DST-NRF CENTRE OF EXCELLENCE

ANNUAL PROGRESS REPORT

Reporting Period

1 January 2013 – 31 December 2013

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Identification

Name of Director	:	Professor Paul D. van Helden
Names of Node Heads	:	Professor Valerie Mizrahi Professor Bavesh Kana
Name of CoE	:	DST/NRF Centre of Excellence for Biomedical TB Research
Abbreviated CoE Name	:	CBTBR
Host institutions	:	University of Stellenbosch, University of the Witwatersrand University of Cape Town
Date completed	:	06/03/2014

EXECUTIVE SUMMARY

1. Financial Information (Funding of the CoE)

Total NRF funding for 2013 (entire year) – CoE only	:	R 9 759 484
CoE-specific Funding from Host institution in 2013 – WITS	:	R 220 000
– UCT	:	R 136,398
– SU	:	R 817 148
Funding from other sources for the CoE in 2013	:	R 46 821 623
Total funding	:	**R 57 754 653**

Total funding for 2013 for WITS node: **R 8,657,475**

- CoE funding from NRF: **R 2,109,778**

- Funding from WITS and the NHLS: **R 1,770,095**, made up as follows:
  - WITS R 1,154,743[1]
  - NHLS R 615,352[2]

- Funding from other sources:[3] **R 4,777,602**, made up as follows:
  - HHMI IECS Award R 975,994[4]
  - NIH Subcontract R 2,266,608[5] (2 Jan 2013 – 31 Dec 2013)
  - Ship R 850,000 (1 Oct 2013 – 31 Dec 2013)
  - CAPRISA R 130,000 (2 Jan 2013 – 31 Dec 2013)
  - NRF Incentive Funding R 80,000 (1 Apr 2013 – 31 Dec 2013)
  - NRF Postdoc Funding R 260,000
  - MRC Research Day Awards R 15,000
  - CDC GeneXpert EQA funding R 200,000

Total funding for 2013 for UCT node: **R 10,411,422**

- CoE funding from NRF: **R 1,363,948**

- Funding from UCT and NHLS: **R 1,874,171**[6]

- Funding from other sources:[7] **R 7,173,303**, made up as follows:
  - MRC Unit (MMRU) R 1,080,585 (1 Apr 2013 – 31 Mar 2014)
  - EU FP7 (MM4TB) (Yr 3) R 925,885 (1 Feb 2013 – 31 Dec 2013)[8]
  - FNIH (HIT-TB) R 3,373,833 (1 Mar 2013 – 28 Feb 2014)[9]
  - SHIP, MRC (SATRII) R 873,000 (1 April 2013 – 31 March 2014)
  - HHMI SIRS grant (Yr 2) R 920,000 (1 Jan 2013 – 31 Dec 2013)[6]

[1] Made up of Equipment Awards to B. Kana, 10% CoE Institutional commitment, co-funding for MRC Career Development Award to B. Kana, salary allocation
[2] Salary allocation
[3] Where applicable, grant awards from external funders include indirect costs
[4] Year 2 of 5-year grant from the HHMI – 10% of funds are retained by WITS as indirect costs
[5] Once-off supplement to the PHRU CTU from the NIH, funds shown are those spent in 2013, 8% of funding is retained by the WITS Health Consortium as indirect costs
[6] Salaries
[7] Where applicable, grant awards from external funders include indirect costs (IDC)
[8] Year 2 of four-year grant (total €331,667 - including IDC), calculated at exchange rate of R11.1/€
[9] Year 3 of 3.5-year grant from FNIH (sub-contractor on grant from BMGF), calculated at exchange rate of R9.2/$
[6] Based on exchange rate of R9.2/$

Funding for 2013 for SU node: **R 38 685 756**

- CoE funding from NRF : **R 6 285 756**
- Other Funding from SU: (best estimate): **R 3 400 000,** incl. some salaries, student bursaries, excl. space, basic infrastructure, secretary, cleaners.

- Funding from other sources (best estimate): **R 29 000 000**, made up as follows:
  - MRC Centre (estimate of the TB component) R 6 600 000 (incl. salaries)
  - PGWC R 2 200 000 (salaries only)
  - WOTRO R 350 000
  - EDCTP R 2 600 000
  - BMGF R 3 500 000
  - Welcome Trust R 600 000
  - Harry Crossley Foundation R 100 000
  - IMPAACT R 300 000
  - EU FP7 (European Union) R 1 900 000
  - SARChI R 2 300 000
  - DF (Germany) R 400 000
  - HPTN/DAIDS R 1 800 000
  - NIH R 5 100 000
  - Other NRF funding R 1 250 000

2. Summary of progress against 5 KPAs

(i) Research

The research productivity of the CBTBR remained excellent in 2013 as evidenced by the fact that 55 articles in peer-reviewed journals and 4 non-peer-reviewed articles were published, and 90 conference presentations were made, including 7 plenary/ keynote lectures, and numerous invited talks. Of the research articles published, 51 were in journals with an impact factor (IF) >2.
Progress against targets SLA 4 targets: The outputs under this KPA exceeded the SLA target (≥10 publications of which ≥5 are in journals with an IF ≥2).

(ii) Education and Training

A total of 6 PhD students, 6 MSc students and 15 Honours students from the CBTBR graduated or completed their training in 2013. All these postgraduate students completed degrees within their maximum allowable time agreed upon in the SLA. A number of new postdoctoral, PhD and MSc students were enrolled in the nodes of the CBTBR. A number of students were afforded the opportunity to work in international labs.
Progress against SLA 4 targets: The total of 94 postgraduate students associated with the CBTBR in 2013 exceeds the SLA target of ≥25. The student breakdown according gender (63% female) and percentage of postdoctoral fellows (19% of total student complement) equalled or exceeded the SLA targets of ≥50% and ≥10%, respectively. The percentage of black students (51%) exceeded the SLA target of ≥50%. The percentage of Honours students was 16% in 2013. No honours students were rejected unless they did not meet the entrance requirements set by the university.

(iii) Knowledge Brokerage

The CBTBR as a collective continued to make significant contributions to the widespread dissemination of key findings through engagement with the scientific community, key stake holders in operational/public health research, policy makers and in some cases, the general public. Apart from enjoying country-wide and international publicity in various media platforms, the CBTBR continued to be involved in many outreach activities, targeting school teachers and learners, and on science communication in general. In this context members of the Wits node attended numerous scientific meetings and engaged with other public stakeholders such as school students during media events and University open days. Of note, was a prestigious public

lecture given by the Head of the Wits node in 2013 and participation in the Discovery Health Journalism Awards. An outreach and science communication project led by a PhD student from the UCT node has resulted in the award of an International Engagement Award from the Wellcome Trust. We continue to strive for improved communication with metropolitan, provincial and national health authorities, Médecins Sans Frontières (MSF) and NHLS. Our interaction with these stakeholders continues to improve. We now engage more with DoH and NHLS than before and have developed a good relationship with both, such that our phone calls and emails are received and responded to. We advise them and continue to advise SANParks, the National Zoological Gardens (NZG) and Johannesburg Zoo, as well as some private entities with regard to TB in wildlife or captive animals. CBTBR members continue to be engaged with the media when and where possible to develop more accurate and meaningful science communication channels between various media stakeholders and the basic researchers.

(iv) Networking

Numerous recent funding opportunities have led to new networking initiatives that have enhanced the local and international footprint of the CBTBR. Prof. Kana from the Wits node was involved in grant application with Swiss group that was funded through the Swiss-South Africa Joint Research Program. The Wits node was also involved in a collaborative research grant application to the Bill and Melinda Gates Foundation on a clinical project that will develop new collaborative links with individuals at the Klerksdorp Hospital Complex in Gauteng. Dr, Warner and Prof. Mizrahi were co-applicants on the Flagship 1 grant from UCT that was funded by the MRC. This has resulted in the development of a new collaborative team led from the IDM (Prof. Robin Wood, PI), and involving investigators from the Departments of Medicine, Clinical Laboratory Sciences and Engineering. Links with UCT's H3-D centre for Drug Discovery and Development were strengthened by the appointment of an H3-D screening technician in the UCT node and through co-supervision of PhD students.
Prof P van Helden was recipient of an MRC flagship grant that will see other MRC units join with our activities for the first time. This will hopefully bring health systems research into our activities for the first time.
The CBTBR regards this activity as central and vital to our activities and encourages it as far as is possible.

(v) Service rendering

The CBTBR has made notable impact in service rendering in 2013. Through activities at the Wits node, the CBTBR has now enabled countrywide roll out of the GeneXpert. Moreover, The CBTBR was able to provide sufficient organisms for the planned rollout and additional material for the verification of over 500 GeneXpert instruments in correctional facilities and mining operations. The program has now been extended to numerous African countries, India, China and recently Brazil. The material from the CBTBR will now also be shipped globally, under the GLI label, for all GLI, CDC and WHO sites. Further, activities in this area include the provision of technical/ scientific services to the Eastern and Western Cape Provincial Health Department, the gold mines, Tygerberg Hospital and various TB clinics, the provision of advice and assistance to individuals, research groups and institutions, locally (including NHLS) and abroad, committee membership and scientific review work at the institutional, regional, national and international levels. We continue to test antimycobacterials for UKZN, UWC and UCT. Members of the CBTBR again played key advisory and participatory roles in the national and regional responses to the extensively drug-resistant (XDR) TB crisis. Assistance to SANParks, NZG, Johannesburg Zoo and others regarding TB in wild animals continues to be given, and to the AACL for companion animals. The SU node continues to assist the MRC (Delft) and SAAVI with TB infection problems in their animals. The Wits node has further assisted the Contract Laboratory Services division of the NHLS to establish DNA extraction methodologies for strain typing for samples in the REMOX clinical trial and continues to provide support where necessary. We previously reported that the SU node developed a new sample collection vial for fine needle aspirates for TB diagnosis. This vial system is being rolled out by NHLS pathologists and is now routinely used in Gauteng.

3. Gender Impact

From the "Science by Women" perspective, it is important to note that 63% of all postgraduate students (including postdoctoral fellows) in the CBTBR in 2013 were female. The very high representation by women at the lower levels of this research enterprise is consistent with the broader demographic picture for the Health Sciences in SA.

PROGRESS REPORT

1. Scientific Research

Overview and Highlights of Progress since the last report:

SU Node

The projects at the SU node are aimed at bridging the gap between basic and clinical research. We undertake many different projects in this field, some of which are listed below: (a) genetics of human TB susceptibility: (b) molecular epidemiology which covers both the drug susceptible and resistant forms of the disease c) evolution of drug resistance (d) mycobactomics (e) diagnostics (f) bacterial genetics (g) immunology, including Mycobacteria/Helminth co-infections (h) surrogate markers for clinical trials (i) drug targets (j) EBA and other drug trials (k) veterinary mycobacteriology and immunology.

Research at the SU node in 2013 highlighted the importance of mycobacterial pharmacogenetics. It emphasizes that next generation diagnostics must be able to predict the mutations conferring resistance to ensure optimal treatment. In this study we show that patients with strains with an rpoB 516 mutation can be treated with rifabutin. This has particularly significant implications for the XDR-TB pandemic in the Eastern Cape region.We also clearly demonstrated that the national TB control strategy to use a standardized second-line treatment regimen without complete drug susceptibility testing results in the selection of XDR-TB strains. We highlighted that the emergence and spread of both XDR-TB and TDR-TB in the Eastern Cape is primarily transmission driven. Of great concern is that these highly resistant strains are spreading between provinces and patients show an exceptionally high mortality.

We also indicated the complexity of drug resistance and showed through whole genome sequencing that numerous mutational events may either precede or follow the emergence of classical resistance mutations. This suggests that the emergence of resistance may involve a number of steps rather than being a single mutational event which has been the dogma for the past 20 years. We also indicated how the introduction of molecular diagnostics has shortened the laboratory turnaround time. However, retooling of the healthcare system remains a major barrier to ensuring rapid entry into care. We also described for the first time a new member of the *Mycobacterium tuberculosis* complex that causes tuberculosis in Meerkats. We reported for the first time that there is an increased number and suppressive immune function of myeloid derived suppressor cells. We demonstrated that ergothioneine is a secreted antioxidant in *Mycobacterium smegmatis*. This is in contrast to mycothiol that is localized only intracellularly. The implications of this phenomenon are being investigated further to determine if it also occurs in slow growing mycobacteria such as *Mycobacterium tuberculosis.*

In terms of funding awards, Paul van Helden was awarded MRC flagship funding, Rob Warren was awarded an NIH subcontract together with UCT to investigate patient infectiousness. Gerhard Walzl served as principal investigator on two multi-site Bill and Melinda Gates Foundation funded projects and two EDCTP projects, as well as co-investigator on another BMGF grant and an FP7 grant, on NIH and Wellcome Trust grants. He was awarded a DST/SHIP bioinformatics grant to develop TB biomarker bioinformatic capacity in SA and was awarded a SARChI chair in TB biomarkers. Two other SARChI chairs were awarded to Stellenbosch University by the NRF, one to Prof Samantha Sampson, who took up her post in late 2013. The other to Prof Michele Miller, who took up her post in January 2014.

For the first time we took part in some systematic reviews (see Durr et al and Muller et al) that were published in high impact journals. Bedaquilin, which was trialled in our Centre, was approved by the FDA for TB treatment in the USA. The first “new” TB drug to be approved in decades. Sadly, the SA MCC has not yet approved it.

UCT Node

The focus of the UCT node is on studying aspects of the physiology and metabolism of *M. tuberculosis* of relevance to drug discovery, drug resistance and persistence. Our work on cofactor metabolism, DNA and nucleotide metabolism form a fundamental research platform upon which new tools for TB drug discovery are being developed and applied. In 2013, we reported the identification of a novel vitamin B_{12} transporter in *M. tuberculosis*. In subsequent work, we have identified key components of the corrinoid salvage and assimilation systems in *M. tuberculosis*. Specifically, the ABC transporter, Rv1819c, implicated previously in *M. tuberculosis* pathogenesis, was shown to be essential for transport of all corrinoids (i.e. not specific for coenzyme B_{12}), and Rv1314c was demonstrated to be the sole adenosyltransferase responsible for the assimilation of exogenous vitamin B_{12} as well as cobinamide, by *M. tuberculosis*. Using a forward genetic screen, we were able to confirm the functionality of CobT (essential for the formation of ribazole, a principal moiety of cofactor-B_{12}) and CobS (involved in the penultimate step of B_{12} synthesis), and demonstrate their critical cobinamide assimilation in *M. tuberculosis*. Ongoing work is aimed at validating other candidate gene(s) identified as being involved in B_{12}-dependent metabolic homeostasis during *M. tuberculosis* growth in propionate and at identifying the interaction partner/s of Rv1819c in corrinoid uptake. A review contextualizing the UCT node's work on the role of vitamin B_{12} in *M. tuberculosis* pathogenesis was published in *Future Microbiology*. In a second study under the cofactor metabolism theme, we completed the construction and of a suite of conditional mutants in essential steps in the coenzyme A biosynthetic pathway with the aim of identifying the most vulnerable steps for chemotherapeutic intervention. To generate more stable conditional mutants, the original *panB*, *panE*, *panK*, *coaBC*, *coaD* and *coaE* promoter-replacement mutants were transformed with integrase-free TetR plasmids that are also codon-optimised for silencing mycobacterial genes. This solved the stability problem of the *coaBC* and *coaE* strains, both of which retain inducer-dependence of growth following four passages *in vitro*, and also resulted in the production of inducer-dependent mutants in *panB*, *coaD* and *panK*. Using the new-generation *coaBC* knockdowns, depletion of *coaBC* was found to be bactericidal in *M. tuberculosis.* In ongoing work under the BMGF-funded HIT-TB program, we are using this suite of tools to rank the various targets in the CoA pathway in terms of vulnerability and kinetics of growth arrest and/or cell death upon target depletion, and to couple this with an assessment of the impact of target depletion on metabolic flux through the pathway.

5-Fluorouracil (5-FU) has been in clinical use for more than five decades and is widely used for the treatment of gastrointestinal and other malignancies. The antibacterial activity of this drug is also well documented. In this study, we are using 5-FU as a tool compound to interrogate the pyrimidine biosynthesis and salvage pathways in *M. tuberculosis*. This study, conducted under the MM4TB program, has revealed that despite the absence of a canonical homologue in *M. tuberculosis* has a weak uridine phosphorylase activity, but lacks uridine kinase and thymidine kinase activity. The lack of these enzymes has a profound influence on the mechanism of action of this pro-drug. We have used a combined genetic, biochemical, and chemical biology approach to elucidate the dual mechanism of resistance to 5-FU and related compounds, and demonstrate 5-FU has a highly complex mechanism of anti-mycobacterial action that involves cell wall biosynthesis and thymidylate synthesis as well as RNA and DNA synthesis.

Significant progress was made on characterising the role of the two polymerase subunits, DnaE1 and DnaE2 in replication fidelity of mycobacteria under conditions of genotoxic stress. Firstly, we determined whether the intrinsic proofreading activity in the PHP domain of *dnaE1* is a critical determinant of replication fidelity in mycobacteria. To address this, we generated a panel of mutants in which key residues associated with the exonuclease proofreading activity have been mutated to disrupt function. Spontaneous mutation rates, using rifampicin resistance as a target, were measured by fluctuation assays for two *dnaE1* point mutants. A reproducible three-fold reduction in replication fidelity was associated with a DnaE1 mutant carrying a point mutation in the PHP domain. Importantly, this effect was fully reversed by knock-in mutagenesis to restore the wild type sequence, thus confirming the phenotype-genotype correlation. Although the "mutator" phenotype was modest, this result provides the first experimental evidence for a role of the PHP domain in determining the intrinsic replication fidelity of DnaE1.

Finally, we have devoted a considerable amount of time in developing the capacity to provide anti-tubercular screening and biology capabilities to support the TB drug discovery efforts of Prof. Kelly Chibale's group in the H3-D Centre for Drug Discovery & Development at UCT. These efforts have begun to yield dividends in the form of publications and jointly supervised students. In recognition of the rapid growth potential in this area, Prof. Chibale has been allocated a new laboratory in the IDM which will house all staff and students jointly

supervised by the UCT node. H3-D and the UCT node have jointly purchased a liquid handler. The UCT node's contribution was provided by Prof. Mizrahi's Mérieux Prize. The strengthening of our research capacity in this area will enable us to take advantage of the many new collaborative opportunities that have arisen in this area. Two new grant applications for TB drug discovery work were submitted in 2013. In terms of other enw grants, Dr. Warner and Prof. Mizrahi were co-applicants on UCT's Flagship 1 project on TB transmission that was awarded a three-year grant from the MRC.

Wits Node

The Wits node of the CBTBR has been engaged in research and development activities that aim to address the TB epidemic through basic, applied, operational and clinical research. The basic research involves a genetic approach to the identification and validation of new drug targets for TB disease. This research encompasses addressing the key knowledge gaps that have hampered the development of new effective drugs that include mechanisms of bacterial persistence, emergence of drug resistance and energy metabolism. Some of these studies also span into clinical research, most of which is aimed at developing a more comprehensive understanding of bacterial physiology during TB infection in humans. Clinical research is also geared towards developing better readouts for bacterial clearance along with a search for biomarkers of treatment response and associated risk factors for recrudescent disease. In this context the Wits node has undertaken a study to identify and characterize dormant bacterial populations in the sputum of patients with active TB disease. During 2013, approximately 250 TB suspects were recruited to this study. Sputum was analysed from 110 patients who were found to have culture confirmed TB disease and subjected to a panel of tests that measure bacterial load, these include, smear status, GeneXpert, MGIT time to positivity and most probable number assays and in the presence and absence of resuscitation promoting factors (Rpfs). These assays reveal that all individuals harbor variable proportions of bacteria that emerge when the culture media is supplemented with CF with or without Rpfs. We observe that these populations have variable dependency on Rpfs for growth and hence term these differentially culturable tubercle bacteria (DCTB). A follow-on study which involved assessing the early treatment response in smear-positive and smear-negative GeneXpert-positive adult TB patients with HIV-coinfection is also underway. To date, 19 patients have been recruited to the study. These patients have been assessed for bacillary load at 5 time points and the data are currently being analyzed. Preliminary analysis reveals that there is a remarkable degree of concordance with the standard CFU and most probable number measurement of bacillary load during treatment.

The role of Rpfs in TB disease is also being studied through an assessment of their biological function in other mycobacteria. Microfluidic growth experiments reveal that deletion of the *rpfA* and *rpfB* genes in *Mycobacterium smegmatis* results in a low frequency of aberrant growth defects, with some atypical branching observed for some cells. Analysis of these mutant strains in an in vitro model of dormancy reveals that mutants defective for two or more *rpf*-like genes are unable to enter into a non-replicating state. The Rpfs have been predicted to mediate their growth stimulatory effects through remodelling of peptidoglycan (PG) in the mycobacterial cell wall. The Wits node has also undertaken to study two other groups of PG remodelling enzymes, namely the *N*-Acetylmuramoyl-L-alanine amidases and DD-Carboxypeptidases, in mycobacteria. Characterization of the multiple amidase homologues in *M. smegmatis* has identified a single, essential amidase (MSMEG_6935) which is could serve as a novel drug target. We now show that depletion of this amidase results in shortening of mycobacterial cells the formation of bulges at the septum position in cells. There are five distinct DD-CPase encoding genes in *M. tuberculosis* and *M. smegmatis*. A rigorous genetic approach has identified the *dacB*-encoding DD-CPase gene as being essential for growth. Depletion of DacB results in loss of growth at one pole of mycobacterial cells. In partnership, the Wits, UCT and SU nodes are studying several enzymes involved in molybdopterin biosynthesis in *M. tuberculosis* have been shown to be essential for in vitro growth, under carbon limiting, nitrate replete conditions. Previously we demonstrated that the novel, fused molybdopterin synthase in *M. tuberculosis*, encoded by *moaX*, gets cleaved into its two constituent components. We now demonstrate that this cleavage occurs at a glycine residue which forms the substrate for a subsequent adenylation reaction. Furthermore, our analysis reveals that the preceding glycine residue is essential for the cleavage process but is not required for catalysis. In collaboration with the UCT and SU nodes, we also generated a mutant of *M. tuberculosis* which is defective for the *mobA* gene and consequently, is unable to synthesis the guanine dinucleotide form of molybdopterin cofactor. In a recent development, we now demonstrate that this form of the cofactor is required for persistent infection in mice and in the guinea pig model of TB infection.

In 2013, there was notable progress at the Wits node on a project aimed at characterization of DNA repair pathways in mycobacteria. The research was specifically aimed at further understanding the base excision repair pathways and roles of the Formamidopyrimidine DNA glycosylases (Fpg/MutM/Fapy). Furthermore, the MutY, Endonuclease VIII (Nei) and Endonuclease III (Nth) DNA repair enzymes have also been the subject of this study**.** Using an *Escherichia coli nth* deletion mutant, we confirm the functionality of the mycobacterial *nth* gene in the base excision repair pathway. Deletion of *nth* individually results in increased UV-induced mutagenesis and combinatorial deletion with the *nei* homologues results in reduced survival under oxidative stress conditions and an increase in spontaneous mutagenesis to rifampicin. Deletion of *nth* together with the *fpg* homolgues did not result in any growth/survival defects or changes in mutation rate but an increase in C:G→T:A transitions was observed for both Δ*nei2* Δ*nei1* Δ*nth* and Δ*fpg1* Δ*fpg2* Δ*nth* strains. Collectively, these data point to an important role for Nth in DNA repair and mutagenesis in mycobacteria and have recently been published in a prestigious international journal, *DNA Repair*.

Together with the other nodes of the CBTBR, Wits node was involved in screening of potential new antitubercular compounds and subsequent determination of mode of drug action. Chemistry support for the synthesis of small compounds is provided by chemistry groups at UCT and iThemba Pharmaceuticals. In 2013, 74 compounds were tested for activity and the results reported to the respective chemistry groups. Four of these compounds have been advanced in the biology pipeline for mutant generation. In the case of 2, stable genetic mutants have been obtained. This project was terminated in September 2013 due to the collapse of the iThemba Pharmaceuticals platform and the lack of chemistry support for the Wits node of the CBTBR. In its place, the Wits node has initiated a new study aimed at developing new counter-screening models for drug development.

The GeneXpert has revolutionized detection of TB infection and provides the exciting possibility of making an accurate diagnosis within a time frame of 2 hours. In recognition of the potential of this technological platform to revolutionize TB control, the South African DoH adopted the national rollout of GeneXpert in 2011. However, local and national reference laboratories had no mechanism for validation and external quality assurance (EQA). The principle challenge in this regard was the availability of inactivated tubercle bacteria that could be used to validate machines without risk to the user. The Wits node of the CBTBR was able to fill the technological gap by creating a production pipeline for inactivated, titred organisms that could be used for instrument verification and EQA. In 2013, a reliable and robust mechanism for bulk scale manufacture was established at the Wits node for continued production of inactivated tubercle bacteria for the national programs. The CBTBR was able to provide sufficient organisms for the planned rollout and additional material for the verification of over 500 GeneXpert instruments in correctional facilities and mining operations. Moreover, the success of these endeavors garnered significant international attention including that of numerous African countries, India, China and recently Brazil all of whom have requested material for verification of GeneXpert instruments. The material from the CBTBR will now also be shipped globally, under the GLI label, for all GLI, CDC and WHO sites. By the end of 2013, the CBTBR provided for greater than 80% of the global demand for verification material. The company that produces the GeneXpert, Cepheid, has now adopted a policy of including bacteria from the CBTBR with all new GeneXpert machines that are procured. By the end of 2014, the CBTBR will provide material for the *global rollout of GeneXpert*.

Joint Research and Training Activities

1. **UCT-Wits-SU.** The project on the biosynthesis and function of molybdopterin in mycobacteria is a strong collaboration between the three nodes. The second collaboration between the three nodes is on the SHIP-funded SATRII project. Researchers at the three nodes together form the Biology component of the SATRII project.

2. **Wits-SU**. Dr Melissa Chengalroyen from the Wits node spent two weeks at the SU node to obtain training on DNA fingerprinting methodologies to distinguish *M. tuberculosis* strains. Dr Chengalroyen has now established the relevant methods at the Wits node and continues to work with Dr Streicher at the SU node on interpretation of the data.

2. Education and Training

Breakdown of postgraduate students and postdoctoral fellows in the CBTBR in 2013

Student category	Number/percentage	Target based on SLA4 (for Performing Phase, 2009-2013)
Total number of students	94	≥ 25
% Postdoctoral fellows	19%	≥10%
% PhD students	34%	N/A
% MSc students	31%	N/A
% BSc (Hons) students	16%	N/A
% Women students[a]	63%	≥ 50%
% Black students	51%	≥ 50%

a) Includes postdocatoral fellows

Degrees conferred and postdoctoral fellowships completed

The CBTBR graduated 6 PhD, 6 MSc and 15 Honours students in 2013.

Dissertations and theses

PhD

1. Fortuin S Promoter: Characterisation of the *Mycobacterium tuberculosis* phosphorylome. Promoter: Prof RM Warren. Co-Promoter: Prof NC Gey van Pittius.
2. Barnard M. Diagnostic Utility of the Line Probe Assay for the detection of Drug Resistance in *Mycobacterium tuberculosis.* Promoter Prof RM Warren. Co-Promoter Prof NC Gey van Pittius.
3. De Vos M**.** Identification of mechanisms regulating the intracellular concentration of Rifampicin in *Mycobacterium tuberculosis*. Promoter: Prof TC Victor. Co-Promoter: Prof RM Warren.
4. Newton-Foot M., Understanding the evolution and function of the mycobacterial Type VII ESX secretion systems (T7SSs) and their substrates. Promoter: Prof NC Gey van Pittius, Co-promoter: Prof RM Warren
5. Viljoen AJ. The glutamate dehydrogenase of the slow growing mycobacteria: its function in nitrogen metabolism and importance to *in vitro* and intracellular survival Promoter: Prof IJF Wiid.
6. Ndwandwe DE. Mechanisms of mutagenesis in *Mycobacterium tuberculosis*: structural and functional characterization of the DNA polymerase accessory factors encoded by *Rv3394c* and *Rv3395c*. Supervisor: Prof V Mizrahi, co-supervisors, Dr D Warner & Prof B Kana

MSc

1. Willemse D. Regulation of efflux in rifampicin resistant mutants of Mycobacterium tuberculosis. Supervisor: Dr MJ William. Co-supervisors: Prof TC Victor and Prof RM Warren
2. Narrandes NC. Functional characterization of mylobdopterin synthase-encoding genes in mycobacteria. Promoters: Prof B Kana and Prof V Mizrahi
3. Senzani S. Analysis of peptidoglycan degrading amidases in *Mycobacterium smegmatis*. Promoter: Prof B Kana
4. Beukes G. The role of resuscitation promoting factors in peptidoglycan hydrolysis and reactivation from dormancy in *Mycobacterium smegmatis*. Promoter: Prof B Kana
5. Moolla N. Construction and phenotypic characterization of *Mycobacterium smegmatis* mutants deficient in DNA glycosylases. Promoter: Dr B Gordon
6. Hassim F. Construction and phenotypic characterization of *Mycobacterium smegmatis* mutants deficient in the MutY DNA glycosylase. Promoter: Dr B Gordon

Recruitment of new postgraduate students

A number of new students have joined the team already or will do so during the course of 2014. Applications from other students are under consideration, pending availability of supervisory capacity, laboratory and office space and/or funding, including bursary support (see above). At the SU node, we enrolled 4 Postdoctoral

fellows, 4 PhD, 7 MSc and 11 Honours students into the CBTBR in 2013. At the UCT node 1 Postdoctoral fellow, 4 PhD students and 4 Honours students were recruited. At the Wits node 3 PhD students and 2 MSc students were recruited in 2013.

Honours and awards to students

- In addition to those listed herein, CBTBR students from all three nodes received various scholarships and travel grants in 2013.
- Dr. C Ealand was selected to given an oral presentation at the Keystone Symposium on Tuberculosis: Understanding the Enemy Keystone Conference. March 13 - March 18, 2013, Whistler Conference Centre, Whistler, British Columbia Canada
- Dr. C Ealand was awarded an NRF Postdoctoral Bursary
- Dr M Chengalroyen was awarded a CAPRISA postdoctoral scholarship for partial salary funding.
- MSc students, Ms. N Narrandes, Ms. N Moolla, Ms. F Hassim, Mr. G Beukes and Mr. S Senzani were awarded MSc degrees with distinction.
- Ms A Koch was awarded a Columbia University-Southern African Fogarty AITRP pre-doctoral training fellowship which will enable her to undertake training in M. tuberculosis bioinformatics and whole-genome sequence assembly with Drs. Tom Ioerger and Jim Sacchettini at Texas A&M University in 2014.
- Dr V Singh was awarded the best oral presentation prize at the MM4TB Consortium CM6 meeting held in Lille, France in July 2013.
- Dr A Moosa and Ms. K Naran were awarded travelling fellowships through a capacity development initiative funded by the World Intellectual Property Organisation (WIPO) that is designed to build drug discovery and development capacity in Africa by allowing postgraduate students and postdoctoral fellows to work in major pharmaceutical companies. Ms. Naran spent three months developing screening assays for TB drug discovery at the AstraZeneca India facility in Bangalore. Doctoral students Ms. Z Ditse, Ms. A Koch and Ms. K Naran were all awarded two-year PhD scholarships from UCT under the "*Developing the Next Generation Academics*" program, funded by a grant from the Carnegie Corporation.
- Honours student, Ms Z Martin, was accepted to the highly prestigious EPFL Summer School in Lausanne. This enabled her to spend two months working in the Global Health Institute at EPFL working under the supervision of the world-leading TB researcher, Prof. John McKinney.
- Ms M Klopper was awarded the Keystone Symposia Global Health Travel Award 2013 (to attend the TB sessions in Whistler, Canada)
- Dr M de Vos received a travel grant from Stellenbosch University to attend the 34th annual congress of the ESM from 30 June - 3 July in Florence, Italy.
- Mrs A Dippenaar received a travel grant from the NRF and the European Society of Mycobacteriology to attend the 34th Annual ESM congress in Florence, Italy from 30 June - 3 July 2013.
- Mr K Hammond-Aryee received a travel grant from Stellenbosch university to attend the 12th International congress on Toxoplasmosis at the St Catherine's college, Oxford, United Kingdom from the 22 to 26 of June 2013
- Miss N Steyn, received the deans travel bursary to attend the Keystone symposium entitled Tuberculosis: Understanding the enemy on the 13th to the 18th of March 2013.
- Mr W Goosen Mr. Wynand Goosen received a travel award from NRF RISA to attend the Annual Bovine tuberculosis meeting in the Kruger National Park in 2013
- Mr K Hammond-Aryee was awarded Stellenbosch University Student travel grant to attend the 12th international congress on Toxoplasmosis (June 2013)
- Mrs M McGrath was awarded a merit bursary from Stellenbosch University for 2013.
- Mrs M McGrath, awarded second prize in Centre of Infectious Diseases poster session at the Stellenbosch University FMHS Annual Academic Day, 2013.
- Dr S Parsons was invited to give an oral presentation at the Qiagen Vet Days Symposium in Leipzig, Germany (November 2013) and was awarded a Claude Leon postdoctoral bursary for 2013.
- Miss N Steyn was awarded a merit bursary from Stellenbosch University, an NRF grant holder bursary and a departmental bursary for 2013.

- Dr NN Chegou received funding from the "German-South African Year of Science" to participate (oral presentation) at the 2nd South African-German workshop on IT-based Technologies for Rural Health Care, held in Berlin, Germany from the 25 - 28 February 2013. He was also awarded the Keystone Symposia Global Health Travel Award to participate in the "Tuberculosis: Understandi[ng] the Enemy, and Host Response in Tuberculosis" meeting, held in Whistler, British Columbia, Canada, from the 13 - 18 March 2013. In addition he received a travel award from the Claude Leon Foundation to participate in the "Biomarkers for Tuberculosis, N[ew] Questions, New Tools" conference, held in Washington Dulles, Chantilly, Virginia, USA, from the 8 – 11 September 2013.
- Ms C Pule was awarded second prize in Centre of Infectious Diseases Oral Presentation at the Stellenbosch University FMHS Annual Ac[ad]emic Day, 2013. She was also awarded A*STAR Singapore International Pre-Graduate Award for 2 months Intern-ship attachment at the Bioinformatics R[es]earch Institute, Biomedical Sciences from 2 December 2013 - 2 February 2014.

Training courses implemented by staff and students

- Prof. Rob Warren ran PCR training courses in 2013 and trainees included Thobile Ngqaneka and Cebisa Mdladla from CCTR and for postgraduate students at the Honours level from the faculty of Health Sciences. All participants had hands-on experience for the extraction of DNA from *Mycobacterium tuberculosis*, restriction enzyme digests, southern blotting, probe labelling and hybridisation. The course equipped all participants with the necessary skill to enable them to perform PCR.
- Tommie Victor and Annemie Jordaan successfully trained 20 participants from various countries in Africa in the use of molecular biology techniques to detect TB and Drug resistant TB. This was funded by AFRA and as a result of the Designated regional training Centre which is hosted in the CMCB.
- Elizabeth Streicher and Annemie Jordaan hosted a TESA sponsored Spoligotyping workshop 27-31 May 2013 Attended by: Simani Gaseitsiwe (Botswana); Sarika Mohabir (South Africa); Kathryn Boyd (Zimbabwe); Themba Nkosi (Malawi); Kebatshabile Nfanyana (Botswana) Tasmiya Irá (Mozambique)
- A second TESA sponsored Spoligotyping workshop was hosted on 26-30 August 2013 Attended by: Manuel Gimo (Mozambique); Kapona Otridah (Zambia); Chilambwe Mwila (Zambia); Liezel Smith (South Africa); Agness Farai Nhidza (Zimbabwe).
- Elizabeth Streicher hosted Dr. Melissa Dalcina Chengalroyen for training and troubleshooting in spoligotyping 13-17 May 2013
- Ms. Amour Venter also conducted initiation training for the laboratory personnel involved with clinical drug trials on the following protocols:
  1. Clinical drug trials overview; 27 March 2013
  2. PanACEA-MAMS-TB-01; 27 March 2013
  3. NTP Bio-banking; 27 March 2013
  4. Early treatment response in smear-positive and smear-negative / GeneXpert positive adult TB patients with HIV co-infection (BALL Study); 04 December 2013

Other Workshops

- Prof Warren was part of the organising committee for the Hain Lifescience symposium, Johannesburg, South Africa March 2013
- Prof Warren was part of the organising committee for the XDR-TB Workshop, Cape Town, Nov 2013
- Prof Warren is part of the organising committee for the TB conference to be held in Durban 2014.
- Prof. Corfield designed Conference Communications skills workshop presented to:
  BSc Hons students in the Dept Medical Biosciences (30 and 31st January)
  Postgraduates and researchers at Stellenbosch University for Dept Research Development (DRD) x2 (at STIAS 22 May and 14 November)
  Postgraduate Skills Development, Postgraduate and International Office Stellenbosch University Main Campus (26 July)
- Understanding the NRF ratings system workshop given at:
  Stellenbosch University (at Lanzerac 5 March and STIAS 6 September)
  Central University of Technology Bloemfontein (4 September)
  University of the Free State (5 September)

Training courses attended by staff and students

Attendees	Training Course	Location/Web address	Start Date	End Date
Gopinath K	Wellcome Trust Protein Interaction and Network course	Wellcome Trust Genome Campus, Cambridge, UK	8 Aug	16 Aug
Klopper M, van der Merwe R, Siame K, Lucas L	Next-Generation Sequencing and Bioinformatics Course	SANBI, University of the Western Cape	12 Aug	16 Aug
Ntsapi C	Conference presentation skills workshop	Stellenbosch University, Sanlam Saal	12 Aug	12 Sep
Ntsapi C	Ensembl-SANBI Workshop	SANBI University of the Western Cape	05 Sep	05 Sep
Various CMCB staff	Project Management for the research team	Tygerberg campus	24 Jun	25 Jun
Dippenaar A, de Vos M, Siame K, Lucas L	Bioinformatics of Infectious Diseases: Comparative Genomics of M. tuberculosis	K-RITH	16 Sep	20 Sep
Muller L, Stanley K, Ehlers L	SANAS ISO 17025 Systems Course	Premier Hotel, Seapoint	26 Aug	28 Aug
Muller L, Stanley K, Ehlers L	Internal Audit Course ISO 17025	Premier Hotel, Seapoint	31 Oct	01 Nov
Muller L	First Aid Level I	University of Stellenbosch	05 Aug	06 Aug
Various SU node students	Workshop in Scientific Writing Skills for Theses and Dissertations	Stellenbosch University, Tygerberg Campus	29 Apr	30 Apr
Du Plessis, N	Leukapheresis Isolation Workshop	Washington DC, USA	29 Jul	02 Aug
Du Plessis WJ	BD FACScanto II Operator Training	BD Flow Cytometry Training Centre, Stellenbosch University – Tygerberg	01 Apr	05 Apr
Warren RM	USAID National Summit on TB Diagnostics	Sheraton Hotel	18 Nov	19 Nov
Ntsapi C	NGS workshop at CHPC [Centre for Proteomic and Genomic Research (CPGR)]	Centre for Proteomic and Genomic Research UCT	14 Nov	15 Nov
Styger G	Mass Spectrometry Based Proteomics	Stellenbosch University, Tygerberg Campus	09 Jul	10 Jul
Willemse D	Mass Spectrometry of Small Molecules: GC-MS workshop	Stellenbosch University, Tygerberg Campus	09 Jul	10 Jul
van der Merwe R, Pule C	Stellenbosch Clinical Science Workshop: Drug discovery and development	Stellenbosch University, Tygerberg Campus	16 Sep	18 Sep
Hammond-Aryee K	EMBO workshop on AIDS related Mycoses	IDM University of Cape Town	03 Jul	05 Jul

van der Spuy GD	Calculus One	Ohio State University - Coursera (http://www.coursera.org)	21 Jan	03 May
van der Spuy GD	Algorithms: Design and Analysis, Part 1	Stanford University - Coursera (https://www.coursera.org)	28 Jan	11 Mar
van der Spuy GD	Mathematical Biostatistics Boot Camp	Johns Hopkins University - Coursera (https://www.coursera.org)	16 Apr	04 Jun
van der Spuy GD	Machine Learning	Stanford University - Coursera (https://www.coursera.org/)	22 Apr	01 Jul
van der Spuy GD	Introduction to Systems Biology	Icahn School of Medicine at Mount Sinai - Coursera (https://www.coursera.org/)	03 Jun	15 Jul
van der Spuy GD	Introduction to Systematic Program Design - Part 1	University of British Columbia - Coursera (https://www.coursera.org)	03 Jun	28 Jul
van der Spuy GD	Calculus Two: Sequences and Series	Ohio State University - Coursera (https://www.coursera.org)	07 Oct	08 Nov
Werely CJ	A Brief History of Mankind by Dr. Yuval N. Harari	https://class.coursera.org/humankind-001/class/index	11 Aug	08 Dec
Werely CJ	Think Again: How to Reason and Argue by Walter Sinnott-Armstrong, Ram Neta	https://class.coursera.org/thinkagain-002/class	26 Aug	18 Nov
van der Spuy GD	Network Analysis in Systems Biology	Icahn School of Medicine at Mount Sinai - Coursera (https://www.coursera.org)	06 Oct	24 Nov

Other capacity development activities

- Prof. Warren presented one lecture in the MBChB module on Infections and Clinical Immunology in 2013. Title: Molecular Epidemiology of Drug Resistant TB in South Africa.
- Prof Warren presented two lectures on “Getting Published” as part of the Research Development training programme.
- Dr. Warner served as coordinator of the “Cloning and Techniques” module of the BSc (Med) (Hons) programme, Faculty of Health Sciences, UCT
- Dr. Warner served as convener of the Bacterial Pathogenesis module of the Infectious Diseases and Immunology Honours Programme, in the Faculty of Health Sciences, UCT. Dr. Warner and Dr. Evans lectured in this course.
- Prof. Kana lectured in the Molecular Medicine and Hematology Honours program in the School of Pathology.
- Prof. Kana lectured in the MMED Registrar Program
- Dr. Gordhan ran a cloning and bacterial culturing course for the Human Genetics Honours Programme.
- Prof. Kana lectured in the Postdoctoral Forum in the Faculty of Health Sciences.

Exchange visits

- Doctoral student, Ms. Anastasia Koch went on a 3-month training visit to the Swiss Tropical and Public Health Institute (STPH) in Basel where she worked under the supervision of Prof Sebastien Gagneux and Dr Daniela Brites. During this visit, she was trained in the analysis of whole-genome sequencing (WGS) data and genetic diversity within *M. tuberculosis* populations.
- Ms. Koch was awarded a Fogarty AIDS and TB Training & Research Programme (AITRP) fellowship. This prestigious award will facilitate a training visit to Prof Tom Ioerger’s group at Texas A&M University. As well

as facilitating an important component of my PhD work, funding from the Fogarty scheme will provide the opportunity to augment computational biology skills that she developed during her visit to the STPH.

- Doctoral student, Ms. Krupa Naran, completed a three-month internship (August-October 2013) at AstraZeneca Bangalore (India) funded by the World Intellectual Property Organisation (WIPO) under a capacity development scheme for drug discovery and development in Africa. During this visit, she acquired new techniques applicable to TB drug discovery and development and was exposed to processes and pipelines for drug discovery, as applied in the pharmaceutical industry
- Dr. Joanna Evans undertook a six-month training visit in the laboratory of Drs. Barry and Boshoff at the NIAID funded by Prof. Mizrahi's HIT-TB grant.
- Dr. K. Gopinath visited the laboratories of Prof. Ajit Lalvani (Imperial College, London) and Prof. Martin Warren (University of Kent, UK) to discuss collaborative projects
- Moller M, van Helden PD, Hoal EG visited the lab of Stefan Schreiber at Institute for Clinical Molecular Biology, Christian-Albrechts-University in Kiel, Germany, for discussions on setting up a bilateral MSc programme, 13-16 November 2013.

Conferences/Symposia Organised (3)

- The three nodes of the CBTBR had a joint Symposium at the SU node on 9-10 April 2013.This event was attended en-masse by all students and staff of the entire CBTBR. The aim was to strengthen networking and joint ventures between the three nodes of the CBTBR. Students presented their projects followed by extensive discussions on each topic.
- The inaugural National Health Laboratory Services Research Summit, 21-22 February 2013. Prof. Kana served on the Scientific Advisory/organizing committee and chaired the opening session of the research summit. He also assisted in drafting the summit report.
- Prof. Kana served on the Scientific Advisory and organizing committee of the Informa Africa Health Infectious Diseases conference.

3. Knowledge Brokerage

The operational environment

All three nodes are actively involved in the sharing of knowledge amongst researchers within the CBTBR through lab meetings held at least weekly. Journal Club meetings, held weekly at the three sites, also provide an opportunity to share broader-based scientific issues and ideas within the field of biological sciences within and beyond our own institutions. We also attend numerous local and international conferences, often as invited speakers, where we share our work with the international community. We have had numerous meetings and contacts with health authorities, such as W and E Cape Departments of Health, to share with them our findings and the implication of these. These are just some of the bodies we have met with. Team members also advise international organisations, such as the TB Alliance and the WHO.

Knowledge translation to stakeholder groups

CBTBR members were involved in numerous public awareness activities countrywide in 2013:

Public awareness, public engagement, and publicity

- Valerie Mizrahi was featured in an article in *Business Day*, published on 26 August.
- Valerie Mizrahi was featured in episodes 1 and 3 of *EXPOSED: The Race Against Tuberculosis*, a four-part series of short films produced by Aeras that highlight the global TB problem and the need for new tools to control this disease. This series has been broadcast widely across the world.

  (http://www.aeras.org/exposed).
- Dr. Digby Warner was interviewed on SAFm Radio as part of a programme for the presentation of projects supported under the SA-EU Science & Technology Cooperation Agreement, held at the Desmond Tutu HIV Centre, Nyanga, 22 November 2013.

- Five Grade 11 students from the LEAP school (http://leapschool.org.za/) were hosted by Anastasia Koch and Zanele Ditse in July 2013. Students were interested in pursuing a career in scientific research, and spent two days in the UCT node finding out what a career in biomedical research might entail.
- Zanele Ditse is also a member of the Harambee Society, which is an Academic Forum for medical professionals whose mission is to promote awareness, development and exchange of knowledge in various fields of research pertaining communicable and non-communicable diseases. This forum is also designed to create cross-disciplinary collaborations and help participants to establish new professional relationships.
- On the 29th May 2013, Bavesh Kana from the Wits node and Professor Gavin Churchyard delivered the 8th lecture in the Wits Prestigious Lecture Series at the Wits School of Public Health. This lecture was attended by members of the student and staff body of the University and the general public. Prof. Kana gave television and radio interviews which profiled the ongoing work in the CBTBR.
- Members of the Wits node participated in the Wits Cross-Faculty Open Day. They created and manned an exhibit to profile the work done at the CBTBR to high school students.
- In March 2013, Prof Kana served as a judge in the 2012 (to be awarded in 2013) edition of the Discovery Health Journalism Awards. He reviewed health related journalism in different categories, including television, radio, print media and trade publications. He provided feedback to journalists regarding reporting style and made recommendations to improve health reporting in these sectors. Dr Kana was also invited to attend the awards function where presentations were made to the journalists with winning entries.
- Dr. Gordhan was invited to participate in the NRF 2013 National Postdoctoral Research Forum, 4-6th December 2013. She chaired a cocktail table for discussion "mentoring/research/challenges for women in science" and participated at a breakfast discussion on promoting women in science. She also served as a panelist for the discussion topic " shaping out your career"
- Numerous radio, TV and newspaper interviews locally and abroad. Owing to extreme administrative burden, opportunistic interviews, no accurate records were kept.

Outreach activities

- UCT node PhD students, Zanele Ditse and Anastasia Koch, together with Olivia Carulei (a PhD student in the Medical Virology Division, UCT) launched the Social Responsiveness Portfolio of the UCT Health Sciences Faculty Postgraduate Students Council. As part of the initiative they started working with IkamvaYouth, whose core mandate is to empower youth through education (http://ikamvayouth.org). The approach taken by Ikamva is unique in that learners are not selected for extra curricula tuition based on current academic performance. Rather the only requirement is a minimum attendance of 75% of lessons. In this way an ethic of inclusiveness is established, and opportunities for academic development are offered to learners willing to commit to the tutoring programme. With 96% of learners passing matric and 94% percent of graduates in tertiary education or employment, the Ikamva model has been hugely successful. Zanele, Anastasia and Olivia sought to use the scientific knowledge they accumulated during their research projects to foster an interest in the scientific basis of health and disease, and to encourage learners to take ownership of health-related behaviour. To this end, a health workshop was held during the annual Ikamva winter school. Topics discussed included TB, HIV and sexual health, substance abuse, diet and nutrition, cancer, and mental health. Postgraduate students directly involved in research related to one of these topics prepared learning tools for the workshop. Ikamva learners interacted enthusiastically, and it is envisaged that the workshop will become a regular part of the Ikamva winter school programme. While planning the workshop, an idea of producing a more durable educational resource emerged. Through numerous informal discussions with South African artists, Herman de Klerk and Ed Young, a project to produce an infographic and short film describing TB within the South African context was developed. The infographic describes the natural history of TB and the basic the biological underpinnings of the disease, while highlighting the importance of seeking treatment. Information is conveyed in a graphic-rich and informal manner so that biological concepts are accessible to a broad audience. The film investigates the opinions of Ikamva learners towards TB and biomedical research more generally, and represents these ideas within the context of high impact TB research that is ongoing within the UCT node. Together the media attempted to coalesce the biology of the TB with the impact the disease has on society, while highlighting TB research currently conducted at the UCT node. The outcome was sincere and students were extremely forthcoming, with a majority having had personal experiences with the disease. While some

had little or no direct encounters with the disease, all contributions allowed valuable access to youths' opinions towards TB in South Africa. Moreover, one of the filming days involved a visit to the UCT node labs. Media will be given to learners to share with their peers and two screening days are planned for 2014. The project was successful both in terms of engaging learners, and in terms of production of high quality digital media products. The project relied on a unique partnership between a biomedical research group, an NGO, artists, and Khayelitsha youth. Ideas were developed spontaneously and organically, with invaluable conceptual input from all partners. The success of the project and the enthusiasm of learners, has led to further funding being sought to expand the public engagement project. In an exciting new development, Ms. Koch led an International engagement Award application from UCT to the Wellcome Trust. This grant has been awarded and will support a significant expansion of the Eh!Woza team's outreach and science communication activities in 2014. Online TB media: http://cargocollective.com/ehwoza

- Prof Corfield has continued her involvement in outreach activities that engage the general public in a greater awareness and appreciation of biomedical science; since 1998, she has received support and encouragement for this work from different stake holders and has actively encouraged the participation of others in these events. These activities have been undertaken with "outreach" funding from the CBTBR.

  Work with DNA project to promote understanding of forensic DNA profiling
  Scifest Africa (1 per day 13-20th March)
  Workshops given to communities in greater Cape Town area Emergency Medical Services (Pinelands 5 April), Tableview (14th August), Goodwood Fire station (7th September), Melkbostrand (14 September) (Thornton 28th September) Elsies River (7th November)

  Murder Mystery that I developed to promote discussion about use of DNA forensics and establishment of a DNA database in South Africa given at:
  Scifest Africa Grahamstown x2 (14th and 16th March)
  Bahrian Science Centre (30 May)
  CT Science Centre as a training workshop for teachers at CT Science Centre, Observatory (9th Feb)
  Whale Coast conservation group, Hermanus (tied in with theme of biopiracy and IKS) (30th August)

  The DNA detective workshop that promotes understanding of genetics, forensics etc given at:
  Scifest Africa (1 per day Grahamstown 13-20 March)
  The Albinism Society (Kleinmond 16 February)
  Bahrain Science Centre x2 per day (26 -30 May)
  Annual Trainers workshop V and A Waterfront (22 and 23 October)

  Careers in Health care presentation:
  Presented by Caroline Pule (CBTBR) to Stellenbosch University bridging course students (28 March)
  With Caroline's assistance Careers in Health Care developed for placement on SAWISE website www.sawise.org.za/ (SAWISE= South African Women in Science and Engineering)
  Poster made and presented to media before the Minister of Health's budget speech

  Presentation entitled "One scientist's journey" (story of my 50 years in science) given at:
  SU High Science meets High school series. Caroline Pule and Nathan McGregor presented their work at the same occasion. (Conservatoire SU main campus 25th July)
  Unizul Science Centre Richards Bay KZN (14th February)
  National Science week at West Coast Science centre Vredenberg (two UCT postgrads presented their work at same time) Diazville High School and Weston High School (31 July)

  Presentation entitled "The science of Love"
  Given a Unizul science Centre Richards Bay, KZN (14 February)

4. Networking

Networks and linkages

The three nodes of the CBTBR are involved in wide collaborative networks that involve TB researchers and research institutions in a large number of countries. Maintaining existing collaborative networks and developing new linkages is of critical importance to the CBTBR. For this reason, members continued to devote significant time and effort to networking.

NAME	INSTITUTION	NATURE/ PURPOSE, OUTPUTS AND FUTURE DIRECTION OF COLLABORATION
Dr. William MacKenzie	Centers for Disease Control and Prevention, USA	Collaboration on the detection and characterization of Rpf-dependent bacterial populations in sputum. Project funded by the NIH.
Prof. Michael Barer, Dr. Galina Mukamolova	University of Leicester, UK	Collaboration on the detection and characterization of Rpf-dependent bacterial populations in sputum. Project funded by the NIH.
Dr. Gavin Churchyard	The Aurum Institute	Collaboration on the detection and characterization of Rpf-dependent bacterial populations in sputum. Project funded by the NIH. The Wits node also collaborating with Dr. Churchyard on several other ventures under the auspices of the Wits-Aurum Coalition.
Prof. Gilla Kaplan	Public Health Research Institute, International Center for Public Health, Newark, NJ	Prof. Kaplan serves as the international member on the Board of the CBTBR. She and Dr. Kana serve on the CU-SA Fogarty AITRP Advisory Board. Dr Kana collaborates with Dr. Kaplan, Prof Mizrahi and Dr Williams on a project aimed at further understanding molybdopterin biosynthesis in mycobacteria.
Prof. Lesley Scott, Prof. Wendy Stevens	University of the Witwatersrand	Ongoing collaboration on the rollout of the GeneXpert diagnostic test and establishment of an external quality assurance system.
Dr. Melinda Suchard	University of the Witwatersrand	Ongoing collaboration of immunological characterization of mutants defective for cell wall turnover/remodeling
Dr. Musa Mhlanga	Council for Scientific and Industrial Research	Ongoing collaboration to develop methods for super-resolution microscopy in mycobacteria
Prof. Mary Gulumian	National Institute of Occupational Health	New collaboration on the study of DNA repair in mycobacteria
Prof. Jim Phillips	National Institute of Occupational Health	New collaboration on the further understanding cell wall metabolism in mycobacteria
Dr. Carolyn Bertozzi	University of California Berkeley	New collaboration on peptidoglycan remodelling
Dr. Neeraj Dhar	Faculte Des Sciences De La Vie, Global Health Institute Ecole Polytechnique Federale De Lausanne	New collaboration on imaging mycobacteria
Dr. Eric Betzig	Howard Hughes Medical Institute	New collaboration on imaging mycobacteria

Dr. Ian Orme	Colorado State University	Collaboration on characterization of mutant strains of *M. tuberculosis* in the guinea pig model of TB infection.
Dr. Kevin Pethe	Institute Pasteur - Korea	Collaboration on characterization of compounds that target the mycobacterial respiratory chain.
Dr. Clifton E. Barry III, Dr. Helena Boshoff	Tuberculosis Research Section, Laboratory of Host Defenses, National Institute of Allergy & Infectious Diseases, NIH, MD	Ongoing collaboration on the HIT-TB project
Prof. Česlovas Venclovas	Institute of Biotechnology, Vilnius, Lithuania	Ongoing collaboration on computational biology of *M. tuberculosis* proteins
Dr. Tom Ioerger, Prof. Jim Sacchettini	Biochemistry & Biophysics, Texas A&M University, College Station, TX	Collaborating on whole-genome sequence analysis of strains of *M. tuberculosis*.
Prof. Sir Tom Blundell, Prof. Chris Abell	Cambridge University, UK	Collaborating members of the HIT-TB and MM4TB Consortia
Prof. Stewart Cole, Dr. Ruben Haartkoorn	EPFL, Lausanne, Switzerland	MM4TB Consortium
Prof. Jonathan Blackburn	IDM, UCT	Collaboration on lipidomic and proteomic analyses of *M. tuberculosis* strains
Prof. Kelly Chibale	H3-D Drug Discovery Centre, UCT	Collaboration on SATRII, HI-TB and H3-D TB drug discovery projects
Prof. Nicola Mulder	CBIO, IDM, UCT	Collaboration on bioinformatic analysis of mycobacterial genomes
Prof. Robert Wilkinson	CIDRI, IDM	Collaboration on sequence analysis of clinical strains of *M. tuberculosis*
Prof. Robert Doyle	Syracuse University	Collaboration on vitamin B_{12} biosynthesis
Prof. David Russell	Cornell University	Collaboration on vitamin B_{12} transport and metabolism
Prof. Robin Wood	DTHC, IDM, UCT	New collaboration on TB transmission, funded by MRC Flagship grant to UCT
Prof. Tom Scriba	SATVI, IDM, UCT	New collaboration on TB transmission, funded by MRC Flagship grant to UCT
Prof. Adrie Steyn	K-RITH	New collaboration on SATRII TB drug discovery project
Prof. Sebastian Gagneux	Swiss TPH, Basel, Switzerland	New collaboration on genome sequencing of clinical strains of *M. tuberculosis*
Prof. Dirk Schnappinger, Dr. Sabine Ehrt	Weill Cornell Medical College, Cornell University	New collaboration on in vivo validation of drug targets
Prof. David Russell	Cornell University	New collaboration on propionate detoxification mechanisms in *M. tuberculosis*
Prof. Ajit Lalvani	Imperial College London	New collaboration on the application of conditional mutants in probing immune responses to *M. tuberculosis*

Dr. Helmi Mardassi	Institut Pasteur de Tunis, Tunisia	Characterisation of LAM evolutionary history (2007-present).
Dr. Wilbert Bitter	Vrije Universiteit, Amsterdam, Netherlands	The trafficking of the *M. tuberculosis* PE and PPE proteins (2006 – present).
Prof. John Ho, Dr. Andrea Gibson, Prof. Richard Huard	Cornell University, New York, USA	The dissemination of the major RDRio sub-lineage of the LAM *M. tuberculosis* spoligotype family in Luso-American countries, Portugal and Africa
Prof. Dick van Soolingen	RIVM The Netherlands	Evaluation of the MIRU-VNTR typing method
Dr. Kristin Kremer	RIVM The Netherlands	Whole genome sequencing of Beijing genotype strains
Dr. Philip Supply, Prof Eric Bottger	Institut Pasteur Lille University of Zurich	Evaluation of hypervariable VNTR regions for the discrimination of Beijing genotype strains
		Development and evaluation of novel genetic based diagnostics for drug resistance.
Prof Edward Nardell	Vrije Universiteit, Amsterdam, Netherlands AIR facility, Witbank	ESX secretion in Beijing genotype straisn
		Transmissibility of drug resistant TB
Dr. Violet Chihota	Aurum Health	Mycobacterium tuberculosis strain population structure in Africa.
Prof. Timothy Sterling	Vanderbilt University Tuberculosis Center, Nashville, USA	Fluoroquinolone resistance
Prof Megan Murray	Florida University Harvard / Broad institute	Development of a novel TB diagnostic for drug resistance
		Various project including the evolution of XDR-TB strains; other mechanisms of drug resistance (in addition to genomic mutations); mechanisms of resistance to 2nd line drugs; strain fitness; certain strain families may have both increased fitness and increased potential for acquiring drug resistance. All of these projects involve whole-genome sequencing, proteomics, microarray. Prof. Murray is directly involved in project planning, paper writing, funding proposals (NIH and Wellcome trust).
Dr. Karen Jacobson	Harvard University, USA	1) GIS of drug resistant TB in the Western Cape 2) MDR treatment outcome in Brewelskloof Hospital Treatment outcome of M(X)DR-TB
Prof. Harald Wiker, Dr Gustavo de Souza	Bergen University and Oslo University, Norway	Ongoing collaboration on the *M. tuberculosis* phosphorylome New collaboration on the detection of drug resistance by single run multi-locus sequencing. New collaboration on the *M. tuberculosis* secretome.
Dr. Anita Schurch	RIVM, Netherlands	Ongoing collaboration on *M. tuberculosis* genome evolution.
Dr. Hernandez Pando Rogelio	National University of Mexico	Test different drug resistant strains (MDR / XDR) in a mouse model for strain fitness/virulence. The isolates are the same as described above and will compliment the data obtained by molecular investigations. To determine whether reinfection induces reactivation.
Dr. Helen Cox	UCT	Collaboration on drug resistance in Khayelitsha, Western Cape. Impact of mixed infection on treatment outcome.

		Evolution of drug resistance in HIV positive and negative individuals
Prof. Keertan Dheda	UCT	Molecular epidemiology of XDR-TB Whole genome sequencing of XDR-TB
Dr. Grant Theron	UCT	Measuring infectiousness through cough aerosol sampling.
Prof. Ruth McNerey	LSTHM	Whole genome sequencing of drug resistant M. tuberculosis strains
Prof. Anab Pain	KAUST	Whole Genome Sequencing of Mycobacterial Species
Prof. Alan Christoffels	SANBI, UWC	Bioinformatic analysis of whole genome sequence data.Wet-lab testing of computationally identified inhibitors
Prof. Sarel Malan	School of Pharmacy, UWC	Assessing anti-mycobacterial activity of novel efflux pump inhibitors
Dr. Nazir Ismail	NHLS	Drug resistant TB in South Africa
Dr. Danie Theron	Eben donges hospital, Worcester	New project on DOTS program on farms.
Dr. Else Marais	Wits/NHLS	Ongoing collaboration on the molecular epidemiology of drug resistant TB in Gauteng.
Prof. Carools Reinecke, Dr. Du Toit Loots	North West University	*M.tuberculosis* metabolome.
Prof. Colleen Wright	NHLS Port Elizabeth	The diagnostic utility of FNAB
Dr. Alistair Calver	Gold Mine in Northern province	Ongoing, outbreak of drug resistance in a setting with a good control program.
Profs. Larry Wangh and Francis Drobneiwski	Brandis University, HPRI, QMUL	Evaluation of LATE PCR for the detection of resistance to first and second-line anti-TB drugs.
Dr. Jyothi Rengarajan	Emory University, USA	Assessment of macrophage and dendritic cell responses to clinical strains of *M. tuberculosis*
Dr. Anita Michel	Faculty of Veterinary Science, University of Pretoria	Assessment of novel biomarkers for the diagnosis of TB in cattle; this work is ongoing
Dr. Julian Drewe	Royal Veterinary College, London, UK	Genetic characterization of *Mycobacterium suricattae*; this project will be expanded in 2013 to include development of diagnostic assays for TB in meerkats
Drs. Peter Buss & Markus Hofmeyer	SA National Parks	Development of a gene transcription assay for lions; ongoing project
Prof. Erwin Schurr	McGill University, Montreal, Canada	Genetic epidemiology. Poster outputs; 4 papers published 2009-2010, one paper in 2013.
Prof. Laurent Abel & Alexandre Alcais	INSERM / Université Paris 5, France	Analysis of genetic epidemiology. Poster outputs; 4 papers published 2009-2010, one paper in 2013.
Dr. Alkes Price	Harvard School of Public Health, Boston, USA	Computational assistance with analysis of admixture mapping. Paper published in 2013
Dr. Brenna Henn	Stony Brook University, New York, USA	Population Ancestry genetic determinations. Paper published in 2013
Prof. Stefan Schreiber, Dr. Almut Nebel, Dr. Andre Franke	Christian-Albrechts University, Kiel, Germany	Investigation of candidate genes in TB. Resulted in 4 publications 2007 - 2009. Manuscript in preparation

Dr. Ad Koets	Utrecht University	Host genetics of BTB (WOTRO Integrated program proposal) (2007 - present). Two papers published 2013
Prof. Mary Carrington, Dr. Maureen Martin, Dr. Xiaojiang Gao	Frederick National Laboratory for Cancer Research, Maryland	Investigation of KIRs as TB candidate genes. Paper published 2013
Dr. Chris Gignoux	University of California San Francisco	Ancestry informative markers. Paper published in 2013
Prof. Harriet Mayanja	Makerere University, Uganda	Collaborators on BMGF-funded project.
Prof. Willem Hanekom	SATVI, UCT	Collaboration on TB vaccine studies
Dr. Carol Holm-Hansen	Norwegian Institute for Public Health	Collaboration on BMGF Grand Challenge Exploration grant, 2010-2011
Dr. Christoph Lange, Dr. Barbara Kalsdorf	Clinical Infectious Diseases,Centre for Clinical Studies,Medical Clinic,Research Centre Borstel, Germany	Collaboration on TB diagnostic study 2011
Dr. Jeff Boyle	Qiiagen, US	Collaboration on diagnostic TB study 2010-2011
Prof. Nulda Beyers, Dr. Anneka Hesseling, Dr. S. Tonkin, Prof. B. Marais	SU	Non-tuberculous Mycobacteria (NTM) - Prevalence and Clinical relevance in HIV-infected and HIV-uninfected children (2006 - present).
Prof. Nulda Beyers	DTTC, SU	Ongoing collaboration of the molecular epidemiology of *M. tuberculosis* in the W. Cape.
Dr. Anita Michel, Jacques Godfroid, Koos Coetzer, Nick Kriek	Onderstepoort Veterinary Institute	Non-tuberculous mycobacteria in wildlife (WOTRO Integrated program proposal) (2007 - present).
Dr. Mary Jackson	Colorado State University	Screen anti-TB compounds against RIF-resistant *M. tuberculosis* strains.
Prof. Kelly Chibale	Dept Chemistry, UCT	Screen antituberculosis lead compounds
Dr. Corli Witthuhn	Food Science, SU	Fermentation Processes to kill *M. Tuberculosis*
Dr. Thavi Govender	Dept. Chemistry, UKZN	Test antituberculosis activity of existing antituberculosis drug derivatives. K. Onajole 2009
Prof. Ivan Green	Dept Chemistry, UWC	Screen new compounds and derivatives for antituberculosis activity
Dr. Colin Kenyon	CSIR, Pretoria	Dormancy regulators of *M.tb* in human macrophages.
Dr. Richard Haynes	Hong Kong University of Technology	Testing new compounds for antituberculosis activity
Prof. Peter Folb	Pharmacology, UCT	Testing derivatives of Diphenyl Oxazole for antituberculosis activity
Ms. Marlein Bosman	NHLS , Green point	Collaborator on all our projects – provides routine samples.
Dr. Lily Telisinghe, Dr. Salome Charalambous	Arum Health	TB in the correctional services

Dr. Sias May	TB Control program in Suidkaap/ Lawaaikamp	TB Control strategy.
Prof. Willem Hanekom, Prof. Frank Brombacher	IDM, UCT	Sharing of technology (multicolour FACS, Luminex machine), sharing of samples, manuscript accepted for publication.
		Sharing of expertise (murine helminth models).
Dr. Anneke Hesseling	SU	New collaboration to investigate genotype-immunological phenotype correlations in children.
Prof. Keertan Dheda	Lung Institute, UCT	Collaboration in diagnostic/biomarker project.
Dr. Anna Mandalakas	Baylot Institute, USA	Collaboration of diagnostic studies in paediatric TB.
Dr. Marc Jacobsen	Univ of Wuerzburg,Germany	Collaboration on helminth/TB co-infection studies.
Prof. Muazzam Jacobs	UCT	New collaboration to assess the impact of steroid hormones on protective immunity to M. tuberculosis in a mouse animal model.
Prof. Annelies van Rie	UNC	Treatment of HIV infected Children with Rifabutin
Prof. Annelies van Rie, L Wangh, B Kreiswirt & F Drobneiwski	UNC Brandis University, HPRI, QMUL	Evaluation of the Xpert MTB/RIF test.
		Evaluation of LATE PCR for the detection of resistance to first and second-line anti-TB drugs.
Prof. Antonio Catanzaro	(University Columbia State University, Sandiago	This is a multi country consortium aims to identify bacterial markers and to develop rapid tests for the diagnosis of XDR-TB
Dr. Harald Seitz	Fraunhofer Institute for Biomedical Engineering (IBMT), Potsdam-Golm, Germany	Develop a small microchip device for the simultaneous detection and TB and resistance to a variety of anti -TB drugs
Dr. Elisabetta Walters	Department of Pediatrics and Child Health, Stellenbosch University	Improved detection of *M. Tb* by Xpert MTB/RIF in gastric aspirates and stool samples collected from children with suspected pulmonary TB.
Dr. Regan Solomons	Department of Pediatrics and Child Health, Stellenbosch University	Detection of *M tuberculosis* by PCR based methods in cerebrospinal fluid from children suspected to suffer from TB meningitis.
Prof. Kathy Eisenach	University of Arkansas, USA	Rapid detection of *M tuberculosis* conferring resistance against the antibiotic pyrazinamide in MDR sputum samples.
Dr. Eva Kolwjick	Department of Medical Microbiology, Radboud University Nijmegen, The Netherlands	Detection of dormant forms of *M tuberculosis* in sputum samples from TB patients on drug treatment by incubation with early stationary phase supernatant.

5. Service rendering

The following services were provided in 2013:

The provision of scientific/ technical service, advice and assistance to local Government, regional services, institutions, research groups and individuals

Thesis examination

- Dr. Gordhan examined MSc dissertations for Stellenbosch University and WITS University.
- Dr. Warner examined an MSc dissertation forWITS ; a PhD thesis for the University of Pretoria; a PhD thesis for Stellenbosch University; and a PhD thesis for the University of Oslo, Norway (he travelled to Oslo to conduct the viva in person).
- Numerous external examinations were done by members of the SU node. These include examining PhD or MSc theses for WITS, Pretoria, UCT, UWC and other universities and Universities of Technology. Details are not kept.

Journal editing and reviews

- Prof. Kana reviewed manuscripts for *PLoS One*, *Journal of bacteriology, Evidence based complementary medicine, South African Journal of Science, Journal of Infectious Diseases, BMC Genomics, PLOS One and Antonie van Leuwenhoek.*
- Dr. Gordhan reviewed manuscripts for *African Journal of Microbiology Research, Antonie van Leuwenhoek* and *Journal of Materials Chemistry B.*
- Prof. Mizrahi served on the Editorial Advisory Boards of the *Biochemical Journal, Tuberculosis*, *Cellular Microbiology,* and the Editorial Boards of *Pathogens & Disease*, and *Emerging Microbes and Infection*. In 2013, she also reviewed manuscripts submitted to *Nature Genetics, e-Life, Infection & Immunity;* and *Science Translational Medicine.*
- Dr. Warner reviewed manuscripts submitted to *Journal of Bacteriology; Future Microbiology; PLoS Biology, PLoS Pathogens, PLoS ONE, FEMS Microbiology Letters; Tuberculosis; mBio* and *Antimicrobial Agents & Chemotherapy*
- Most if not all senior members of the SU node review numerous manuscripts for international journals. Records are not kept, but journals include *Nature Reviews, Lancet, Lancet Infectious Diseases, PLoS, J Antimicrobial Chemotherapy, J Mol Med, BMC, Tuberculosis, IJTLD, JID, J Biotech, IJMS, Indian Heart Journal, Cardiovasc. J SA, J Biotech, IJMS, Molecular Biology and Evolution, Journal of Infection in Developing Countries, Journal of Bacteriology, Journal of Medical Microbiology, American Journal of Respiratory Critical Care Medicine, Tuberculosis and Journal of Molecular Biology and Biotechnology.*

Expert Panel or Committee Membership

Expert Panel or Committee	Organisation	Term	Member/ Role
Expert Committee	MSF, GATB, WHO	2008-present	G. Walzl
Working Group on New Drugs	Stop TB Partnership	2008-present	Prof. G. Walzl
Internal Governance and an Institutional scientific advisory committee	SU	2014-present	Prof. G. Walzl
IMPAACT TB Scientific Committee	NIH IMPAACT	2012-present	Prof. G. Walzl
Research Committee of Faculty of Health Sciences	SU	2009-present	Profs. G. Walzl & RM. Warren
Ethics Committee for Experimental Animal Research	SU	2008-present	Dr. I. Wiid
Committee for Postgraduate Education of Faculty of Health Sciences	SU	2008-present	Prof. NC. Gey van Pittius
Centre for Infectious Diseases	SU	2008-present	Prof. RM. Warren
Human Research Ethics Committee of the Faculty of Health Sciences	SU	2009-present	Prof. NC. Gey van Pittius & Dr Kinnear

J-Expert Job evaluation Panel	MRC	2010-present	Dr CJ. Kinnear
Planning Committee of Annual Academic YearDay	Faculty of Medicine & Health Sciences, SU	2012-present	Dr CJ. Kinnear (vice-chair)
Critical Path to Treatment Regimens	NIH/Gates Foundation	2013	Profs. PD van Helden & RM Warren
Scientific Advisory Committee	Structure-guided Drug Discovery Consortium	2013	Prof. V. Mizrahi
Scientific Advisory Board	K-RITH)	2013	Prof. V. Mizrahi
Scientific Advisory Committee	TB Alliance	2013	Prof. V. Mizrahi
Trust and Management Board	SACEMA, SU	2013	Prof. V. Mizrahi
Visiting Scholars Fund Committee	UCT	2013	Prof. V. Mizrahi
Research Funding and Internationalisation Task-Teams of the University Research Committee	UCT	2013	Prof. V. Mizrahi
Executive and Membership Committees	IDM, UCT	2013	Prof. V. Mizrahi
Senior Council on Research	Faculty of Health Sciences, UCT	2013	Prof. V. Mizrahi
Health & Safety Committee of the IDM	UCT	2013	Dr. D. Warner (Chair)
Editorial Board	*PLoS ONE*	2013	Dr. D. Warner
Steering Committee	iThemba Pharmaceuticals	2013	Dr. D. Warner
Institutional Biosafety Committee	UCT	2013	Dr. D. Warner
GMO Committee	UCT	2013	Dr. D. Warner
Hazardous Chemical Coordinator of MMRU	UCT	2013	Dr. D. Warner
Lead Academic in charge of the WBS Level 2 BSL III Lab of IDM	UCT	2013	Dr. D. Warner
Integrated Education Committee	IDM, UCT	2013	Dr. D. Warner
Health & Safety Committee	IDM, UCT	2013	Dr. J. Evans
Operations & Lab Management Committee	IDM, UCT	2013	Dr. A. Moosa
Advisory Committee	CU-SA Fogarty AITRP	2013	Prof. Kana
Steering Committee and Projects Committee (Chair)	WITS-AURUM	2013	Prof. Kana
University Research Council (URC)	WITS	2013	Prof. Kana
Research Entity Review Task Group	Faculty of Health Sciences, WITS	2013	Dr. Gordhan
FRC Budget task group,	Faculty of Health Sciences, WITS	2013	Prof. Kana
Executive Committee of the School of Pathology	Faculty of Health Sciences, WITS	2013	Prof. Kana
Research Entity Forum	Faculty of Health Sciences, WITS	2013	Prof. Kana
Research Equipment Review Committee	Faculty of Health Sciences, WITS	2013	Prof. Kana
Research Coordinators Committee	Faculty of Health Sciences, WITS	2013	Prof. Kana
Imaging Committee, Wits University	Faculty of Health Sciences, WITS	2013	Prof. Kana
Faculty Research Council (FRC)	Faculty of Health	2013	Prof. Kana & Dr

	Sciences, WITS		Gordhan
Postgraduate Committee	Faculty of Health Sciences, WITS	2013	Prof. Kana & Dr Gordhan
BTC Scholarship Selection Committee	BTC	2013	Dr. Gordhan
Postdoctoral review Committee	NRF	2013	Dr. Gordhan

Examples of Research Funding Reviews

- Dr. Kana served as a reviewer for MRC Career Award Applications. He also served as a reviewer for the NRF Rating and Evaluation program and NRF postdoctoral program. Dr Gordhan was part of a panel at the NRF post-doctoral and PDP workshop where she gave input on the NRF review process for fellowships and discussed some of the common mistakes and omissions on the applications. Both Dr. Gordhan and Dr. Kana served on assessor committees at Wits University for MSc and PhD proposals. Dr. Gordhan reviewed an application for the NHLS Research Trust grant program.
- Prof. Mizrahi served as a reviewer for the Wellcome Trust, the Bill & Melinda Gates Foundation and the Fondation Recherche Médicale, France. She also served as a reviewer for promotion at Cornell University (New York), the University of Basel, the NIAID (NIH) and Stellenbosch University. Dr. Warner reviewed proposals submitted to the NRF and also served as an internal reviewer for numerous research proposals considered by the IDM Research Committee and Institutional Biosafety Committee. Dr. Warner also served as an adjudicator for the S2A3 Medal, SA Association for the Advancement of Science.
- Many of the SU node members are either on editorial boards or act as regular reviewers for many journals. Again, a list is not provided, since we have so many of these we do not keep record.

Other services rendered

- Dr Gordhan reviewed abstracts submitted for the Informa Africa Health Infectious Diseases Conference.
- Speciation of Non Tuberculous Mycobacteria (NTM) for Kruger National Park
- Genotyping of clinical isolates (RFLP or mutation detection) for the NHLS, MSF and City Health.
- Prof V Corfield was NRF rating panel moderator in 2013
- Specialist diagnostic service for MDR or XDR TB cases
- Specialist diagnostic service for suspect extra-pulmonary TB cases
- Hospital medical specialist clinical services, e.g. pulmonology and genetics
- Hain Life Sciences (Germany): Evaluation of the MDRTBsl genetic drug susceptibility test and Formulation of a SHIP grant application to the MRC.
- Biosearch technologies (USA): Formulation of a SHIP grant application to the MRC.
- Asure PCR (UK): Formulation of a SHIP grant application to the MRC.
- Nanobiosym (USA): Formulation of a SHIP grant application to the MRC.
- Vakzine Project Management (VPM): phase IIa vaccine trial on tuberculosis
- Cellestis: Evaluation of new peptide to diagnose TB

6. Gender impact of research

"Science for Women" (gender-sensitivity of the research agenda)

The work being undertaken in the CBTBR is aimed at contributing towards global efforts in researching and developing new laboratory-based tools for reducing the societal burden of TB. TB is the greatest single infectious cause of death in young women, and causes more deaths among women than all causes of maternal mortality combined. The particularly high rates of HIV co-infection in women are expected to fuel an increased prevalence of TB in women over time. In addition to the disease burden, TB also imposes a massive, but largely hidden burden of social impact on women.

"Science by Women" (the participation by women in the research programme)

Four out of the 13 Core Team Members of the CBTBR are women. In 2013, the CBTBR has also maintained a high percentage of female students (63% of all students and 50% of postdoctoral fellows), which is in line with demographic norms for the Life and Health Sciences at a national level. All three nodes have demonstrated that they are able to provide an environment which is attractive to, and supportive of women researchers at all levels, from Honours students to senior postdoctoral fellows and Core Team Members. These indicators confirm that the CBTBR serves as a centre in which women researchers are nurtured and developed.

HUMAN RESOURCES

1. Core Team Members

Title	Surname	Citizenship	Institution	Gender	Race	% Time spent in CBTBR
Prof.	Mizrahi	Italy	UCT/NHLS	F	W	50[a]
Dr.	Gordhan	SA	Wits	F	B	100
Dr.	Kana	SA	Wits	M	B	100
Dr.	Warner	SA	UCT	M	W	100
Prof.	Gey van Pittius	SA	SU	M	W	10[b]
Prof.	Hoal van Helden	SA	SU	F	W	100
Dr	Martinson	SA	Wits	M	W	25[c]
Dr.	Sampson	SA	SU/NRF	F	W	100[d]
Prof.	Van Helden	SA	MRC	M	W	100
Prof.	Victor	SA	PAWC	M	W	100
Prof.	Walzl	SA	SU	M	W	100
Prof.	Warren	SA	MRC	M	W	100
Dr.	Wiid	SA	PAWC	M	W	100

a. Director of the IDM
b. Appointed as deputy dean for Research in September 2012
c. Dr. Martinson is also a member of the Perinatal HIV Research Unit (PHRU)
d. Appointed as SARChI Chair of Proteomics

2. Scientific Staff

Title	Surname	Citizenship	Institution	Gender	Race	% Time spent in CBTBR
Dr.	Ronacher-Mansvelt	SA	SU	F	W	100
Dr.	Streicher	SA	SU	F	W	100
Dr	Abrahams[a]	SA	UCT	M	B	100
Dr	Williams[b]	SA	UCT	F	B	100

a. Seconded full-time to NIAID,NIH
b. Seconded full-time to SU node

3. Postdoctoral Fellows

Title	Surname	Citizenship	Institution	Gender	Race	% Time spent in CBTBR
Dr.	Chegou	Cameroonian	SU	Male	Black	100
Dr.	Chengalroyen	South African	Wits	Female	Black	100
Dr.	Du Plessis	South African	SU	Female	White	100
Dr.	Ealand	South African	Wits	Male	White	100
Dr.	Evans	South African	UCT	Female	White	100
Dr.	Gopinath	Indian	UCT	Male	Black	100
Dr.	Kleynhans	South African	SU	Female	White	100
Dr	Leisching	South African	SU	Female	White	75[a]
Dr.	Loxton	South African	SU	Male	Black	100
Dr.	Möller	South African	SU	Female	White	100
Dr.	Moosa	South African	UCT	Female	Black	100
Dr	Mukherjee	Indian	UCT	Female	Black	25[b]
Dr.	Ngwane	South African	SU	Male	Black	90[c]
Dr.	Parsons	South African	SU	Male	White	100
Dr	Roetz	South African	SU	Female	White	100
Dr	Singh	Indian	UCT	Male	Black	100
Dr	Styger	South African	SU	Male	White	80[d]
Dr	van der Merve	South African	SU	Male	White	90[e]

a. Commenced in April 2013
b. Commenced in October 2013
c. Commenced in February 2013
d. Commenced in March 2013
e. Commenced February 2013

4. Students

Title	First Name	Surname	Degree	Institution	Race	Gender	Nationality	Status
Ms	Jesmine	Arries	Hons	SU	Black	Female	South African	Completed
Ms	Courtney	Berrington	Hons	SU	White	Female	South African	Completed
Mr	James	Gallant	Hons	SU	Black	Male	South African	Completed
Mr	Jason	Limberis	Hons	SU	White	Male	South African	Completed
Mr	Jarryd	Lunn	Hons	UCT	White	Male	South African	Completed
Mr	Baby	Mameja	Hons	SU	Black	Female	South African	Completed
Ms	Zela	Martin	Hons	UCT	White	Female	South African	Completed
Mr	Armel	Mbouna	Hons	SU	Black	Male	Zimbabwean	Completed
Ms	Cheleka	Mpande	Hons	UCT	Black	Female	Zambian	Completed
Ms	Sonja Catherine	Podgorski	Hons	SU	White	Female	South African	Completed
Mr	Michael	Reiche	Hons	UCT	White	Male	South African	Completed
Ms	Reneilwe Louisa	Serepa	Hons	SU	Black	Female	South African	Completed
Mr	Marvin	Theys	Hons	SU	Black	Male	South African	Completed
Ms	Caitlin	Uren	Hons	SU	White	Female	South African	Completed
Ms	Gratia-Lize	Willemse	Hons	SU	Black	Female	South African	Completed
Ms	Rukaya	Asmal	MSc	Wits	Black	Female	South African	Incomplete
Mr	Germar	Beukes	MSc	Wits	White	Male	South African	Completed
Ms	Michelle	Daya	MSc	SU	White	Female	South African	Incomplete
Ms	Juanelle	Du Plessis	MSc	SU	White	Female	South African	Incomplete
Mr	Willem Jacques	Du Plessis	MSc	SU	White	Male	South African	Incomplete
Ms	Lizaan	Ehlers	MSc	SU	White	Female	South African	Incomplete
Mr	Wynand Johan	Goosen	MSc	SU	White	Male	South African	Incomplete
Ms	Andrea	Gutschmidt	MSc	SU	White	Female	German	Incomplete
Dr	Kenneth	Hammond-Aryee	MSc	SU	Black	Male	Ghanian	Incomplete
Ms	Sidhika	Hariparsad	MSc	UP/Wits	Black	Female	South African	Incomplete
Ms	Farzanah	Hassim	MSc	Wits	Black	Female	South African	Completed
Ms	Angela Maria	Menezes	MSc	SU	White	Female	South African	Incomplete
Ms	Nabiela	Moolla	MSc	Wits	Black	Female	South African	Completed
Ms	Vuyiseka	Mpongoshe	MSc	SU	Black	Female	South African	Incomplete
Ms	Nicole	Narrandes	MSc	Wits (co-sup UCT)	Black	Female	South African	Completed
Mr	Paulin Essone	Ndong	MSc	SU	Black	Male	Gabonese	Incomplete
Ms	Claudia	Ntsapi	MSc	SU	Black	Female	South African	Incomplete
Ms	Khutso Germina	Phalane	MSc	SU	Black	Female	South African	Incomplete
Ms	Caroline	Pule	MSc	SU	Black	Female	South African	Incomplete
Ms	Sheena	Ruzive	MSc	SU	Black	Female	Zimbabwean	Incomplete
Mr	Sibusiso	Senzani	MSc	Wits	Black	Male	South African	Completed
Ms	Zaahida	Sheik-Ismail	MSc	Wits	Black	Female	South African	Incomplete
Mr	Kabengele Keith	Siame	MSc	SU	Black	Male	Zambian	Incomplete
Dr	Kauna	Skikongo	MMed	Wits	Black	Female	Namibian	Incomplete
Ms	Leani	Thiart	MSc	SU	White	Female	South African	Incomplete
Ms	Hanri	Visser	MSc	SU	White	Female	South African	Incomplete
Ms	Louise	Vos	MSc	SU	White	Female	South African	Incomplete
Ms	Danicke	Willemse	MSc	SU	White	Female	South African	Completed

Mr	Kennedy	Zvinairo	MSc	SU	Black	Male	Zimbabwean	Incomplete
Mr	Marinus	Barnard	PhD	SU	White	Male	South African	Completed
Dr	Adane Mihret	Bekele	PhD	SU	Black	Male	Ethiopian	Incomplete
Ms	Philippa	Black	PhD	SU	White	Female	South African	Incomplete
Mr	Simon	Broadley	PhD	UCT	White	Male	South African	Incomplete
Ms	Marieta	Burger	PhD	SU	White	Female	South African	Incomplete
Ms	Margaretha	de Vos	PhD	SU	White	Female	South African	Completed
Mrs	Anzaan	Dippenaar	PhD	SU	White	Female	South African	Incomplete
Ms	Zanele	Ditse	PhD	UCT	Black	Female	South African	Incomplete
Mr	Zhuo	Fang	PhD	SU	Black	Male	Chinese	Incomplete
Ms	Suereta	Fortuin	PhD	SU	Black	Female	South African	Completed
Ms	Melanie	Grobbelaar	PhD	SU	White	Female	South African	Incomplete
Mr	Xavier	Kaygire	PhD	SU	Black	Male	Rwandan	Incomplete
Ms	Elizabeth	Kigondu	PhD	UCT	Black	Female	Kenyan	Incomplete
Ms	Marisa	Klopper	PhD	SU	White	Female	South African	Incomplete
Ms	Anastasia	Koch	PhD	UCT	White	Female	South African	Incomplete
Mrs	Lungile	Kwitshana	PhD	UKZN	Black	Female	South African	Incomplete
Ms	Nikki	Le Roux	PhD	SU	White	Female	South African	Incomplete
Mr	Lance Andrew	Lucas	PhD	SU	White	Male	South African	Incomplete
Mr	Lubabalo	Macingwana	PhD	SU	Black	Male	South African	Incomplete
Ms	Matsie	Mphahlele	PhD	SU	Black	Female	South African	Incomplete
Ms	Krupa	Naran	PhD	UCT	Black	Female	South African	Incomplete
Ms	Duduzile	Ndwandwe	PhD	Wits (sup UCT)	Black	Female	South African	Completed
Ms	Mae	Newton-Foot	PhD	SU	White	Female	South African	Incomplete
Ms	Charles	Omollo	PhD	UCT	Black	Male	Kenyan	Incomplete
Mr	Muneeb	Salie	PhD	SU	Black	Male	South African	Incomplete
Ms	Carine	Sao Emani	PhD	SU	Black	Female	Cameroonian	Incomplete
Ms	Nastassja Lise	Steyn	PhD	SU	White	Female	South African	Incomplete
Ms	Anjo	Steyn	PhD	SU/CSIR	White	Female	South African	Incomplete
Ms	Sophia	van Coller	PhD	UCT	White	Female	South African	Incomplete
Mr	Albertus	Viljoen	PhD	SU	White	Male	South African	Completed
Mr	Ignatius	Viljoen	PhD	SU/UP	White	Male	South African	Incomplete
Ms	Antonina	Wasuna	PhD	UCT	Black	Female	Kenyan	Incomplete

5. Administrative and Other Staff

Title	Surname	Position	Based at	Gender	Race
Dr	Baker	Project Manager	SU	M	B
Mrs	Hull-Conrad	Part-time admin clerk	UCT	F	B
Ms	Peachy	Bookkeeper/ Admin. Assistant	Wits	F	B
Ms	Magobo	Research Assistant	Wits	F	B
Ms	Motsi	Research Assistant	Wits	F	B
Ms	Serapa	Research Assistant	Wits	F	B
Ms	Nkomo	Laboratory Assistant Technical	Wits	F	B

OUTPUTS

* The Names in bold are CBTBR staff

Books / Chapters in Books (Total: 0)

Articles in Peer-Reviewed Journals (Total: 55)

Gous N, Cunningham B, **Kana BD**, Stevens W, Scott LE. (2013) Performance monitoring of *Mycobacterium tuberculosis* Dried Culture Spots for use on the GeneXpert within a National Program in South Africa. J. Clin. Microbiol. 51:4018-4021. (IF=4.07)
Small JL, Park SW, **Kana BD**, Ioerger TR, Sacchettini JC, Ehrt S. (2013) Perturbation of cytochrome *c* maturation reveals adaptability of the respiratory chain in *Mycobacterium tuberculosis*. MBio, 4:e00475-13. (IF=5.62)
Li Y, de Kock C, Smith PJ, Hendricks DT, **Naran K, Mizrahi V, Warner DF,** Chibale K, Smith GS. (2013) Synthesis, characterization, and pharmacological evaluation of silicon-containing aminoquinoline organometallic complexes as antiplasmodial, antitumor, and antimycobacterial agents. Organometallics **32:**141-150. (IF=4.15)
Gopinath K, Venclovas Č, Ioerger T, Sacchettini JC, McKinney JD, **Mizrahi V**, **Warner DF.** (2013) An ABC transporter essential for vitamin B_{12} acquisition in *Mycobacterium tuberculosis*. Open Biology **3:**120175. (IF=3.63)
Warner DF, Tonjüm T, Mizrahi V. (2013) DNA metabolism in mycobacterial pathogenesis. Curr. Top. Microbiol. Immunol. doi: 10.1007/82_2013_328. (IF=4.86)
Gopinath K, Moosa A, Mizrahi V, Warner DF. (2013) Vitamin B_{12} metabolism in mycobacteria. Future Microbiol. **8:**1405-1418. (IF=4.02)
Kumar A, Casey A, Odingo J, Kesicki EA, Abrahams GL, Vieth M, Masquelin T, **Mizrahi V**, Hipskind PA, Sherman DR, Parish T. (2013) A high-throughput screen against pantothenate synthetase (PanC) identifies 3-biphenyl-4-cyanopyrrole-2-carboxylic acids as a new class of inhibitor with activity against *Mycobacterium tuberculosis*. PLoS One **8:**e72786. (IF=3.73)
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Viljoen AJ, Kirsten CJ, **Baker B, van Helden PD, Wiid IJ**. (2013) The Role of Glutamine Oxoglutarate Aminotransferase and Glutamate Dehydrogenase in Nitrogen Metabolism in Mycobacterium bovis BCG PLoS One 8(12):e84452. (IF=3.73)

Non Peer-Reviewed Articles (Total: 4)

Van Helden PD. (2013) Data-driven hypothesis. EMBO reports. 14:104. (IF=7.19)
Van Helden PD, Hoal EG. (2013) A New TB Vaccine: fact or fiction? CIMID. 36(3): 287-294. (IF=1.81)
Van Helden PD, van Helden LS, **Hoal EG**. (2013) One world, one health. EMBO reports. 14(6):497-501. (IF=7.19)
Kana BD, Churchyard G. (2013) Tuberculosis: The global killer. South African Journal of Science, 109:9-10. (IF=0.84)

Published Abstracts (Total: 0)

Technical Reports (Total: 0)

Products / Artefacts / Patents (Total: 0)

Conferences/Meetings Attended & Invited Talks/Seminars Presented (Total: 90)

Plenary/Keynote Lectures
Kana BD. Developing a Scientific Career. Invited Plenary lecture Young Researchers Forum – South Africa Society for Human Genetics. School of Public Health, Wits University,South Africa, 5-9 October 2013
Kana BD. Stretching the bacterial skin: How much do we know about mycobacterial growth? Invited Opening Plenary lecture presented at the Gordon Research Seminar on Tuberculosis Drug Development. Il Ciocco Hotel and Resort, Lucca (Barga), Italy, 21 – 22 July 2013
Gopinath K, Venclovas C, Ioerger T, Sacchettini JC, McKinney JD, Mizrahi V. Vitamin B_{12} metabolism in *M. tuberculosis*. Plenary lecture delivered at the Keystone Symposium on TB: Understanding the Enemy, Whistler, B.C., Canada, 13-18 March, 2013
Mizrahi V. Understanding and targeting core metabolic pathways in *M. tuberculosis*. Inaugural Lecture, Centre for Structural Systems Biology Seminar Series, EMBL, Hamburg, Germany, 18 June 2013.
Mizrahi V. Understanding the biology of *Mycobacterium tuberculosis* and why it matters. Keynote Lecture, Annual Academic Day, Faculty of Health Sciences, Stellenbosch University, 15 August 2013.
Mizrahi V. Tuberculosis drug discovery: lessons learned and future prospects. Plenary lecture, SACORE TB Symposium, Cape Town, 31 August 2013.
Mizrahi V. Gearing for the future: configuration, culture and values for research and training. Keynote Lecture, 2013 UCT Research Function, University of Cape Town, 10 September 2013.
Invited Talks
Ealand CS, Kana BD. The Role of Mycobacterial DD-Carboxypeptidases in Peptidoglycan Remodeling and Turnover. Short Talk and Poster Presentation, Tuberculosis: Understanding the Enemy Keystone Conference. March 13 - March 18, 2013, Whistler Conference Centre, Whistler, British Columbia Canada
Gordhan BG. Empowering women to be the best researcher/scientific writers. Oral presentation at the "Women in Science and technology conference" 14-15th, Sandton Convention Centre, Johannesburg.
Kana BD. Differential Bacterial Culturability in tuberculous sputum: Can we look at both sides of the same coin at once? Invited talk presented at the Gordon Research Conference on Tuberculosis Drug Development. Il Ciocco Hotel and Resort, Lucca (Barga), Italy, 22 – 26 July 2013
Kana BD. What makes a good target? Invited talk presented at the Working group on new TB drugs Symposium at the Gordon Research Conference on Tuberculosis Drug Development. Il Ciocco Hotel and Resort, Lucca (Barga), Italy, 22 – 26 July 2013
Kana BD. Eliminating TB. Lecture Given at the 8th Prestigious Research Lecture in the Faculty of Health Sciences. Wits School of Public Health. 29th May 2013
Kana BD. Peptidoglycan Remodelling during TB Infection: Separation Anxiety and Bipolar Disorder in mycobacterial cells. Invited lecture as part of the Frontiers in Biological Sciences Seminar Series, Tsinghua University, Beijing, China. 12 November 2013
Kana BD. Success in Academic Careers. Invited Lecture and workshop. Tsinghua University, Beijing, China. 11 November 2013
Kana BD. Counter-screening models for TB drug development – Exploiting the mycobacterial cell wall, 30th October 2013, Helmholtz Institute-South Africa joint research meeting, Braunschweig, Germany.
Kana BD. Peptidoglycan Remodelling: Implications for mycobacterial growth and TB disease. Invited Lecture, 16 September 2013, Johns Hopkins University, Baltimore, USA.
Ditse Z, Mizrahi V, Warner DF. Replication fidelity in M. tuberculosis. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013.
Ditse Z, Mizrahi V, Warner DF. Replication fidelity in the microevolution of Mycobacterium tuberculosis. 5th CLS/HUB Postgraduate Research Day, UCT, 4 September 2013. [Winner, best oral presentation prize]
Ditse Z, Mizrahi, V, Warner DF. Replication fidelity in the microevolution of Mycobacterium tuberculosis. FIDSSA Conference, Drakensberg, 10-12 [Winner, best oral presentation prize]
Ditse Z. Replication fidelity in the microevolution of mycobacteria. IDM/MCB Carnegie Scholars Retreat, Silver Mist Mountain Lodge, Cape Town, 14 October 2013.
Evans J, Mizrahi V. Identifying vulnerable steps in CoA biosynthesis. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Evans J, Mizrahi V. CoaBC, CoaD and CoaE. Lecture presented at the Second HIT-TB Consortium meeting,

Cape Town, 26-28 February 2013
Mizrahi V. Conditional mutants as tools for TB drug discovery. Invited lecture, SA MRC-HZI Symposium on Infection Research, Braunschweig, Germany, 30 October 2013.
Mizrahi V. Target-based whole-cell screening. Lecture presented at the Second HIT-TB Consortium meeting, Cape Town, 26-28 February 2013
Mizrahi V. Target-based whole-cell screening. Talk presented at NITD & H3-D workshop, Vineyard Hotel, Cape Town, 12 June 2013
Mizrahi V. Co-factor metabolism in M. tuberculosis: doing things differently. Invited talk presented at the MRC Centre for Molecular Bacteriology & Infection, Imperial College, London, 17 June 2013.
Mizrahi V. Tuberculosis drug discovery research: a personal perspective from South Africa. After-dinner speech presented at the DST budget vote dinner, South African Museum, Cape Town, 16 May 2013.
Mizrahi V. Tuberculosis drug discovery: lessons learned and future prospects. SACORE TB Symposium, Cape Town, 31 August 2013.
Moosa A, Seldon R, Mizrahi V, Warner DF. Smart screening for TB drug discovery. H3-D TB Projects meeting, Hermanus, 21-22 November, 2013.
Narrandes N, Mizrahi V, Kana BD. Functional characterization of molybdopterin synthase-encoding genes in mycobacteria. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Singh V, Evans J, Warner D, Mizrahi V. The role of the thymidylate synthase, ThyX, in the mechanism of action of 5-fluorouracil in M. tuberculosis. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Singh V, Evans J, Warner DF, Mizrahi V. Update on conditional knockdown of Wag31. Consortium Meeting 6, MM4TB, Lille, France, 4-5 July 2013.
Warner DF. How M. tuberculosis gets its vitamin B_{12} shot. Invited talk presented at the University of Oslo, Norway, 2 April 2013
Warner DF. SATRII Biology Component capacity. Lecture presented at the Second HIT-TB Consortium meeting, Cape Town, 26-28 February 2013
Warner DF. The changing nature of the role of the institution and challenges for supervisors with regards to research students. Invited talk presented at the UFCT Postdoctoral Supervision Training Programme, Mont Fleur, Stellenbosch, 11-12 November 2013
Warner DF. Translesion synthesis in Mycobacterium tuberculosis and its impact on antibiotic resistance. 11th International Conference on Environmental Mutagens (11th ICEM), the XI Congress of SBMCTA and the IX Congress of ALAMCTA: Bacterial Models for Mutagenesis Studies: From Basic Mechanisms to Infectious Diseases, Foz do Iguaçu Brazil, 2-8 November 2013.
Warner DF. What it means to be an academic in the 21st century. Launch of Phase II of the Carnegie Corporation's Developing the Next Generation Academics programme, UCT, 23 April 2013
Sao Emani C. The role of ergothioneine in mycobacteria. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Macingwana L. An Old drug: Sulfamethoxazole. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Anderson D. TB Genomics. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Fortuin S. TB Proteomics. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Newton-Foot M. TB Functional Biology. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
De Vos M. TB Diagnostics. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Klopper M. Molecular epidemiology of Drug resistant TB. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Grobbelaar M. Rifampicin resistance. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Black P. Novel mechanisms of resistance. Talk presented at the CBTBR Symposium, Stellenbosch

University, 9-10 April 2013
Moller M. Host TB genetics. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Du Plessis N. Innate immunity to mycobacterial infections. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Kleynhans L. Immune endocrine interactions during TB. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Chegou NN. Host Biomarkers for active TB. Talk presented at the CBTBR Symposium, Stellenbosch University, 9-10 April 2013
Chegou NN. Evaluation of M. tuberculosis specific host cytokine signatures in whole blood culture supernatants as diagnostic markers for active tuberculosis. Talk presented at the 2nd South African-German workshop on IT-based Technologies for Rural Health Care. Berlin University of Applied Sciences, Berlin, Germany. 25-28 February 2013
Chegou NN. Utility of M. tuberculosis specific host cytokine signatures in whole blood culture supernatants as diagnostic markers tuberculosis disease. Talk presented at the MRC Early Career Scientist Convention. MRC, Parow, Cape Town, South Africa. 16 October 2013
Daya M. A panel of ancestry informative markers for the South African Coloured population. Talk presented at the DAAD conference. Stellenbosch Protea Hotel, Stellenbosch, South Africa. 08-10 November 2013
De Vos M, Louw GE, van Helden PD, Victor TC, Warren RM. Understanding the biology of poly-rifampicin resistance in Mycobacterium tuberculosis. Talk presented at the 34th European Society of Mycobacteriology Annual Congress. Demidoff Hotel, Florence, Italy. 30 June - 03 July 2013
Du Plessis N. MDSCs in TB. Talk presented at the Respiratory Unit Research Meeting. Tygerberg Pulmonary Division, Cape Town, South Africa. 16 October 2013
Du Plessis N. Suppressive Innate Immunity to Mycobacterium tuberculosis infection. Talk presented at the Institute of Infectious Diseases Seminars. University of Cape Town, 30 October 2013
Essone P. Diagnostic utility of antigen-stimulated host markers in an overnight whole blood culture assay. Talk presented at the EDCTP. Dakar Hotel, Dakar, Senegal. 20 October - 20 October 2013
Fortuin S. Deciphering the impact of the evolution of drug resistance on the physiology of Mycobacterium tuberculosis. Talk presented at the Southern African Consortuim for Research Excellence TB Workshop. Vineyard Hotel, Cape Town, South Africa. 31 August - 02 September 2013
Fortuin S. Proteomic analysis of Mycobacterium tuberculosis strains demonstrating varying levels of virulence and drug resistance. Talk presented at the Southern African Corsortium for Research Excellence TB Meeting. Vinyard Hotel, Cape Town, South Africa. 31 August - 02 September 2013
Hoal EG. Life in South Africa: Political situation, recent history, social life. Talk presented at the Christian Albrechts University Strategic Planning workshop. Christian Albrechts University, Kiel, Germany. 14-17 November 2013
Klopper M, Streicher EM, Warren RM, Victor TC. The evolution of Totally Drug-Resistant TB in South Africa. Talk presented at the Southern African Consortuim for Research Excellence TB Meeting. The Vineyard Hotel, Cape Town, South Africa. 31 August - 04 September 2013
Le Roex N, van Helden PD, Hoal EG, Parsons S, Goosen W Bovine TB in buffalo: what's in the genes?. Talk presented at the Annual Bovine Tuberculosis Meeting and Workshop. Veterinary Wildlife Services, Kruger National Park, South Africa. 12-13 September 2013
Malherbe S, Walzl G. Recent, current and future biomarker discovery at SUN-IRG to aid TB diagnosis and cure. Talk presented at the Desmond Tutu Trial Centre Dissemination meeting. Klein Joostenberg, Cape Town, South Africa. 13 December 2013
Moller M. TB research in South Africa. Talk presented at the Christian Albrechts University Strategic Planning workshop. Christian Albrechts University, Kiel, Germany. 14-17 November 2013
Ronacher-Mansvelt K. Biomarkers of TB treatment response. Talk presented at the Meeting. Helmholz Insitute, Braunschweig, Germany. 28 October 2013
Sampson SL. Mice in TB Research - what's new and how is this useful in a Southern African context? Talk presented at the Southern African Consortium for Research Excellence, Workshop: Understanding and intervening in tuberculosis in Southern Africa. Vineyard Hotel, Cape Town, South Africa. 31 August 2013
Steyn NL, Newton-Foot M, Warren RM, van Helden PD, Gey van Pittius NC. Investigating the localisation of

the ESX-3 secretion system in Mycobacterium smegmatis. Talk presented at the 57th FHSM Annual Academic Day. Stellenbosch University, Cape Town, South Africa. 14-15 August 2013
Van Helden PD. Internationalisation in Science. Talk presented at the Christian Albrechts University Strategic Planning workshop. Christian Albrechts University, Kiel, Germany. 14-17 November 2013
Van Helden PD. Rapid genetic detection of pyrazinamide susceptibility. Talk presented at the The Annual ACTG Network Meeting. Grand Hyatt Washington Hotel, Washington DC, USA. 29 July - 02 August 2013
Van Helden PD. Session chair. Talk presented at the Gordon Research Conference on Tuberculosis Drug Development. Renaissance Tuscany Il Ciocco Resort, Lucca (Barga), Italy. 21-26 July 2013
Walzl G. TB biomarkers in peripheral blood. Talk presented at the 34th Annual Conference of the European Society of Mycobacteriology. Florence, Italy. 30 June - 03 July 2013
Walzl G. TB biomarkers in peripheral blood. Talk presented at the Biomarkers for Tuberculosis: New Questions, New Tools Meeting. Washington, USA. 8-11 September 2013
Warren RM. Rapid genetic detection of pyrazinamide susceptibility. Talk presented at the The Critical Path to TB Drug Regimens Workshop. Marriott Renaissance Hotel, Washington, USA. 30 September - 01 October 2013
Warren RM. The Genesis and Transmission of Drug Resistant TB in SA: Molecular Epidemiologic View. Talk presented at the XDR-TB Workshop. University of Cape Town, South Africa. 16-17 November 2013
Warren RM. The Molecular Epidemiology of Drug-Resistant TB in South Africa. Talk presented at the Southern African Consortuim for Research Excellence TB Workshop. Vineyard Hotel, Cape Town, South Africa. 31 August - 02 September 2013
Warren RM. Virtual DNA sequencing: Lights-on/Lights-off assay platform rpoB as an example. Talk presented at the The Critical Path to TB Drug Regimens Workshop. Marriott Renaissance Hotel, Washington, USA. 30 September - 01 October 2013
Warren RM. The Molecular Epidemiology of Drug-Resistant TB in SA. Talk presented at the 3rd Pan-African Infectious Diseases Conference. Gallagher Convention Centre, Johannesburg, 07-08 May 2013
Williams MJ, Peixoto B, Manca C, Kaplan G, Mizrahi V, Kana BD. Biosynthesis of bis-molybdopterin guanine dinucleotide is dispensable for virulence of Mycobacterium tuberculosis. Talk presented at the 57th FHSM Annual Academic Day. Stellenbosch University, Cape Town, South Africa. 14-15 August 2013
Posters
Kana BD. Resuscitation promoting factors in bacterial growth and cell wall remodelling - Extreme Makeover for the Cell wall. Poster presentation at the Annual HHMI Scholars Meeting, HHMI Janelia Farm Research Campus, Ashburn, Virginia, USA. 10-12 February 2013
Kana BD. A role for N-acetylmuramoyl-L-alanine amidases and DD-carboxypeptidases in mycobacterial growth and cell division. Poster presentation at the Bacterial Cell Biology Conference 2013, Occidental Grand Xcaret Resort, Mexico. 9-12 December 2013
Singh V, Evans J, Warner D, Mizrahi V. The role of the thymidylate synthase, ThyX, in the mechanism of action of 5-fluorouracil in M. tuberculosis. Poster presented at the Keystone Symposium on TB: Understanding the Enemy, Whistler, Vancouver, Canada, 13-18 March 2013.
Evans J, Abrahams GL, Mizrahi V. Identification of vulnerable steps in the coenzyme A biosynthesis pathway of Mycobacterium tuberculosis. Poster presented at the Gordon Research Conference on Tuberculosis Drug Development, Lucca (Barga), Italy, 22-26 July 2013
Naran K, Mizrahi V, Warner DF. Mechanisms of antibiotic subversion in M. tuberculosis: role of the SOS response. Poster presented at the Gordon Research Conference on Tuberculosis Drug Development, Lucca (Barga), Italy, 22-26 July 2013
Mjambili F, Ngoroje M, Naran K, Warner DF, Chibale K. Synthesis, ADME and pharmacological evaluation of 2-amino-4-(2---pyridyl)-thiazole derivatives as antimycobacterial agents. Poster presented at the Gordon Research Conference on Tuberculosis Drug Development, Lucca (Barga), Italy, 22-26 July 2013
Soares De Melo C, Feng T, Gessner R, Boshoff H, Moosa A, Naran K, Warner DF, Street L, Chibale K. Hit-to-lead progression of anti-tuberculosis leads. Poster presented at the Gordon Research Conference on Tuberculosis Drug Development, Lucca (Barga), Italy, 22-26 July 2013
Hammond-Aryee K. Toxoplasama gondii seroprevalence studies in Africa. Poster presented at the 12th International Conference on Toxoplasmosis. St Cathrine's College, Oxford, UK. 22-27 June 2013
Hammond-Aryee K. Toxoplasama gondii seroprevalence studies in Africa. Poster presented at the EMBO

Aids related Mycoses conference 2013. University of Cape Town, Cape Town, South Africa. 03-05 July 2013
Klopper M. Deciphering the evolution of totally drug-resistant tuberculosis - a catalogue of genome variation at single-base pair resolution. Poster presented at the Keystone Symposia. Tuberculosis: Understanding the Enemy. Whistler Conference Centre, Whistler, Canada. 13-18 March 2013
Dippenaar A, Warren RM, Gey van Pittius NC, van Helden PD, McNerney R, Clark T, Abdallah AM, Pain A Deciphering the evolutionary history of the Mycobacterium tuberculosis Latin American Mediterranean (LAM) genotype. Poster presented at the 34th European Society of Mycobacteriology Annual Congress. Hotel Demidoff, Florence, Italy. 30 June - 03 July 2013
Sao Emani, Williams MJ, Wiid IJF, Baker B. Ergothioneine is secreted by mycobacteria. Poster presented at the 57th FHSM Annual Academic Day. Stellenbosch University, Tygerberg Campus, Cape Town, South Africa. 14-15 August 2013
Gallant JL, Viljoen AJ, Tshoko S, van Helden PD, Wiid IJF. Purification and characterisation of the aspartate aminotransferases from the mycobacteria. Poster presented at the 57th FHSM Annual Academic Day. Stellenbosch University, Tygerberg Campus, Cape Town, South Africa. 14-15 August 2013
Chegou NN, Walzl G, Loxton A, Ronacher-Mansvelt K, Malherbe S, Smith B. Utility of M.tuberculosis specific host cytokine signatures in whole blood culture supernatants for the diagnosis of TB disease. Poster presented at the Biomarkers for Tuberculosis, New Questions, New Tools and FDA Workshop on Immune Correlates of Protection against Tuberculosis Vaccines. Westfields Marriott, Chantilly, Virginia, USA. 08-11 September 2013
Chegou NN, Walzl G, Loxton A, Ronacher-Mansvelt K, Smith B. Beyond the IFN-gamma horizon: Biomarkers for immunodiagnosis of infection with M. Tuberculosis. Poster presented at the Biomarkers for Tuberculosis: New Questions, New Tools and FDA Workshop on Immune Correlates of Protection against Tuberculosis Vaccines. Westfields Marriott, Chantilly, Virginia, USA. 08-11 September 2013
Newton-Foot M, Warren RM, van Helden PD, Gey van Pittius NC. The evolution of the mycobacterial Type VII ESX secretion system. Poster presented at the 57th FHSM Annual Academic Day. Stellenbosch University, Cape Town, South Africa. 14-15 August 2014
Steyn N, Newton-Foot M, Warren R, van Helden PD, Gey van Pittius NC. Investigating the localisation of the ESX-3 secretion system in Mycobacterium smegmatis. Poster presented at the Keystone Symposium: Tuberculosis Understanding the enemy. Whistler Conference Centre, Vancouver, Canada. 13-18 March 2013
Whitfield M, Streicher E, York T, Mardarowicz I, Scott L, Stevens W, Van Helden PD, Van Rie A, Warren RM. Association between Genotypic and Phenotypic Pyrazinamide Resistance in Rifampicin Resistant Mycobacterium tuberculosis Isolates. Poster presented at the 57th Annual Academic Day. Stellenbosch University, Tygerberg, South Africa. 14-15 August 2013
Klopper M, Hill-Cawthorne G, Abdallah AM, Rangkuti F, Hayes C, McNerney R, Clarke T, Dheda K, Trollip A, van Helden PD, Victor TC, Warren RM, Pain A. Deciphering the evolution of totally drug-resistant TB. Poster presented at the Keystone symposia: Tuberculosis: Understanding the enemy (x8). Whistler Conference Centre, Vancouver, Canada. 13-18 March 2013
Chegou NN, Ronacher-Mansvelt K, Loxton A, Walzl G. Utility of host markers detected in Quantiferon supernatants for the diagnosis of tuberculosis in children in a high-burden setting. Poster presented at the Keystone Symposium: Tuberculosis: Understanding the Enemy and Host Response in Tuberculosis. Whistler Conference Centre, Vancouver, Canada. 13-18 March 2013
Chegou NN, Walzl G. Utility of M.tuberculosis specific host cytokine signatures in whole blood culture supernatants for the diagnosis of TB disease. Poster presented at the Biomarkers for Tuberculosis, New Questions, New Tools. Washington Dulles, Chantilly, Virginia, USA. 08-11 September 2013
Chegou NN, Walzl G. Beyond the IFN-g horizon: Biomarkers for immunodiagnosis of infection with M. tuberculosis. Poster presented at the Biomarkers for Tuberculosis, New Questions, New Tools. Washington Dulles, Chantilly, Virginia, USA. 08-11 September 2013
Loxton AG. Immunogenicity of novel DosR candidate vaccine antigens of M.tb in ARV-naive HIV+ patients with a range of CD4 counts from a high-burden country (South Africa). Poster presented at the AIDS Vaccine 2013. Barcelona, Barcelona, Spain. 07-10 October 2013
Ronacher-Mansvelt K, Kleynhans L, Ruzive S, Ehlers L, Thiart L, Walzl G. Hormones as markers of TB treatment response. Poster presented at the Keystone Meeting. Whistler Conference Centre, Vancouver, Canada. 13-18 March 2013

Honours and Awards to Staff

Prof PD van Helden was awarded the MRC lifetime Achievement award (Silver Medal) in 2013
MRC Flagship funding was awarded to Prof PD van Helden for the project entitled, "*Improving TB diagnosis and treatment through basic, applied and health systems research"*
Prof RM Warren and Prof G Walzl were awarded the vice rectors award for outstanding publication numbers.
Bavesh Kana was promoted to the academic rank of Reader in August 2013.
Bavesh Kana and Bhavna Gordhan were honored for their research achievements and leveraging significant research funding at the 2013 Annual Faculty of Health Sciences Research Awards.
Bavesh Kana and collaborator from the NHLS (Lesley Scott, Wendy Stevens and Brad Cunningham) were awarded the NHLS innovation award from the NHLS for the GeneXpert program.
Valerie Mizrahi was awarded the 2013 Christophe Mérieux Prize from the Fondation Christophe et Rodolphe Mérieux and the Institut de France. This prize recognizes contributions to infectious disease research in the developing world. In this case, the award was given in recognition of contributions to *M. tuberculosis* research; to developing the field of TB research in South Africa; and to the training of students in this field.
Valerie Mizrahi received a Helmholtz International Fellow Award from the Helmholtz Institute. This award is given as an acknowledgement of scientific achievements and recognition of personal and institutional cooperation to date and as motivation for its further development. She received the award at the Helmholtz Zentrum für Infektionsforschung (HZI) in Braunschweig, Germany, from the Scientific Director of the HZI, Prof. Dr. Dirk Heinz, during the SA MRC-HZI Symposium on Infection Research, 30-31 October 2013.
Valerie Mizrahi delivered the Keynote Lecture at the Stellenbosch University Faculty of Health Sciences Annual Academic Day in August and the Keynote Lecture at the University of Cape Town Research Function in September
Digby Warner was awarded the UCT College of Fellows Young Researcher Award for 2013. The award is granted annually to young academics at UCT to support their demonstrated ability of making a significant contribution to their field, and is intended for research purposes. He received his award at the annual Fellows' dinner held on 13 November 2013.

Progress of CBTBR Trainees (2005-2013)

Title	Surname, Initial	Training/Degree	Yr completed	Current position
Dr	Abrahams, GL	Postdoctoral	2010	Research Officer at UCT node in 2011. Seconded for 3 years to Dr. Clifton Barry's lab at the NIAID
Ms	Ansarie, M	Hons	2012	Unknown
Ms	Arries	Hons	2013	Remained in CBTBR for a MSc degree
Ms	Axcell, A	MSc	2012	Working at the NHLS
Dr	Babb, C	PhD	2007	Took up a Scientist post with Wits/NHLS
Dr	Bapela, BN	Postdoctoral	2007	Took up a permanent position at the MRC
Ms	Barichievy, S	MSc	2005	Sydney Brenner postdoctoral fellow in the lab of Dr. Musa Mhlanga at the CSIR
Mr	Barnard	PhD	2013	Took up a Management post with TASK
Mr	Barnard, M	MSc	2005	Unemployed
Dr	Baumann R	Postdoctoral	2006	Returned to Germany, to private company
Ms	Berrington	Hons	2013	Remained in CBTBR for a MSc degree
Ms	Bester, M	MSc	2009	Remained in CBTBR for a PhD degree
Mr	Beukes	MSc	2013	Remained in CBTBR for a PhD degree
Dr	Bezuidenhout, J	PhD	2005	Employed as F/T pathologist at Tygerberg Hospital
Dr	Bintou, AA	PhD	2011	Took up a postdoctoral position with Prof. Bishai, John Hopkins University, USA
Dr	Black, JF	Postdoctoral	2010	Took up a position with Livelihoods Foundation

Ms	Black, P	MSc	2012	Remained in CBTBR for a PhD degree
Ms	Botha, J	MSc	2007	Studying pharmacy at UWC
Ms	Botha, MM	PhD	2012	Took up a permanent position at ICON
Ms	Brackin, R	MSc	2005	Compelting PhD degree at the CSIR
Dr	Brown, N	Postdoctoral	2007	Moved to UK
Ms	Bruiners, N	PhD	2012	Took up a Postdoctoral position in the USA
Ms	Carinus, H	Hons	2005	Moved to Dubai
Dr	Chegou, N	PhD	2009	Remained in CBTBR as postdoctoral fellow
Dr	Chihota, V	PhD	2011	Deputy Director Research, Aurum Institute
Ms	Coetze, L	Hons	2012	Unknown
Dr	Conradie E	Postdoctoral	2006	Full-time mother
Ms	de Vos	PhD	2013	Remained in CBTBR as postdoctoral fellow
Dr	de Wit, E	PhD	2009	Homemaker
Dr	Djoba, J	PhD	2008	Took up a postdoctoral position in France
Ms	Du Plessis, N	PhD	2012	Remained in CBTBR as postdoctoral fellow
Mr	Du Plessis, WJ	Hons	2012	Remained in CBTBR for a MSc degree
Ms	Du Toit, I	Hons	2006	Planning to do forensics through UNISA
Mr	Dudhia, ZE	Hons	2009	Took a MSc studentship at the MRC
Ms	Ehlers, L	Hons	2010	Remained in CBTBR for a MSc degree
Dr	Esterhuyse, M	Postdoctoral	2010	Took up a post in Prof Kaufmann's lab (Germany)
Ms	Falmer, A	MSc	2008	Moved to HIV NGO in Paarl
Dr	Fenhalls, G	Postdoctoral	2005	Now working in husband's company
Ms	Fortuin	PhD	2013	Remained in CBTBR as postdoctoral fellow
Mr	Gallant	Hons	2013	Remained in CBTBR for a MSc degree
Mr	Goosen, WJ	Hons	2012	Remained in CBTBR for a MSc degree
Ms.	Goosens, V	MSc	2005	Completed PhD degree in The Netherlands
Ms	Grobbelaar, M	MSc	2012	Remained in CBTBR for a PhD degree
Dr	Hanekom, M	PhD	2009	Remained in Lecturer's post
Dr	Harper, CJ	Post Doc	2012	Housewife
Ms	Hassim	MSc	2013	Unknown
Dr	Hayward, D	Postdoctoral	2010	Took up a permanent position at Triclinium
Ms	Heysen, T	Hons	2009	Unknown
Ms	Hoek, K	PhD	2010	Took up a permanent position at the NHLS
Mr	Jennings, G	Hons	2005	Moved to the USA for postgraduate study
Dr	Johnson, R	Postdoctoral	2009	Took up a permanent position at the MRC
Ms	Kleynhans, L	PhD	2012	Remained in CBTBR as postdoctoral fellow
Ms	Koch, A	MSc	2011	Remained in CBTBR for a PhD degree
Ms	Kruger, C	PhD	2009	Took up PhD at Water Health Research Unit, JHB
Mr	Laisse, CJM	MSc	2010	Returned to UEM in Mozambique
Mr	Lambrecht, D	Hons	2005	Left CBTBR to do MSc in Chemistry at SU
Mr	Limberis	Hons	2013	Unknown
Dr	Loebenberg, L	Post Doc	2012	Took up a permanent position at Afriplex
Dr	Louw, GE	Post Doc	2012	Took up a Postdoc position at NIAID
Dr	Loxton, A	PhD	2009	Remained in CBTBR as a postdoctoral fellow
Mr	Lucas, L	MSc	2012	Remained in CBTBR for a PhD degree
Mr	Lunn	Hons	2013	Took up MSc position at UCT
Dr	Machowksi, E	Postdoctoral	2006	P/T Senior Scientist in CBTBR
Ms	Magan, N	Hons	2009	Unknown
Dr	Magwira, C	Postdoctoral	2010	Postdoctoral fellowship in the RMPRU, Wits/NICD
Mr.	Mahasha, P	MSc	2007	Moved to Univ. of Pretoria, for family reasons
Mr	Mameja	Hons	2013	Unknown
Ms	Mapela, L	MSc	2012	Unknown
Ms	Martin	Hons	2013	Remained in CBTBR for MSc degre
Dr	Matsoso, LG	PhD	2007	Took a position in a TB-focused NGO in Johannesburg
Mr	Mazorodze, JH	MSc	2010	Took up a PhD in Bill Jacobs's lab in USA
Mr	Mbouna	Hons	2013	Unknown
Dr	McEvoy, CRE	Postdoctoral	2010	Returned to Australia in March 2010
Ms	Mlamla, Z	MSc	2011	Remained in CBTBR for a PhD degree
Dr	Moller, M	PhD	2007	Remained in CBTBR as a postdoctoral fellow
Ms	Moolla	MSc	2013	Unknown

Ms	Moosa, A	PhD	2012	Remained in CBTBR as postdoctoral fellow
Dr	Mowa, B	PhD	2009	Appointed as Lecturer at Wits after completing postdoc
Ms	Mpande	Hons	2013	Took up a MSc position in SATVI (UCT)
Mr	Mufamadi, S	Internship	2005	Completed MSc at Wits
Ms	Muller, L	Researcher	2006	Full-time mother
Ms	Myburgh, R	Hons	2006	Left the CBTBR to start her family
Ms	Naran, K	MSc	2010	Remained in the CBTBR for a PhD degree
Ms	Narrandes	MSc	2013	Remained in CBTBR for a PhD degree
Ms	Ndabambi, S	MSc	2009	Unknown
Mr	Ndong, PE	Hons	2010	Remained in CBTBR for a MSc degree
Dr	Ndwandwe	PhD	2013	Took up senior scientist post at HPRU (MRC, Durban)
Dr	Nel, HJ	PhD	2007	Took a postdoctoral at Trinity College Dublin, Ireland
Dr	Nene, N	PhD	2009	Took up a Postdoctoral at LifeLab in Durban
Ms	Newton-Foot	PhD	2013	Remained in CBTBR as postdoctoral fellow
Ms	Ngombane, NC	MSc	2011	Returned to MRC
M	Ngwane, AH	PhD	2012	Remained in CBTBR as postdoctoral fellow
Ms	Ntsapi, MC	Hons	2012	Remained in CBTBR for a MSc degree
Dr	Parsons, S	PhD	2009	Remained in CBTBR as postdoctoral fellow
Ms	Phalane, KG	Hons	2010	Remained in CBTBR for a MSc degree
Ms	Podgorski	Hons	2013	Unknown
Dr	Ramburan, A	PhD	2009	Took up a permanent position at NHLS, Durban
Mr	Reiche	Hons	2013	Remained in CBTBR for MSc degree
Ms	Richardson, M	PhD	2006	Deceased
Dr	Roberts, T	PhD	2008	Took up a permanent position at CPGR, UCT
Ms	Ruzive, S	Hons	2012	Remained in CBTBR for a MSc degree
Ms	Sao Emani, C	Hons	2010	Remained in CBTBR for a PhD degree
Dr	Savvi, S	PhD	2009	Completing second postdoc at UCT
Ms	Seepe, P	MSc	2011	Remained in CBTBR for a PhD degree
Mr	Senzani	MSc	2013	Remained in CBTBR for a PhD degree
Ms	Serepa	Hons	2013	Unknown
Dr	Sholto-Douglas-Vernon, C	PhD	2005	Employed at St. George's Hospital, London
Mr	Siame, KK	Hons	2010	Remained in CBTBR for a MSc degree
Ms	Steyn, NL	MSc	2012	Remained in CBTBR for a PhD degree
Ms	Strauss, O	MSc	2009	Moved to Kayaletsha HIV clinic in Cape Town
Dr	Streicher, EM	PhD	2007	Remained in CBTBR as postdoctoral fellow
Mr	Theys	Hons	2013	Remained in CBTBR for a MSc degree
Ms	Thiart, L	Hons	2010	Remained in CBTBR for a MSc degree
Ms	Tshoko, S	Hons	2012	Remained in CBTBR for a MSc degree
Ms	Uren	Hons	2013	Remained in CBTBR for a MSc degree
M	Van der Merwe,R	PhD	2012	Remained in CBTBR as postdoctoral fellow
Dr	Van der Spuy, G	PhD	2009	Remained in CBTBR in MRC Post
Dr.	Veenstra, H	PhD	2007	Housewife
Mr	Viljoen	PhD	2013	Took up a postdoctoral Position in France
Ms	Visser, H	Hons	2012	Remained in CBTBR for a MSc degree
Ms	Wagman, CK	MSc	2012	Remained in CBTBR for a PhD degree
Dr.	Warner, DF	Postdoctoral	2007	Moved from NHLS to UCT as CBTBR Team Member
M	Werely, CJ	PhD	2012	Staff, PAWC (SU)
Ms	Willemse, G-L	Hons	2013	Unknown
Ms	Willemse, D	MSc	2013	Remained in CBTBR for a PhD degree
Dr	Williams, M	Postdoctoral	2009	Contract Senior Scientist, UCT/SU nodes, 2010-2012; then SU node, 2013-
Dr	Wright, CA	PhD	2009	Remained in University Post
Mr	Zvinairo, TK	Hons	2012	Remained in CBTBR for a MSc degree

FINANCES

The income statement, balance sheet and cash flow statement for period 1 Jan 2013 to 31 Dec 2013 are currently under review by the external auditors and will be forwarded to the Board as soon as they become available.