chibale*

*E-mail: [kelly.chibale@uct.ac.za](mailto:kelly.chibale@uct.ac.za)*

*Web: <http://www.h3-d.co.za>*

### MRC/UCT Immunology of Infectious Diseases Research Unit

Human infectious diseases are a high-priority area for South Africa and Africa, where they continue to be a leading cause of childhood and adult morbidity and mortality. Thus the MRC/UCT Immunology of Infectious Diseases Research Unit focuses on the understanding of host-protective immune responses and the development of effective vaccine strategies for the eradication of diseases that are identified as priority areas by the World Health Organisation: tuberculosis, leishmaniasis, helminth diseases (bilharziosis) and African trypanosomiasis (sleeping sickness). The unit's mission is to be relevant as an excellent multidisciplinary and international team, embracing both basic and applied research, in order to improve capacity, teaching, and training in the immunology of infectious diseases.

*Director: Professor F Brombacher*

*E-mail: [fbrombac@mweb.co.za](mailto:fbrombac@mweb.co.za)*

*Web: <http://www.health.uct.ac.za/research/groupings/iidu/>*

### MRC/UCT Oesophageal Cancer Research Group

The MRC/UCT Oesophageal Cancer Research Group is an inter-disciplinary and inter-institution group (UCT, MRC and the University of Stellenbosch), established by the MRC in 1997. Squamous cell carcinoma of the oesophagus is one of the eight most common cancers worldwide. High-incidence areas include China, Japan, and certain hot spots in France, Iran and South America. More important is the fact that the incidence of squamous cell carcinoma of the oesophagus is very high in Southern and Eastern

Africa, but virtually absent in West Africa. This group is investigating the environmental and genetic factors that predispose Africans to this disease.

*Director: Professor MI Parker*

*E-mail: [iqbal.parker@uct.ac.za](mailto:iqbal.parker@uct.ac.za)*

*Web: <http://www.iidmm.uct.ac.za/iparker/index.htm>*

### MRC/UCT Receptor Biology Research Group

The mission of the group is to study the structure and function of G protein-coupled receptors and to apply the research to understanding and treating diseases that have major effects on the social and economic welfare of South Africa. The group focuses on the gonadotropin-releasing hormone receptors and on the kisspeptin receptor, which are central regulators of the reproductive function, on the prostaglandin receptors and their role in cervical cancer, and on the CCR5 chemokine receptor and its role in Human Immunodeficiency Virus (HIV) entry and infection.

*Co-Directors: Associate Professor AA Katz, Dr CA*

*Flanagan and Professor RP Millar*

*E-mail: [arieh.katz@uct.ac.za](mailto:arieh.katz@uct.ac.za)*

*Web: <http://web.uct.ac.za/depts/iidmm/akatz/research.htm>*

### UCT Leukaemia Unit

The UCT Leukaemia Unit was established with the objective of fostering basic and clinical research in the area of haematological stem cell disorders and blood malignancies. Some of the current interest includes the marrow microenvironment in multiple myeloma, molecular genetics of acute or chronic leukaemias, and clinical studies in lympho-proliferative disorders. As a consequence, a laboratory with a comprehensive array of equipment is available where honours, master's and doctoral students are running research projects. Based on these studies, a number of clinical and laboratory programmes have been developed. In this regard, the only university-based haematopoietic stem-cell transplantation programme in the country is located at Groote Schuur Hospital. Parallel studies focusing on haematopoietic stem-cell biology and immune reconstitution after transplantation are ongoing.

*Director: Professor N Novitzky*

*E-mail: [nicolas.novitzky@uct.ac.za](mailto:nicolas.novitzky@uct.ac.za)*

*Web: <http://www.health.uct.ac.za/research/groupings/leukaemia/>*

## Research Groupings associated with this theme

### Albertina and Walter Sisulu Institute of Ageing In Africa

The Albertina and Walter Sisulu Institute of Ageing in Africa is a cross-disciplinary group within the Department of Medicine in the Faculty of Health Sciences and incorporates the divisions of Geriatric Medicine, Geriatric Neuropsychology, Geriatric Neurosciences and Geriatric Psychiatry, and a Gerontology programme. The institute strives to be an academic and research centre of excellence that addresses critical issues of ageing in Africa, and serves as a catalyst for local, national, and regional expertise and a focal point for the development of research services and training. Its mission is achieved through inter-disciplinary and cross-national partnerships and research collaboration, human-resource development, and policy information in the national context and on the African continent. Areas in which research projects are currently conducted at the institute include physical, cognitive and social functioning, and quality of life; vascular risk factors and stroke; falls in older persons and quality of care; and dementia and risk factors for cognitive disorders.

*Director: Dr S Kalula*

*E-mail: [sebastiana.kalula@uct.ac.za](mailto:sebastiana.kalula@uct.ac.za)*

*Web: <http://www.instituteofageing.uct.ac.za>*

### MRC/UCT Human Genetics Research Unit

The group's current focus is on the genetics of colorectal cancer, inherited forms of blindness, and neuropsychiatric diseases. Recent breakthroughs include identifying the genetic basis of retinitis pigmentosa and developing therapeutics to stem loss of vision in individuals shown to carry the disease-causing mutation. A greater effort is being put into engaging with high-throughput technologies and the mapping of genes for common chronic disorders.

*Director: Professor R Ramesar*

*E-mail: [raj.ramesar@uct.ac.za](mailto:raj.ramesar@uct.ac.za)*

*Web: <http://www.health.uct.ac.za/research/groupings/hgru/>*

### MRC/UCT Medical Imaging Research Unit

The mandate of the Medical Imaging Research Unit (MIRU) is to conduct world-class research in medical

imaging that specifically addresses the healthcare needs of Africa. Although located in the Western Cape, the MIRU sees itself as a national facility, with the responsibility of providing an imaging platform that is available to the wider research community in the country. Our research focuses on the role of medical imaging in addressing problems such as trauma, cancer, tuberculosis, HIV/AIDS, neuromuscular disorders, cardiovascular disease, and alcohol abuse, all of which pose serious threats to public health in South Africa. In addition to using established techniques to address local healthcare needs, we are developing novel imaging methods in areas such as magnetic resonance imaging, mammography and microscopy, which are appropriate for our national context but will also find application in the rest of the world. The unit has strong collaborative links with Western Cape hospitals, the local medical device industry, and international institutions.

*Director: Associate Professor T Douglas*

*E-mail: [tania.douglas@uct.ac.za](mailto:tania.douglas@uct.ac.za)*

*Web: <http://www.miru.uct.ac.za/>*

### Women's Health Research Unit

The Women's Health Research Unit, established in 1996 in the School of Public Health and Family Medicine, is involved in research, teaching, technical health service support, and advocacy in the areas of women's health, and gender and health. It is made up of a multidisciplinary team of researchers with expertise in public health, epidemiology, sociology, and anthropology. The unit works closely with the national, Western Cape provincial, and City of Cape Town Departments of Health, as well as with other academic institutions and NGOs, in sexual and reproductive and women's health. Key research areas include HIV and reproductive health, gender and HIV, health systems research (reproductive health), female cancers, contraception, and termination of pregnancy.

*Director: Dr J Harries*

*E-mail: [jane.harries@uct.ac.za](mailto:jane.harries@uct.ac.za)*

*Web: <http://www.whru.uct.ac.za>*

### UCT/MRC Research Unit for Exercise Science and Sports Medicine

The UCT/MRC Research Unit for Exercise Science and Sports Medicine is part of the Department of Human Biology, within the Faculty of Health Sciences. The

primary functions of the unit are to research factors influencing physical performance and health, and to disseminate knowledge and skills through education. Specifically, the research aims to develop a novel understanding of integrated human function during exercise and to use this knowledge to promote health and well-being; to treat and prevent specific chronic diseases; to treat and prevent injuries and medical conditions associated with sport and exercise; and to optimise exercise performance.

*Director: Professor TD Noakes*

*E-mail: [timothy.noakes@uct.ac.za](mailto:timothy.noakes@uct.ac.za)*

*Web: <http://www.essm.uct.ac.za/>*

### Centre for Supramolecular Chemistry Research

Located in the Faculty of Science, this group was constituted in 1997 and focuses on the physical chemistry of supramolecular systems. Various host-guest compounds are synthesized, their structures analysed by means of powder and single crystal X-ray diffraction, as well as thermal and spectroscopic techniques, and the results related to their physical properties. Our research efforts concentrate on the beneficiation of drugs through investigation of their polymorphs, solvates, co-crystals, and cyclodextrin inclusion complexes; on the synthesis and characterisation of open framework transition metal structures and purely organic porous materials, and on the synthesis and characterisation of large supramolecular assemblies and the study of guest selectivity in organic host-guest systems.

*Director: Professor MR Caira*

*E-mail: [Mino.Caira@uct.ac.za](mailto:Mino.Caira@uct.ac.za)*

*Web: <http://www.supramolecular.uct.ac.za/index.htm>*

### Structural Biology Research Unit

The Structural Biology Research Unit co-ordinates and promotes the experimental determination of biological structure at the University of Cape Town. The Unit is a grant funded entity, operationally located in the Division of Medical Biochemistry, Department of Clinical Laboratory Sciences, that employs staff, provides a home for post-graduate students and post-doctoral fellows and conducts research. It has members who are UCT academics who wish to conduct structural research and who are prepared to apply for grants to fund research in the Unit. The Unit also has affiliates, either from South

Africa or abroad, who participate in the activities of the Unit in a variety of ways – including but not limited to: providing advice and expertise, exchanging materials, providing resources and using the resources of the Unit.

The visualization of the structure of biological objects ranging from cells to macromolecules with microscopic or atomic detail is essential for understanding how living systems work. The knowledge of the structures can be exploited to produce medicines and vaccines, ecologically friendly industrial processes and agricultural products. The unit specializes in determining structures experimentally by electron microscopy and X-ray crystallography and makes extensive use of computer based modelling to extend the results. The unit has access to unique resources for the purification and preliminary characterization of proteins, cryo-electron microscopy and X-ray diffraction at a synchrotron beamline. It plays a pivotal role in South Africa's BioEconomy strategy by providing the core expertise for establishment of the discipline of Structural Biology in the whole country and applying the technology to a wide range of problems of scientific, medical and industrial interest.

*Director: Professor BT Sewell*

*E-mail: [Trevor.Sewell@uct.ac.za](mailto:Trevor.Sewell@uct.ac.za)*

*Web: <http://sbio.uct.ac.za/>*

### Gender, Health and Justice Research Unit

The Gender, Health and Justice Research Unit at the University of Cape Town's Faculty of Health Sciences (Division of Forensic Medicine and Toxicology) conducts progressive research in the area of women's rights. Faced with staggering levels of violence against women in South Africa, the unit is dedicated to improving access to health and justice services for survivors of gender-based violence. The unit uses inter-disciplinary methods from various academic fields, including law, the social sciences, and public health, to contribute to policies and laws, and to advocate for social justice. Among its current projects are monitoring legislation relating to sexual and domestic violence, as well as inter-disciplinary research relating to women in prisons, domestic and rape homicide, access to post-exposure prophylaxis after rape, "conflicting laws" and torture in post-conflict African states.

*Director: Associate Professor L Artz/Acting Director: Dr K Moul*

*E-mail: [Lillian.Artz@uct.ac.za](mailto:Lillian.Artz@uct.ac.za) and [Kelley.Moul@uct.ac.za](mailto:Kelley.Moul@uct.ac.za)*

*Web: <http://www.ghjru.uct.ac.za>*

## DST/NRF SARCHI Chairs associated with this theme



*Professor Jonathan Blackburn*

### Applied Proteomics and Chemical Biology

Professor Jonathan Blackburn holds the SARCHI Chair in Applied Proteomics and Chemical Biology and is head of the ANDI Centre of Excellence in Proteomics and Genomics. He obtained his DPhil degree in Chemistry from the University of Oxford, and carried out postdoctoral research at the Medical Research Council (UK). Professor Blackburn serves on a number of national and international committees, including the National Health Research Committee, the Biotechnology committee of the International Union of Pure and Applied Chemistry, and the Nominations and Election Committee, Human Proteome Organisation. He sits on the editorial advisory boards of the *Journal of Proteome Research*, *Journal of Proteome Science* and *Computational Biology*, and *Expert Review of Proteomics*. He also sits on the Scientific Advisory Board of GenTel BioSciences (USA), and on the Research Advisory Panel of the Council for Scientific and Industrial Research Biosciences.



*Associate Professor Ernesta Meintjes*

### Brain Imaging

Associate Professor Ernesta Meintjes completed her undergraduate studies at the University of KwaZulu-Natal, Pietermaritzburg, and master's and PhD degrees in Physics at Oregon State University, USA. Since July 2000, she has been employed as a research officer and lecturer in the Department of Human Biology and in

2007 she was awarded the South African Research Chair in Brain Imaging. Her current research focuses on both magnetic resonance imaging methods development and application. She has significant expertise in prospective motion correction and application of these methods to study brain development in children with fetal alcohol spectrum disorders and HIV infection, and in the study of cardiac disease.



*Associate Professor Marc Combrinck*

### Clinical Neurosciences Research

Associate Professor Marc Combrinck is a neurologist who trained in medicine and biochemistry at the University of Cape Town and Groote Schuur Hospital. He was a research fellow at the University of Oxford before returning to South Africa in 2004. His research interests lie in dementia, neuro-inflammation and mechanisms of neuro-degeneration. He continues this work in Cape Town, using clinically based observational studies of cognitive impairment in the elderly and in HIV-associated brain disorders. In March 2011, Associate Professor Combrinck was also appointed to the prestigious William Slater Chair of Geriatric Medicine, the first endowed chair in the sub-specialty of geriatric medicine in South Africa.



*Professor Kelly Chibale*

### Drug Discovery

Professor Kelly Chibale obtained his PhD in Synthetic Organic Chemistry from the University of Cambridge in

the UK with Stuart Warren (1989–1992). This was followed by postdoctoral stints at the University of Liverpool in the UK as a British Ramsay Research Fellow with Nick Greeves (1992–94) and at the Scripps Research Institute in the USA as a Wellcome Trust International Prize Research Fellow with K.C. Nicolaou (1994–96). He was a Sandler Sabbatical Fellow at the University of California San Francisco in the USA (2002), a US Fulbright Senior Research Scholar at the University of Pennsylvania School of Medicine in the USA (2008) and a Visiting Professor at Pfizer in the UK (2008). Professor Chibale's current research interests include discovery of potential drugs that fight malaria, tuberculosis and helminth (parasitic worm), as well as cardiovascular and fibrosis diseases.



*Professor Keertan Dheda*

of Medicine. He is the recipient of several prestigious awards, including the 2010 International Union Against Tuberculosis and Lung Disease Scientific Award, and holds several large local and multinational grants, including those sponsored by the EU. His main research interests are the study of the immunopathogenesis, epidemiology and diagnosis of tuberculosis, including drug-resistant TB. He is the co-author of more than 100 peer-reviewed publications, holds patents that are being commercialised, and serves on the editorial boards of several peer-reviewed international journals.



*Professor Frank Brombacher*

## Immunology of Infectious Diseases in Africa

Professor Frank Brombacher, a NRF A1-rated researcher, holds the SARCHI Chair in Immunology of Infectious Diseases in Africa, and heads up an extramural MRC Research Unit in addition to his ICGEB Scientific Co-ordinator position for Immunology and Infectious Diseases. His group investigates immunological mechanisms, regulation and protective host effector functions in experimental murine infectious disease models that are relevant to Africans, such as tuberculosis, African trypanosomiasis, leishmaniasis and helminthic infections, including bilharzia – four of the top ten WHO-declared human threats. In addition, he and his group are interested in chronic diseases, including allergic asthma and colitis, that cause high morbidity and mortality in humans.

## Infection and Immunity of Poverty-related Diseases

Keertan Dheda is Professor of Respiratory Medicine and Director of the Lung Infection and Immunity Unit within the Division of Pulmonology, Department



*Professor Anne-Lise Williamson*

## Vaccinology

Professor Anne-Lise Williamson is a virologist on the joint staff of the University of Cape Town and the National Health Laboratory Service (NHLS). As she is a full member of the IIDMM, her research activities are housed in this Institute. She is internationally recognised for both her HIV vaccine and Human Papillomavirus (HPV) expertise. She has headed the South Africa AIDS Vaccine Initiative-funded vaccine development team since 2000. This team of people has been responsible for the development of two vaccines currently in Phase 1 clinical trials in the USA and South Africa, and the ongoing potency assay for one of the vaccines is currently performed in the UCT Vaccine Research Group Good Laboratory Practice Facility. Professor Williamson is head of the World Health Organisation's HPV Labnet lab for the Africa Region and joint head of the Molecular Epidemiology Laboratory (UCT/NICD/NHLS).