



UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

RESEARCH REPORT

2013





UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

RESEARCH REPORT

2013



- 4 Message from the Vice-Chancellor and Principal**
- 8 Message from the Deputy Vice-Chancellor: Research**
- 12 Message from the Director of Research Development**

16 RESEARCH OVERVIEW

30 ETHICS COMMITTEES

- 32** Human Research Ethics Committee (Medical)
- 33** Human Research Ethics Committee (Non-Medical)
- 34** Institutional Biosafety Committee
- 35** Animal Ethics Screening Committee

36 FACULTY REPORT: COMMERCE, LAW & MANAGEMENT

- 38** Message from the Acting Dean
- 42** Human Rights, Land Rights & Contemporary Customary Law
- 44** The Development of Competition Law & Economics in South Africa
- 46** Monitoring & Evaluation: The Key to Good Governance & Service Delivery

48 FACULTY REPORT: ENGINEERING & THE BUILT ENVIRONMENT

- 50** Message from the Acting Dean
- 54** Optimisation in Process Engineering
- 56** Mathematical Brilliance Solves Systems Engineering Problems
- 58** Building Bridges Between Planning & Urban Politics, Communities & Academia

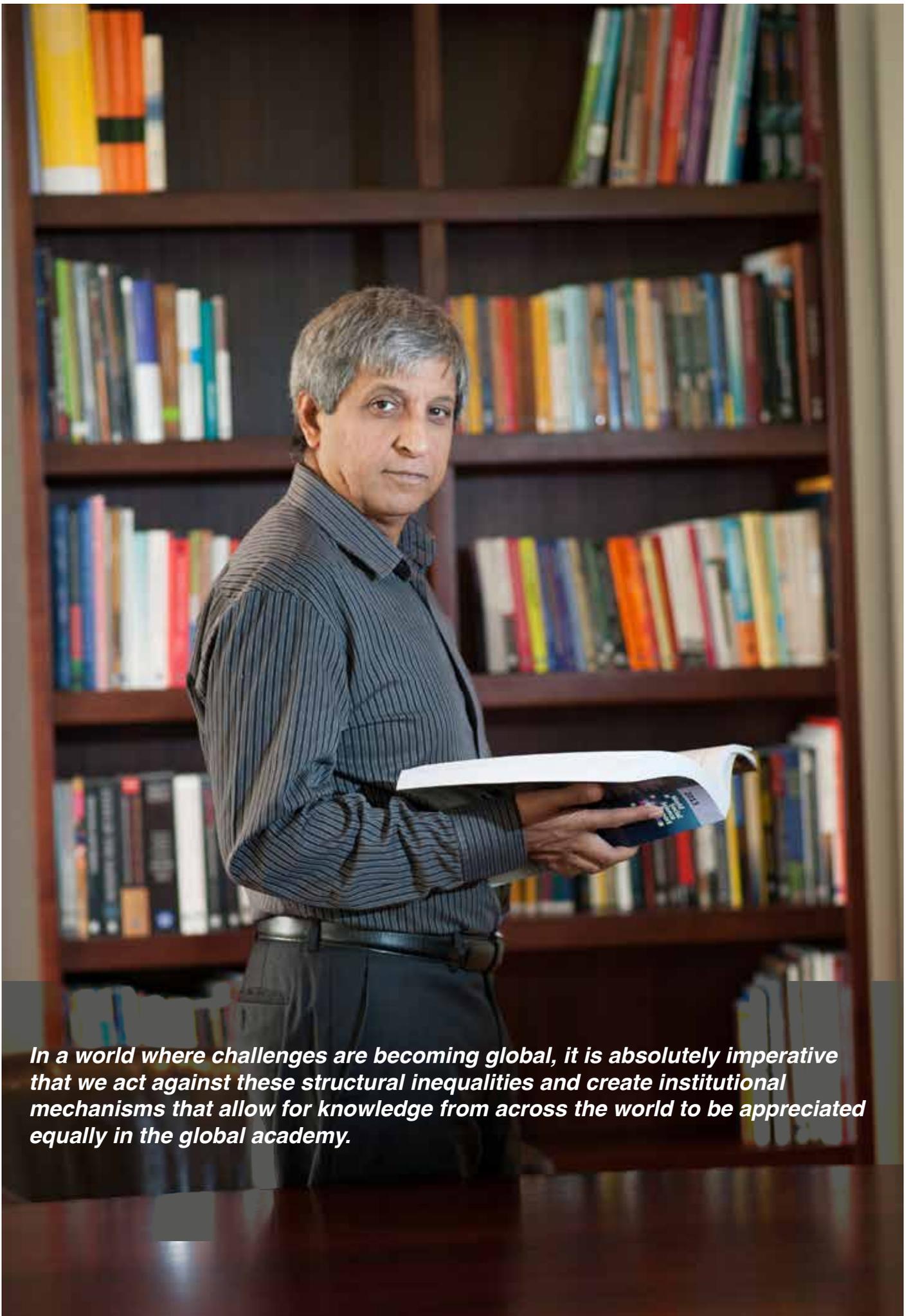
60 FACULTY REPORT: HEALTH SCIENCES

- 62** Message from the Acting Dean
- 66** Evaluating the Growth & Development of HIV Infected Children
- 68** The Zeitgeist of RNA
- 70** Silicosis – A Chronic, Incurable Occupational Disease

72 FACULTY REPORT: HUMANITIES

- 74** Message from the Dean
- 78** Migration & Dealing with Difference
- 80** State of the South African Newsroom
- 82** The Effects of Ongoing Violence & Trauma on South Africans

**86 FACULTY REPORT: SCIENCE****88** Message from the Dean**92** Distinctly in the Lead**96** When We Discover the Universe**98** Lightning Strikes & the Shaping of Mountains**100 POSTDOCTORAL FELLOWS****112** Investments in Research Equipment**118** Developing & Using Research Equipment Innovatively**120** Wits Art Museum**122** Centre for Creative Arts in Africa**124** Wits University Press**126** 21st Century Research Institutions**132** Gauteng City-Region Observatory**136** Wits Enterprise**140** Wits Health Consortium**144** News & Events**148** Books**150** In Memoriam**152** Acronyms



In a world where challenges are becoming global, it is absolutely imperative that we act against these structural inequalities and create institutional mechanisms that allow for knowledge from across the world to be appreciated equally in the global academy.

MESSAGE FROM THE VICE-CHANCELLOR & PRINCIPAL

PROFESSOR
ADAM HABIB

The fundamental challenge of the global academy is to ensure that it can harness the knowledge sets across the world for the common benefit of humanity.

The feature that prevents this from happening is the inequality in the global academy. In a context where some institutions are particularly well-endowed in terms of resources – financial, infrastructural, and human – what inevitably comes to the fore is that these institutions, reflecting very much the assumptions, norms and values of their parts of the world, tend to predominate in the global academy. In this way, the transmitting of knowledge itself gets skewed by the inequalities of the world as a whole.

This should be of serious concern. In a world where challenges are becoming global, it is absolutely imperative that we act against these structural inequalities and create institutional mechanisms that allow for knowledge from across the world to be appreciated equally in the global academy. Universities of the developing world need to be able to grow their capacities and become interlocutors that transmit knowledge into the global academy.

This is the fundamental mandate of Wits. It is a mandate to be a world class African institution – not a world class university in Africa, but a world class African institution. The latter description fundamentally involves taking one's context seriously and using this context as a lens through which to

This does not mean that we don't do the kinds of research that happens in the more established parts of the world. Of course we do, because South African society has as many established parts to it as it has poverty-stricken components. South Africa is in many ways a microcosm of the world – it is as unequal within its national boundaries as is the world. And so we have to respond to the needs and challenges of both the established parts of our society and the ones that are more impoverished.

We need to understand how renewable energy and the technologies that emanate from our renewable energy research can be deployed to poor communities as much as they are to the rich. We need to ensure that our biomedical research results in technological outputs that can benefit poor communities as much as they do the privileged.

When analysing disease patterns in our society, we should not simply look at those causal patterns that afflict rich communities but those that impact on poor ones as well.

We need to ask why it is that poor communities are as predisposed to heart attacks and strokes, and whether the causal variables are distinct from those that afflict rich communities. We need to understand how inequality prevails in our society and how it impacts on the choices that get made – the policies that get generated – and the responsiveness of political and economic elites to citizens.

WE HAVE TO RESPOND TO THE NEEDS AND CHALLENGES OF BOTH THE ESTABLISHED PARTS OF OUR SOCIETY AND THE ONES THAT ARE MORE IMPOVERISHED.

understand the global, scientific challenges of our time. It involves using one's context as a means of innovation to address the historical challenges that we face as a society and world.

These are all fundamental questions that are central to the agenda of Wits University and it is what animates the conversations that occur in the corridors of our Faculties.

To build a world class university that can be at the cutting edge and serve as an interlocutor to the global academic debates requires the pragmatic implementation of a simple formula: the appointment of good academics, providing them with resources, and creating an enabling environment for their operations. This will enable us to produce the kind of research that we are talking about – contextually relevant and globally innovative.

Towards this end we have undertaken a number of reforms. We have established new academic positions including distinguished professorships; created a new incentive structure to reward research; developed a series of capacity building initiatives to empower our academics to become productive researchers in their disciplines and related fields; and invested more money into research positions, including

postdoctoral fellowships and postgraduate scholarships. To create a more enabling environment we are trying to relieve the pressure on academics so that they have more time to do research. One way to do this is by adjusting our staff-student ratios so that they are more appropriate to our mandate of providing knowledge. In the next couple of years we will be driving up our numbers of postgraduate students and reducing our undergraduate ones.

We are enhancing our administrative efficiencies so that our academy is not overly burdened by administrative responsibilities. This includes overhauling our IT systems and online registration processes to relieve administrative pressures on academics. These and many other initiatives are underway to create a more research productive academy.



IN THE NEXT COUPLE OF YEARS WE WILL BE DRIVING UP OUR NUMBERS OF POSTGRADUATE STUDENTS AND REDUCING OUR UNDERGRADUATE ONES.

The purpose of creating an enabling academic environment is of course not simply to encourage research – it is also to fundamentally address the scientific challenges of our world at the dawn of the 21st century; to create a global citizenry where knowledge from every part of the world infuses

the conversations of the global academy and defines the research that is required to create a common humanity. This is the agenda of Wits University. Ultimately, it is the agenda that should be defining all institutions of the 21st century.

Professor Adam Habib





Wits has continued to feature in the top 300 universities worldwide, as defined by the Shanghai and Times Higher annual ranking surveys, one of only two South African universities to do so. In 2013 Wits advanced its position within the international rankings, much to our delight, and this signals Wits' avowed intent to continue to climb the ladder.

Cradle of Humankind
© World Heritage 2002



MESSAGE FROM THE DEPUTY VICE-CHANCELLOR: RESEARCH

PROFESSOR

HELEN LABURN

I hope you will enjoy reading our Research Report for 2013. This was my final year in office and I am pleased to have observed a period of steady growth in research outputs and the University's activities during my tenure.

There were a number of significant policy and operational developments in 2013. Most importantly, we finalised the 2012-2017 Strategic Plan for Research, which will be the blueprint for advancing research in the University over that period. The Strategic Plan for Research was approved by the University Research Committee, Senate and Council. We expect to introduce priority targets for implementation each year, funding allowing, and to see a significant advance in research activities, profile, collaborations, stature and ranking of our institution among national and international competitive institutions. I am grateful to Dr Gerhard von Gruenewaldt for the unstinting effort he put in to drive what became a very inclusive process. We plan to grow our numbers of postdoctoral fellows and have made more explicit our expectations of them. The strategic management of postgraduate affairs was taken into my portfolio and in 2014 the Postgraduate Office will become physically a part of the Research Office.

Wits has continued to feature in the top 300 universities worldwide, as defined by the *Shanghai* and *Times Higher* annual ranking surveys, one of only two South African universities to do so.

The rankings are based on several criteria, of which research and peer review are arguably the most important ones.

A publication of this sort cannot hope to cover all the richness and diversity of research that goes on at Wits. In this 2013 Report, we report, *inter alia*, on the further development of our five 21st Century Institutes, and the growth in numbers of NRF-rated researchers and of postdoctoral fellows. We look back over a very successful few years in the acquisition of major items of research equipment. We take stock of the progress of some of our brightest young researchers. As in previous Reports, this latest version draws attention to some specific success stories. The Report is intended to be indicative of the sort of excellent research done at Wits in 2013, to demonstrate to the reader the breadth and depth of our research. You will also find reference to other suggested sources of further information.

In 2013, the University was home to 15 NRF A-rated scientists, those at the very pinnacle of their careers, four MRC Units or Groups, three DST/NRF Centres of Excellence (one jointly with Stellenbosch and Cape Town Universities) and one DTI Centre of Excellence. 2013 saw the recognition of our newest Centre of Excellence, in palaeosciences, by the DST, in which Wits has been a national and international leader for many years.

WE LOOK BACK OVER A VERY SUCCESSFUL FEW YEARS IN THE ACQUISITION OF MAJOR ITEMS OF RESEARCH EQUIPMENT.

In 2013 Wits advanced its position within the international rankings, much to our delight, and this signals Wits' avowed intent to continue to climb the ladder.

In 2014, we will be able to report on fourth and fifth centres, so watch this space – we will, with considerable pride. We also have two Centres of Excellence conferred upon us by the African Network for Drugs and Diagnostics Innovation.

We continue to attract outstanding candidates in the South African Research Chairs Initiative, funded by the DST and NRF.

We hosted 22 South African Research Chairs in 2013, including three new ones awarded to us in December. These awards were particularly significant for Wits' success in this initiative. In other achievements Professors David Block and Lesley Cornish carried off awards from the National Science and Technology Forum, in the categories Women in Science and Outreach and Awareness respectively. Professor Neil Coville was awarded the NRF Award for Research Capacity Development, over the course of a long career in chemistry.

Each year the University selects a winner of the prestigious Vice-Chancellor's Research Award and in 2013 the Award went to Professor Viness Pillay, holder of the South African Research Chair in Pharmaceutical Biomaterials and Polymer-Engineered Drug Delivery Technologies, located in the Department of Pharmacy and Pharmacology of the School of Therapeutic Science. The Friedel Sellschop Awards, which recognise excellence and exceptional potential in emerging researchers, were awarded in 2013 to Drs Joel Quirk, Robyn Hetem, Samuel Laryea and Jonah Choiniere.

One new equipment grant was awarded under the NRF's National Equipment Programme in 2013, although again we already know that 2014 will be a more successful year.

The University was the beneficiary of a number of major grants from overseas funders, including the Andrew W. Mellon, Gates and Andrew Carnegie Foundations, the Howard Hughes Medical Institute, the British MRC, the Wellcome Trust, the University of North Carolina and the European Union. Domestically, the University was the recipient of major funding under the NRF's SARChI, Centre of Excellence, Indigenous Knowledge, Nano Flagship, African Origins Platform and Global Change Programmes. These grants varied in value between R1 million and R3 million a year. In total, the University received R261 million in new external research funds in 2013. This number excludes the funds raised by the Wits Health Consortium, which is reported on in detail towards the end of the Report.

Fifteen projects ran in 2013 under the NRF's THRIP Programme, bringing in R9.92 million from the NRF and R17.19 million from industrial partners. Collaboration with industrial partners will continue to be indispensable to our research endeavours.

Internally, the University Research Committee was given a budget of R99.4 million, of which R23 million was for equipment. Within that budget we continued to support both emerging and established researchers in their quest for recognition, funding and awards. We are proud to say that we had 256 NRF-rated researchers at the end of 2013 and the number continues to grow. There are definitions of the various NRF ratings later in this Report. Each year we have held a function to congratulate and acknowledge the achievements of our rated researchers.

COLLABORATION WITH INDUSTRIAL PARTNERS WILL CONTINUE TO BE INDISPENSABLE TO OUR RESEARCH ENDEAVOURS.

In 2013, as in previous years, we hosted many distinguished overseas researchers who visited the University. Among them were Ben Fine, Professor of Economics at the School of Oriental and African Studies; Jack Halberstam, Professor of American Studies and Ethnicity, Gender Studies and Comparative Literature at the University of Southern California; Hilda Borko, Professor of Education at Stanford University; Dr Michel Verstraete from the European Commission Joint Research Centre; Linda Graham, Professor and Principal Research Fellow at the Queensland University of Technology; Didier Fassin, Professor of Social Science at the Institute for Advanced Study of Princeton; Ananya Roy, Professor of City and Regional Planning and Distinguished Chair in Global Poverty and Practice at the University of California, Berkeley; Glauco Arbix, Professor of Sociology at the University of São Paulo; John Lennox, Professor in Mathematics at Oxford University; and Dr Duncan Green, Head of Research, Oxfam, Great Britain.

As previously, this Report includes mention of our two University companies, namely Wits Enterprise and Wits Health Consortium and their specific contributions to our research effort. Both are wholly-owned University companies, which specialise in promoting and facilitating research. Wits Enterprise provides specialist assistance to researchers in contract negotiations and pricing, patent registration, technology transfer and project management. Wits Health Consortium runs a range of clinical trials, many of them multi-centre international trials and funds independent medical research. The Consortium hosts arguably the largest research enterprises in the study of HIV/AIDS research in South Africa.

As in any year, there were low points, amongst many higher ones. Included in the former category would be the passing away of some notable researchers, particularly Professors Geoffrey Blight and Ismael Mahomed. Details are listed later in this report.

I hope you enjoy reading this Report and will find much to interest you.

RESEARCH IN NUMBERS:

2013

A-RATED SCIENTISTS
15

4 MRC UNITS OR GROUPS

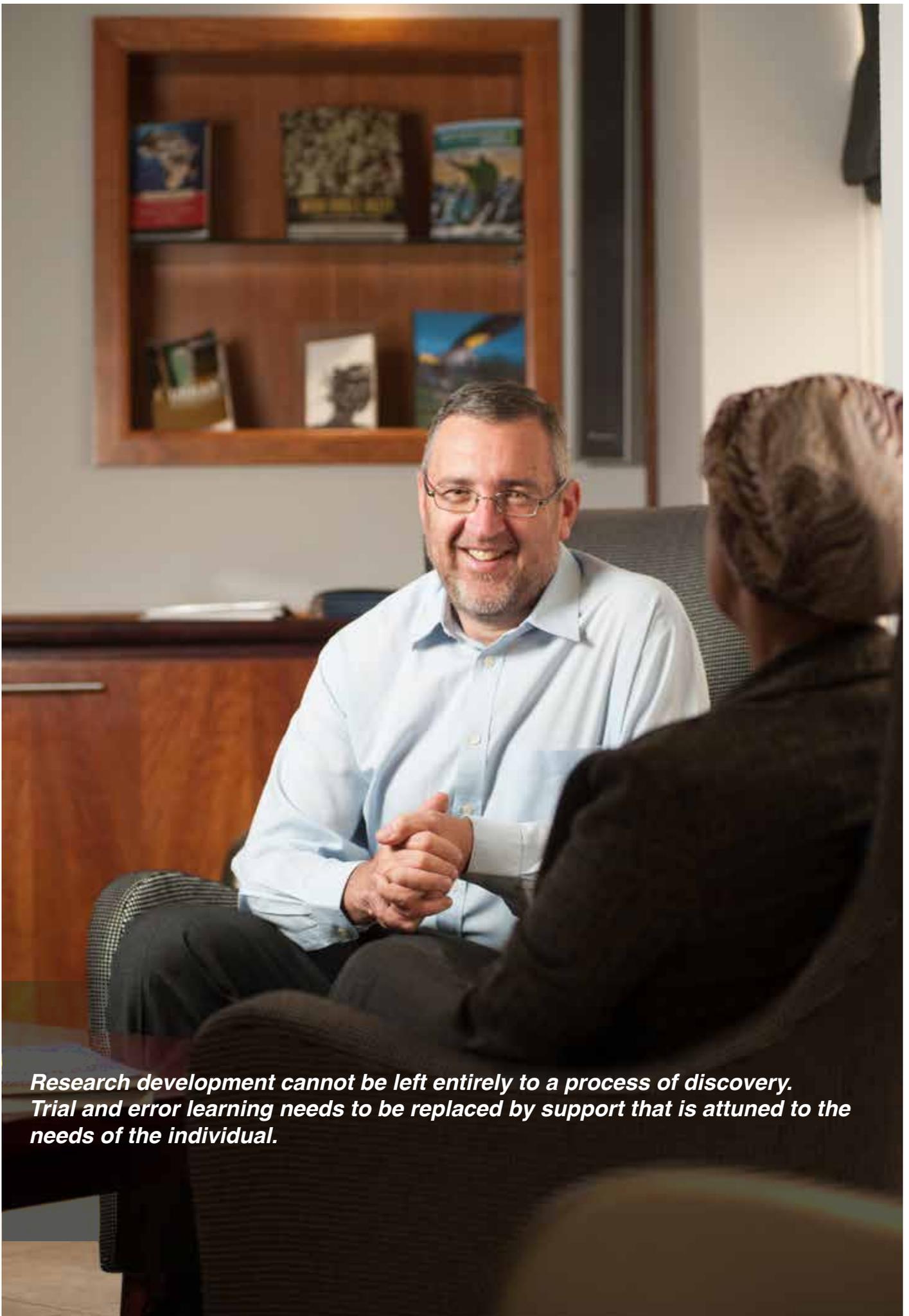
3 DST/NRF CENTRES OF EXCELLENCE
ONE JOINTLY WITH STELLENBOSCH & CAPE TOWN UNIVERSITIES

1 DTI CENTRE OF EXCELLENCE

NEW: PALAEO SCIENCES

Professor Helen Laburn





Research development cannot be left entirely to a process of discovery. Trial and error learning needs to be replaced by support that is attuned to the needs of the individual.

MESSAGE FROM THE DIRECTOR OF RESEARCH DEVELOPMENT

DR

ROBIN DRENNAN

In 2013 Wits continued to aspire to be a leading international research intensive university. This context was sharpened in the local sense by the Department of Higher Education and Training (DHET) moving ever closer to differentiating the higher education landscape in South Africa by identifying a set of five or six research intense universities and supporting these differently than the rest.

Within this context research development in the sense of developing researchers to increase their productivity and, arguably more importantly, their impact was as relevant in 2013 as in the recent past. Research development cannot be left entirely to a process of discovery. Trial and error learning needs to be replaced by support that is attuned to the needs of the individual.

This report on the University Research Office development initiatives achieved in 2013 is organised around the following topics: (i) recruitment and management of postdoctoral fellows, (ii) researcher development, (iii) mentoring and coaching of emerging researchers and (iv) recognition of research achievements and improvement of the research environment by increasing funding for research through the exploitation of networks and reducing unnecessary barriers to research.

Postdoctoral Fellows

Postdoctoral fellows (postdocs) are a key cog in the

developing new patterns of understanding it cannot be easily taught. Although guidance, in the form of supervision, and case studies are extremely useful in pointing the way to successful research, there remains a period in the development of any academic where they have to learn to “go it alone”. Using an analogy of learning to ride a bicycle, every researcher needs to learn to ride solo and unaided.

The postdoc fellowship is an ideal opportunity to do this. Although the PhD is the first exposure to real research, in the sense of creating something new and original, it is done under close supervision. Postdocs for the first time begin to develop their own independent research trajectory without the aid of “training wheels”, so to speak.

The Research Office is committed to making the postdoc experience at Wits a good one that enables the development of an independent research trajectory. This is achieved by assisting the new fellows to be inducted into South Africa, Johannesburg and Wits.

The number of postdocs at Wits grew slightly in 2013 and stood at 101 (up from 2012 by 9%). These postdoc fellows were distributed across the Faculties as follows: 43 (up from 2012 by 48%) in Science, 26 (up by 24%) in Health Sciences, 14 (up by 17%) in Humanities, 9 (up by 13%) in Engineering, 8 (down by 14%) in cross-faculty research institutes and one in Commerce, Law and Management.

THE RESEARCH OFFICE IS COMMITTED TO
MAKING THE POSTDOC EXPERIENCE AT WITS A
GOOD ONE THAT ENABLES THE DEVELOPMENT
OF AN INDEPENDENT RESEARCH TRAJECTORY.

renewal and development cycle of the academy. As research is ultimately a thinking process that focusses on discovery, critical questioning, solving of problems and

Of these 77 or 76% were funded by external sources and 79 (78%) came from beyond the borders of South Africa.

Dr Robin Drennan



Researcher Development

The University Research Office has embraced a development model based on the notion that there are four elements, regarded by some¹ as necessary precursors for successful research other than a thorough and deep understanding of the knowledge field. These four elements include peripheral knowledge, patience, money and luck.

The peripheral knowledge, i.e. knowledge other than the discipline specific knowledge core to the academic training, includes knowledge of governance, ethics, finance, project management and copy rights, to name a few areas. Essentially it is involved with the “art and craft” of the research process.

Patience has a focus on temporal issues related to research projects. Time is precious and a critical success element for research. It is important to be able to manage time effectively so that one can fit everything into a busy academic life. The ability to “juggle time” is imperative.

Money is a research driver. Despite our frustrations, the University will never be able to afford to fund all its academics’ research and so external funding is vital for success. Learning the art of “grantsmanship” is important for success.

Finally, the model focusses on preparing for luck. Although some would say that research excellence has nothing to

do with luck it can be argued that the more one is prepared to take advantage of opportunities the more one may be perceived to be lucky. So the developmental focus here is on being prepared to take advantage of opportunities whenever they may arise.

The delivery of the skills development programme is achieved in partnership with the Wits Centre for Learning, Teaching and Development (CLTD).

Mentoring and Coaching

The objective of mentoring is to maximise the transfer of knowledge from the existing, experienced research talent to the cohort of emerging researchers.

Informal mentorships exist across the University but the Mellon Retiree Mentorship Programme – a three year programme that began in 2012 – focussed on the humanities and supported 32 mentees with the aid of six mentors in 2013.

Coaching programmes that help people to set goals and remain committed to achieving them is very different from mentoring. Coaching does much to drive forward research development by realising goals.

A coaching service was provided by CLTD in 2013 that consisted of about 30 trained coaches supporting about 60 emerging researchers.

¹ Paul Ehrlich as quoted in M Perutz, ‘Rita and the Four Gs’, *Nature*, 332, 791 (1988)

RESEARCH IS A RATHER MERCURIAL PURSUIT THAT IS DISRUPTED BY MORE IMMEDIATE ACTIVITIES LIKE TEACHING. THUS IT IS IMPORTANT TO DEVELOP AND MAINTAIN AN ENVIRONMENT THAT IS CONDUCIVE TO RESEARCH. SMALL THINGS OFTEN DISRUPT THIS RESEARCH CULTURE. CONSTANT ATTENTION NEEDS TO BE FOCUSED ON REMOVING BUREAUCRATIC HURDLES, ENHANCING ACTIVE SUPPORT AND RECOGNISING ACHIEVEMENTS.

POSTDOCS IN NUMBERS:



Research Conducive Environment

Research is a rather mercurial pursuit that is disrupted by more immediate activities like teaching. Thus it is important to develop and maintain an environment that is conducive to research. Small things often disrupt this research culture. Constant attention needs to be focussed on removing bureaucratic hurdles, enhancing active support and recognising achievements. Achievements in these areas in 2013 are mentioned below.

The process of reducing unnecessary bureaucratic barriers moved from the 2012 success of the “project statement” to the establishment of a legal service within the Research Office.

Legal services are vital for the support of research projects, which often involve non-disclosure, collaboration, material transfer and similar agreements. The line between speedy contracting to benefit from transient opportunities and the risk of losing vital intellectual property is fine. It is hoped that the transfer of a legal practitioner from the Legal Office to the Research Office will benefit the practitioner to get this balance right.

Eleni Flack-Davison LL.M will start work in the Research Office in January 2014. The effectiveness of the transfer will be judged after a year via an independent review.

By way of providing active support for researchers the University Research Office purchased a licence for

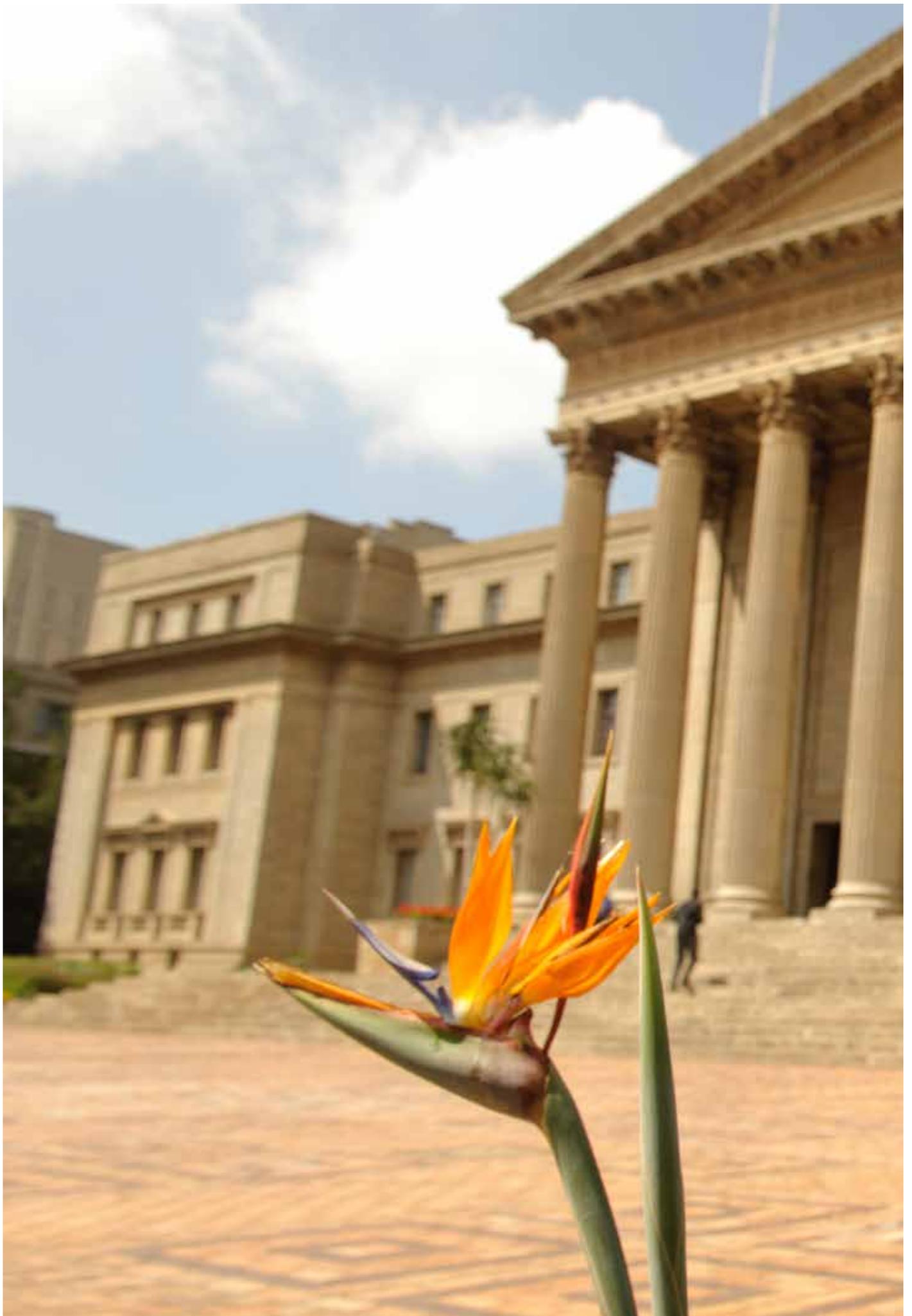
Research Professional in 2013. This web portal consists of a news service that reports on future funding opportunities in all disciplines. Several events were organised in the latter half of 2013 to advertise the availability of the service. Towards the end of the year some encouraging signs of take up were witnessed, although many more people will need to use the service to fully justify its expense.

The single major event in terms of recognition of research achievements was the celebration of NRF-rated researchers at Wits that took place in November 2013. The function was held at the Origins Centre and was addressed by Dr Thandi Mgwebi of the NRF and was attended by the new Vice-Chancellor and Principal, Professor Adam Habib.

It was also the last official duty of the outgoing Deputy Vice-Chancellor of Research, Professor Helen Laburn, who stepped aside for health reasons. A special word of thanks needs to be addressed to her for the short but most valued example of leadership that she provided for the University’s research community.

The Research Office continued its support in 2013 for academics writing research funding proposals. Two specific interventions were run in 2013 including (figures in brackets show the corresponding success in 2011 and 2012):

- NRF Thuthuka proposals
 - 48 (45, 32) submitted, 38 (27, 20) awards
- NRF rating proposals
 - 62 (45, 40) submitted, results outstanding.



RESEARCH OVERVIEW



UNIVERSITY RESEARCH COMMITTEE

The membership of the University Research Committee (URC) in 2013 is shown below. Members are appointed jointly by Senate and Council and serve a term of office of three years, which may be renewed.

URC Members 2013

Deputy Vice-Chancellor: Research and Chairperson	Professor HP Laburn
Vice-Chancellor and Principal	Professors LG Nongxa (to 31/5/13) and A Habib (from 1/6/13)
Deputy Vice-Chancellors	Professors AM Crouch and R Moore
Council representatives	Professors S Madhi, G Marcelle, G Eagle, B Kana and C Albertyn
Deans' representative	Professor HM Marques
Deans' nominees	Professor M Pieterse, S Fonn and N Pillay; Drs M Shuma-Iwisi and K Khoza-Shangase
FRC Chairpersons	Professors LA Cornish, S Hassim, B Kramer, M Moller and A van Nieuwkerk
Ex-officio representatives	A Farrell, C Jeffrey, K Menon, D Raftesath and F Ubogu
Postgraduate association	D Singo
By invitation	Dr G von Gruenewaldt and D Gozo

Some of the major issues addressed by the URC in 2013

- Review of the research performances of all five Faculties in 2013
- Adoption of a constitution for 21st Century Institutes
- Strategic Plan for Research 2012 - 2017
- Open access publishing
- Recruitment of postdoctoral fellows

Research thrusts

The research thrusts approved by Senate and Council to date and still active in 2013 are set out below:

1. Biodiversity - Champion: Professor ETF Witkowski
2. Evolution of the Species and Natural Heritage - Champion: Professor BS Rubidge
3. Cities - Champion: Professor AS Mabin
4. Materials Science and Engineering - Champion: Professor LA Cornish
5. Mineral Resources, Exploration and Mining - Champion: Professor R Gibson
6. South Africa/India - Champion: Professor CI Hofmeyr
7. Diseases of Lifestyle: An Emerging African Problem - Champion: Professor NJ Crowther
8. Molecular Biosciences - Champions: Professors M Ramsay and MEC Rey
9. Global Change and Sustainability - Champion: Professor AM Crouch

URC RECOGNISED RESEARCH ENTITIES

Institutes

1	Wits Reproductive Health and HIV Institute	Professor H Rees
2	Wits Research Institute for Malaria	Professor M Coetzee
3	Wits Institute for Social and Economic Research	Professor S Nuttall
4	Society, Work and Development Institute	Professor K von Holdt
5	Economic Geology Research Institute	Professor J Kinnaird
6	Materials Physics Research Institute	Professor E Sideras-Haddad
7	Molecular Sciences Institute	Professor D Brady
8	Rock Art Research Institute	Professor BW Smith
9	Evolutionary Studies Institute ¹	Professor BS Rubidge
10	Global Change and Sustainability Research Institute ¹	Professor H-P Plag
11	Sydney Brenner Institute for Molecular Bioscience ¹	Professor M Ramsay (Acting)
12	Wits Mining Research Institute ¹	Professor N van der Merwe (Acting)
13	City Institute ¹	Professor AS Mabin

¹21st Century Research Institutes

Research Units

1	Flow Research Unit	Professor BW Skews
2	Rural Public Health and Health Transitions Research Unit ¹	Professor SP Tollman
3	Bone Research Laboratory	Professor U Ripamonti
4	Carbohydrate and Lipid Metabolism Research Unit	Professor F Raal
5	Cardiovascular Pathophysiology and Genomics Research Unit	Professor G Norton
6	Clinical HIV Research Unit	Professor I Sanne
7	Developmental Pathways for Health Research Unit ¹	Professor SA Norris
8	Effective Care Research Unit	Professor GJ Hofmeyr
9	Antiviral Gene Therapy Research Unit	Professor PB Arbutnot
10	Pulmonary Infections Research Unit	Professor C Feldman
11	Perinatal HIV Research Unit	Professor G Gray
12	Respiratory and Meningeal Pathogens Research Unit ¹	Professor K Klugman/Professor S Madhi
13	Health Communication Research Unit	Professor C Penn
14	Protein Structure-Function Research Unit	Professor HW Dirr
15	John Knopfmacher Centre for Applicable Analysis and Number Theory	Professor A Knopfmacher
16	Centre for Theoretical Physics	Professor JAP Rodrigues

¹ Joint Wits/Medical Research Council entities

Research Groups

1	Brain Function Research Group	Professor A Fuller
2	Centre for Health Policy ¹	Dr J Goudge
3	African Ecology and Conservation Biology Research Group	Professor BFN Erasmus
4	Water in the Environment Research Group	Professor KH Rogers

¹ Joint Wits/Medical Research Council entities

CENTRES OF EXCELLENCE

The University hosted three DST/NRF Centres of Excellence.

- Strong Materials (Director: Professor Lesley Cornish)
- Biomedical Tuberculosis Research, jointly with the Universities of Stellenbosch and Cape Town (Director: Dr Bavesh Kana)
- Palaeosciences (Interim Director: Professor BS Rubidge)

Furthermore, Wits staff members participated in the Centre of Excellence in Catalysis, based at the University of Cape Town. A fourth centre of excellence, in Aerospace, operates at Wits under the auspices of the Department of Trade and Industry (Director: Rudolph Louw). Fifth and sixth centres of excellence were recognised at Wits in 2012, by the African Network for Drugs and Diagnostics Innovation. They are in Antiviral Gene Therapy (Director: Professor Patrick Arbuthnot) and Advanced Drug Delivery Technology (Director: Professor Viness Pillay).

AWARDS

Vice-Chancellor's Research Award

The Vice-Chancellor's Research Award was made to Professor Viness Pillay. He works in the area of advanced drug delivery systems, devising methods of targeting specifically those organs of the human body which require the medication, rather than the less effective traditional methods by which patients ingest medication.

The purpose of the award is to stimulate research and research related scholarly activities by acknowledging and rewarding a quite exceptional worker who has been engaged in research and more general scholarly activity at the University. The award is open to all full-time academic staff between the ages of 38 and 65.

Friedel Sellschop Award

This award recognises exceptional researchers who are under 35 years of age at the date of application. The award takes the form of a substantial grant and may be annually renewed for up to three years in total. The award is open to applicants in all five Faculties.

Thurman	C	Dr	Literature, Language & Media - English
Vickey	T	Dr	Physics
Gillespie	K	Dr	Social Sciences - Social Anthropology
Choonara	Y	Dr	Therapeutic Sciences - Pharmacy
Zelenyuk	Y	Dr	Mathematics
Watermeyer	J	Dr	Human & Community Development - Speech Pathology
Ally	S	Dr	Social Sciences - Sociology
Harden	L	Dr	Physiology
Jorritsma	M	Dr	Arts - Music
Lemmerer	A	Dr	Chemistry
Quirk	JN	Dr	Social Sciences - Political Studies
Hetem	R	Dr	Physiology
Laryea	S	Dr	Construction Economics
Choiniere	N	Dr	Geosciences - Evolutionary Studies Institute

AW Mellon Postgraduate Mentoring Award

The University received a sixth award of R3.8 million to cover the period 2012 - 2015 from the Andrew W. Mellon Foundation. The scheme is open to all black, female or disabled doctoral students in the Faculty of Humanities.

Mellon Postgraduate Mentoring Scheme October 1995 to December 2013

	Masters	Doctoral	Total
No. taken in	66	175	241
Graduated	53	140	193
Still registered	11	3	14
Discontinued	24	10	34

POSTDOCTORAL FELLOWS

In the course of 2013, the University hosted 139 postdoctoral fellows, an increase of 45% on 2012. Sixty-five of these fellows stayed for two years or longer and only six for less than a year. The NRF was the major single funding source, at 40%, followed by the University at 21% and the Leon Foundation at 10%.

Europe was the largest single source of fellows (29%), followed by South Africa (22%), the rest of Africa (20%) and Asia (14%). The largest concentration of fellows was in the Faculties of Science (41%) and Health Sciences (27%).

The University regards postdoctoral fellows as an under-tapped resource in terms of generating research publications and has embarked on a programme to have at least 200 fellows in place in 2014.

DST/NRF SOUTH AFRICAN RESEARCH CHAIRS

DST/NRF South African Research Chairs as at December 2013

1	Professor	S Madhi	Vaccine Preventable Diseases
2	Professor	V Pillay	Pharmaceutical Biomaterials & Polymer Engineered Drug Delivery Technologies
3	Professor	M Coetzee	Medical Entomology & Vector Control
4	Professor	CS Henshilwood	Origins of Modern Human Behaviour
5	Professor	R de Mello Koch	Fundamental Physics & String Theory
6	Professor	A de Sousa	Bio-inorganic Chemistry
7	Professor	HW Dirr	Protein Biochemistry & Structural Biology
8	Professor	JB Adler	Mathematics Education
9	Professor	H Venkatakrisnan	Mathematical Numeracy
10	Professor	P Harrison	Development Planning
11	Professor	T Majози	Sustainable Process Engineering
12	Vacant		Intelligent Systems
13	Professor	N Nieftagodien	Local Histories & Present Realities
14	Professor	V Jejjala	Theoretical Particle Cosmology
15	Professor	S Colafrancesco	Square Kilometre Array
16	Professor	R Durrheim	Seismology
17	Professor	C Tiemessen	HIV Vaccine Translational Research
18	Professor	J Eyles	Health Policy
19	Professor	R Falcon	Clean Coal Technology
20	Professor	L Landau	Mobility & Politics of Difference
21	Professor	M Steyn	Critical Diversity Studies
22	Professor	M Ramsay	Bioinformatics

NEW RESEARCH CHAIRS



PROFESSOR

JOHN EYLES

***DST/NRF South African Research Chair
for Health Policy and Systems Research***

The Centre for Health Policy has appointed Professor John Eyles, an eminent international research scientist, as the DST/NRF South African Research Chair for Health Policy and Systems Research.

The research portfolio associated with this Chair will focus on the move towards universal health access in South Africa (also referred to as universal health coverage) through national health insurance, by examining some of the issues around finance, human resources and governance.

It is a massive undertaking that the Chair will tackle by concentrating on the district level. This is identified as the most important level in the current re-engineering of health care in South Africa. Lessons from best international practice will be drawn from (in Canada, for example, Eyles has worked extensively with national, provincial and local health authorities), but at the same time the specific historical and economic context of South Africa will be kept front of mind.

Eyles is confident that solutions can be found to strengthen South Africa's public health system and its ability to use resources effectively and efficiently, while increasing the production of skilled health workers.

World-renowned in the field of health systems and policy research, he is also a Distinguished Professor at McMaster University, Canada and an elected member of the Royal Society of Canada.

His current research focusses on two main areas: the factors that influence the distribution of sickness and health, and access to and equity in the delivery of health care.

Prior to this SARChI appointment, he worked extensively in South Africa and other LMIC. His writings address both an academic audience (he has over 300 life-time publications in all his fields of interest) and knowledge users in industry, NGOs and government.

PROFESSOR

LOREN LANDAU

***DST/NRF South African Research Chair in
Human Mobility and the Politics of Difference***



The African Centre for Migration and Society (ACMS) at Wits – one of Africa's leading scholarly institutions for research and teaching on human mobility – is hosting the new DST/NRF South African Research Chair in Human Mobility and the Politics of Difference.

Chair holder Professor Loren Landau – who is the founding director of the ACMS – is widely published in the academic and popular press. He is author of *The Humanitarian Hangover: Displacement, Aid, and Transformation in Western Tanzania* (Wits Press), co-editor of *Contemporary Migration to South Africa* (World Bank), and editor of *Exorcising the Demons Within: Xenophobia, Violence and Statecraft in Contemporary South Africa* (UN University Press).

He has served as the Chair of the Consortium for Refugees and Migrants in South Africa; and he is a member of the South African Immigration Advisory Board and of the editorial boards of *International Migration Review*, *Migration Studies*, and the *Journal of Refugee Studies*.

This Chair promises to generate new insights into the changing nature of African society while questioning what heightening diversity, mobility and fluidity means for the nature of community, political authority, and urban development. Its findings may have far reaching policy implications for debates over social cohesion, immigration, urban planning and municipal management. Research through the Chair will develop comparative perspectives on how human mobility is reshaping the politics of rapidly transforming and diversifying communities. Starting in South Africa and extending across Africa and elsewhere, it will identify and explain emerging forms of political subjectivity, authority and sources of solidarity and conflict. In its initial phase, work will concentrate on hybrid governance regimes in the continent's urban estuaries: gateway zones characterised by transience, translocalism and social heterogeneity. As migration changes the nature of the continent's communities and their position within a globalised world, the Chair will further its Africa-based research that speaks to policy challenges while informing the global academic discourse.



PROFESSOR

MELISSA STEYN

***DST/NRF South African Research Chair in
Critical Diversity Studies***

In 2013 both the establishment of the Wits Centre for Diversity Studies (WiCDS) and the DST/NRF process for awarding the DST/NRF South African Research Chair in Critical Diversity Studies were finalised.

Professor Melissa Steyn has been developing diversity studies as a field in higher education since founding iNCUDISA (Intercultural and Diversity Studies of Southern Africa) at the University of Cape Town in 2001. She subsequently relocated to Johannesburg and is the founding director of the WiCDS.

She is well known for her publications on whiteness and white identity in post-apartheid South Africa, including her celebrated book *Whiteness just isn't what it used to be: White identity in a changing South Africa* (2001, SUNY Press). Her co-edited books include *The Prize and the Price: Shaping Sexualities in South Africa* (Vol 2) (2009, HSRC), *Performing Queer: Shaping Sexualities in South Africa* (Vol 1) (2005, Kwela), *Under construction: Race and identity in South Africa Today* (2004, Heinemann) and *Cultural Synergy in South Africa: Weaving Strands of Africa and Europe* (1996, Knowledge Resources). The Chair is located within the WiCDS and is due to commence in 2014.

Research to be undertaken will involve:

- i. theorising contextually-grounded understandings of diversity, difference and otherness, as these become salient through the current operations of power;
- ii. researching how these dynamics are "at work" empirically in specific sites and locations; and
- iii. developing knowledge and materials that address South African needs.

The Chair's work within the WiCDS will create spaces for interdisciplinary engagement, both within Wits and internationally. In 2013 this involved a trilateral collaboration with Diversitas, a Diversity Studies International Teaching and Scholarship Network involving the University of Oldenburg, Wits and the University of Mumbai. The first summer school on "Critical Diversity Studies in Globalised Contexts" was held at Oldenburg University in June, funded by the Volkswagen Foundation.

A further international interdisciplinary workshop titled: "Challenging the Gender Binary through Art, Activism, and Academia: A South-South Dialogue reimagining the field of gender and sexuality studies" was made possible by the NRF Knowledge Field Development programme.

PROFESSOR

CAROLINE TIEMESSEN

***DST/NRF South African Research Chair in HIV
Vaccine Translational Research***



DST/NRF South African Research Chair holder, Professor Caroline Tiemessen, started studying HIV in 1993 and currently heads the Cell Biology Research Laboratory within the Centre for HIV and STIs at the National Institute for Communicable Diseases, National Health Laboratory Services. She holds a joint appointment with the University of the Witwatersrand in the Division of Virology, School of Pathology. She collaborates with many international and local investigators, and has published widely in scientific journals.

African populations have the greatest genetic diversity, and population-based differences exist in phenotypic outcomes. There is considerable variation in the degree to which different individuals are susceptible to HIV-1 infection, and among those who become infected in their ability to control their course of infection. Having identified potential targets for protection from HIV-1 acquisition and attenuation of disease progression, Tiemessen and her team continue to source new targets, and seek solutions to combating HIV-1 infection/disease progression through understanding and ultimately manipulating relevant pathways of protection

in diverse population groups. Tiemessen and her team's mother-to-child transmission (MTCT) studies have highlighted the value of using a more integrated approach of combining genetic and immunological phenotype studies.

Broadly their research questions are the following:

- What constitutes protection from HIV-1 acquisition, and from disease progression in HIV-1 infected individuals with good (long term non-progressors: LTNPs) and exceptional control (elite controllers: ECs)?
- What are the mechanisms that underlie protective immune processes identified through models of MTCT, adult transmission studies and study of LTNPs/ECs?
- How can these pathways be manipulated for improving human health through vaccine or therapeutic approaches?

Overall, this knowledge is crucial to the development of HIV vaccines that provide protection from infection and from disease progression, and for the development of novel anti-HIV treatments.



PROFESSOR

MICHÈLE RAMSAY

***DST/NRF South African Research Chair
in Bioinformatics and Genomics of African Populations***

In December 2013, Professor Michèle Ramsay of the Division of Human Genetics, National Health Laboratory Service and Faculty of Health Sciences, and Director of the Sydney Brenner Institute for Molecular Bioscience at Wits, was awarded the Chair in Bioinformatics and Genomics of African Populations.

Ramsay chaired the Wits Bioinformatics Steering Group from 2005 to 2013, and is the current Acting Director. She chaired the Southern African Society for Human Genetics from 2009 to 2013, and is joint Principal Investigator of the Southern African Human Genome Programme – a national initiative funded by the Department of Science and Technology. She is Principal Investigator and co-Principal Investigator of two National Institutes of Health-funded studies that aim to promote research into non-communicable diseases among African populations. The research focus of this Chair is to identify, analyse and explore patterns of genetic diversity among African populations to contribute to a better understanding of susceptibility to diseases in changing environments and lifestyles. This is achieved by mining genomic data to explore signatures of past influences

that have shaped patterns of variation across sub-Saharan Africa and to study their impact on health and disease.

Specific research interests include studies on genomic architecture in African populations, investigating the genetic and environmental contributions to rising levels of obesity, hypertension and diabetes, and genetic studies on HIV-related kidney disease, autoimmune traits and ophthalmological traits, including glaucoma.

The dearth of genomic studies on African populations heightens their relevance in a global context. Complicating this research is the high genetic diversity and complex population structure among the peoples of the continent. This, however, offers a unique opportunity to identify disease-causing or disease-associated variants.

The field of health-related genomics is young, providing excellent opportunities to develop novel and innovative approaches to improve our understanding of the relationship between genetic variation and the influence of the environment on gene expression and behaviour.

PROFESSOR

THOKOZANI MAJOZI

***DST/NRF South African Research Chair
in Sustainable Process Engineering***



Professor Thokozani Majazi of the School of Chemical and Metallurgical Engineering has been appointed as the new holder of the DST/NRF South African Research Chair in Sustainable Process Engineering which was awarded to Wits eight years ago. Majazi is a NRF B1-rated researcher, a member of several international scientific committees and a Fellow of the Academy of Sciences of South Africa, the Academy of Engineering of SA and the Water Institute of Southern Africa. He has received numerous awards for his research, including the AU-TWAS Award in Basic Sciences, Technology and Innovation (2012). He is author and co-author of more than 150 scientific publications, including a book on *Batch Chemical Process Integration* published by Springer in January 2010.

The Chair's current research interests involve process integration of batch chemical processes as well as debottlenecking of utilities in continuous processes. Batch chemical processes constitute more than 50% of the South African industrial sector and are usually encountered in the manufacturing of low volume, high-value added products. Typical examples are pharmaceuticals, agrochemicals as well as food and beverage industries.

Majazi and his team's research is aimed at rectifying the significant knowledge gap in the optimal and sustainable design of these operations. Current research on batch processes focusses on design, synthesis and optimisation of multipurpose batch plants. The synthesis problem in this context pertains mainly to capturing the essence of time that is paramount in discrete-task processes, as traditionally encountered in batch facilities. Work on continuous processes is aimed at developing systematic techniques for optimum design of systems that are characterised by simultaneous heat and mass transfer. Typical examples include cooling water systems and steam system networks.

The team is extending this approach to optimisation of an integrated gasification combined cycle (IGCC).

Their work on the IGCC is aimed at optimum design of power generation systems with thermal efficiencies above 50%, instead of about 35%, which is typically encountered in power generation facilities that are based on pulverised coal-fired boilers. Given the country's reliance on coal, improvement in efficiencies is concomitant with significant reduction in CO₂ emissions.

Cataloguing newly discovered 260 million year old skulls of therapsid mammal-like reptiles from the Karoo



NATIONAL RESEARCH FOUNDATION RATINGS

The National Research Foundation (NRF) is a government agency which channels funding to tertiary educational institutions and science councils for research in virtually all fields. As part of the assessment process, the NRF organises a peer evaluation process of individual researchers. At the end of 2013, the University had 281 NRF-rated researchers. The figure is made up as follows:

Number of NRF Ratings		
A	Researchers who are accepted by the international community as being amongst the leaders in their field	16
B	Researchers who enjoy considerable international recognition as independent researchers of high quality	79
C	Proven researchers who have maintained a constant high level of research productivity and whose work is regularly made known internationally	135
L	Members of the academic community who have demonstrated potential as researchers in the past and who can demonstrate that they were prevented from realising that potential, but who now can show promise of being able to establish themselves as researchers within a five-year period after evaluation	2
P	Researchers younger than 35 years who have shown exceptional potential as researchers, or are accepted by the international community as being amongst the leaders in their field, or enjoy international recognition as researchers of high quality	2
Y	Researchers younger than 35 who increasingly exhibit research productivity as individuals or as team members and whose work is regularly made known internationally, or researchers normally younger than 35 years who on the basis of their recent outputs show promise to become recognised specialists within a period of about four years	47

NRF A-RATED RESEARCHERS

- Professor Jill Adler (Education)
- Professor Lewis Ashwal (Geosciences)
- Professor Darrell Comins (Physics)
- Professor Arthur Every (Physics)
- Professor Charles Feldman (Clinical Medicine)
- Professor Glenda Gray (Clinical Medicine)
- Professor Keith Klugman (Pathology)
- Professor David Lewis-Williams (Geography, Archaeology & Environmental Studies)
- Professor Shabir Madhi (Pathology)
- Professor Duncan Mitchell (Physiology)
- Professor Fazal Mahomed (Computational & Applied Mathematics)
- Professor Norman Owen-Smith (Animal, Plant & Environmental Sciences)
- Professor John Pettifor (Clinical Medicine)
- Professor Linda Richter (Human Development)
- Professor Beric Skews (Mechanical Engineering)
- Professor Lyn Wadley (Institute for Human Evolution)

NEWLY NRF A-RATED RESEARCHER

PROFESSOR
FAZAL MAHOMED

School of Computational and Applied Mathematics
Director: Differential Equations, Continuum
Mechanics and Applications Group

Professor Fazal Mahomed's distinguished mathematical career has earned him international recognition in differential equations, with many highly deserved recognitions and awards to his name, including a recent NRF A2 rating.

He has been at Wits since 1984 when he enrolled for a BSc Honours degree in Computational and Applied Mathematics. He went on to do a masters and PhD at Wits, completing his PhD in 1989, after which he joined the School of Computational and Applied Mathematics as a staff member. He is now a research professor.

He has significantly advanced the field of symmetry, geometry and operator analysis of differential equations, both nationally and internationally. He is widely regarded as one of a small number of leading researchers in symmetry and operator methods for differential equations.



An outstanding feature of his research is the breadth and depth of his contributions. His publications include 204 research papers and he has co-edited nine journal issues, proceedings and a book. He has been on the editorial boards of 11 international journals and has reviewed papers for over 85 different international journals.

He has an outstanding record of supervising higher degree students. He has successfully supervised three masters students and 18 PhD students.

He has served on a great number of councils, committees and commissions in South Africa and internationally.

His biographical profile has been included in the *Who's Who in the World 2012* (29th edition) for outstanding achievements in his field.

FUNDING SOURCES

University Council Funding			
	2013 R '000	2012 R '000	2011 R '000
Direct allocation to Faculties	36 795	34 422	32 475
Individual grants centrally awarded			
Equipment - major	20 000	19 340	18 500
Postdoctoral fellowships	6 000	4 000	3 691
Equipment - minor	3 295	3 160	3 000
Thuthuka	2 978	2 954	1 308
Technology Transfer Office	2 862		
Contingencies	2 194	7 450	3 407
Miscellaneous	1 899		20
Sellschop Award	1 662	1 494	1 002
NRF Rating Award	1 403	820	315
Centres of Excellence	1 200	1 351	1 067
Co-funding of Y, L & P ratees	820	660	520
Audit fees	350		
Electronic subscriptions	286	350	341
Animal purchases	260	300	350
Vice-Chancellor's Research Award	250	250	250
Artworks	235	200	200
Research Report	200	150	140
Publication award			60
Research niche areas		305	305
Total	82 689	77 206	66 951

Estimate of Available Funding Sources			
	2013 R '000	2012 R '000	2011 R '000
URC grants ¹	59 394	48 038	42 264
URC equipment grants	23 295	22 500	18 500
Statutory councils & government departments	143 394	132 729	115 848
Other external sources (contracts, donations, grants, etc.)	117 543	103 808	86 014
Wits Foundation ²	202 754	226 783	179 108
Total ³	546 380	533 858	441 734

¹ The 2013 figure excludes the cost of the Research Office and the five central services

(Central Animal Service, Microscopy and Microanalysis Unit, Art Museum, Radiation and Health Physics Unit and Central Optical Service)

² Balance as at 1 January 2013

³ Excludes funds held in the Wits Health Consortium – see separate report towards the back of this publication

Funds from Statutory Councils & Government Departments			
	2013 R '000	2012 R '000	2011 R '000
Science Councils			
National Research Foundation	123 349	118 685	98 624
South African Medical Research Council	7 185	4 080	4 738
Other government departments & science councils	12 860	9 964	12 486
Total	143 394	132 729	115 848

OTHER EXTERNAL FUNDING

Funds Received by Research Field and in Current Accounts			
Research Fields	2013 R '000	2012 R '000	2011 R '000
Built Environment	0	0	231
Commerce & Management	2 969	5 779	0
Earth Sciences	2 435	4 116	3 884
Palaeo Studies & Archaeology	3 408	700	1 578
Education	0	245	235
Engineering	4 408	8 947	10 596
Humanities & Social Sciences	7 772	7 426	10 221
Law	0	1 253	150
Biological Sciences	30 114	15 942	1 397
Health Sciences ¹	54 664	47 388	46 895
Materials Sciences	4 189	6 675	2 519
Physical Science & Mathematics	975	1 197	7 368
General	2 690	4 140	940
Total	113 624	103 808	86 014

¹ This figure excludes funds held by the Wits Health Consortium

Funds Received by Research in the Wits Foundation, as at 1 January 2013			
Research Fields	2013 R '000	2012 R '000	2011 R '000
Built Environment	56	52	0
Commerce & Management	4 061	1 619	1 506
Earth Sciences	15 715	7 028	4 851
Education	144	2	168
Engineering	19 073	11 655	10 728
Humanities & Social Sciences	23 592	19 535	24 298
Law	1 836	2 684	3 785
Biological Sciences	2 363	7 867	6 722
Health Sciences ¹	46 710	74 501	54 966
Mathematical Sciences	1 145	1 254	1 623
Physical Science & Mathematics	5 547	7 223	5 867
Materials Sciences	3 414	2 213	2 221
Palaeo Studies & Archaeology	6 316	17 594	28 286
General ²	72 782	73 556	34 087
Total	202 754	226 783	179 108

¹ This figure excludes funds held by the Wits Health Consortium

² Included here are, *inter alia*, the NRF grant deposit (R56 348) and the Gauteng City-Region Observatory (R7 522)

APPLICATION OF FUNDS

Expenditure of Research Funds			
	2013 R '000	2012 R '000	2011 R '000
Wages & salaries	149 330	109 959	101 116
Running costs, consumables & equipment	253 942	325 908	306 769
Total	403 272	435 867	407 885
Wages & salaries as a percentage of total	37.03	25.23	24.79
Total available funds, including balances in the Wits Foundation	546 380	533 858	441 734
Unexpended research incentive funding, as at 31 December 2013	16 492	13 473	
Total	562 872	547 331	441 734
Total expenditure as a percentage of total available	71.65	79.63	92.34

Research Outputs in 2013								
Faculty	Publication units in 2013 ¹	Doctorates completed in 2013 ²	Masters by dissertation completed in 2013 ³	Masters by coursework completed in 2013 ⁴	Total research units	Number of full-time academic staff as at 31/12/2013 ⁵	Average output per staff member in 2013	Average output per staff member in 2012
CLM	114.30	48	6	124.33	292.63	193	1.52	0.98
EBE	106.64	112	115	44.67	378.31	155	2.44	1.56
Health Sciences	377.40	188	51	41.37	657.77	192	3.43	1.73
Humanities	301.07	208	51	109.06	669.13	352	1.90	1.00
Science	326.43	280	89	12.00	707.43	218	3.25	2.30
Other	31.60							
University	1 257.45	836	312	331.43	2 705.28	1 110	2.44	1.46

Notes

The main significance of this table is that the DHET funding formula is based on an assumed output of 1.41 research units (publications plus higher degrees) per full-time member of the academic staff.

¹ Actual journal numbers, plus an estimate for books, chapters and conference proceedings

² Each completed doctorate scores 3 points in the DHET assessment

³ Each completed masters by dissertation scores 1 point in the DHET assessment

⁴ Only the component contributed by the research report in a masters by coursework is counted in the DHET assessment

⁵ Excluding joint staff