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CO-OP OBJECTIVES

To explore career opportunities in biochemistry, immunology, and microbiology. My long- term goal is to become a senior researcher in the health or agricultural sciences.

EDUCATION

YEAR	INSTITUTION	MAJOR
2015-2018	University of Pretoria	PhD Biotechnology
2012-2014	University of Pretoria	MSc Biotechnology
2011	University of Pretoria	BSc (hons) Biochemistry
2008-2010	University of the Witwatersrand	BSc (undergrad) Biochemistry/Physiology

RESEARCH EXPERIENCE

CSIR, Materials Science and Manufacturing, Polymers and Composites; University of Pretoria, Department of Biochemistry
January 2015-July 2018
Doctoral Research title: **Novel recombinant anti-mycolic acid immunoglobulin tools for improved understanding and management of Tuberculosis**
In this study molecular techniques were used to develop a set of recombinant antibodies specific to mycolic acids – the major lipid cell wall component of the mycobacterial tuberculosis pathogen. In tuberculosis patients, antibody immune activity to mycolic acids is always accompanied by cross-reactivity to cholesterol. The recombinant monoclonal antibodies were used to characterise the cholesteroid nature of mycolic acids, thereby creating a better understanding of how mycolic acid antigens and the monoclonal antibodies designed may be applied in the development of a quick, affordable, and accurate tuberculosis screening test. Such a device is anticipated to enable regular monitoring of people at risk of infection and may also be used to determine how tuberculosis patients respond to their therapies. This research was presented at an international conference and published in an internationally accredited journal.

University of Pretoria, Department of Biochemistry
January 2012-June 2014
Master Research title: **Chemically synthetic mycolic acids as vaccine adjuvants**
This project set about to determine if one or more synthetic MA may be a beneficial compound as a vaccine adjuvant. Twenty male calves of ages five to six months were intradermally injected with an anti-TB antigen (Ag85A) in combination with different synthetic MA adjuvants, while MF59 served as positive, and phosphate buffered saline

(PBS) as negative adjuvant controls. None of the animals revealed severe inflammatory reactions at the site of injection. Blood samples collected for the isolation of peripheral blood mononuclear cells (PBMCs) and sera were used to perform T-cell proliferation assays and enzyme-linked immunosorbent assays (ELISAs), respectively. It was concluded from the T-cell proliferation assays that the concentration of Ag85A used in the synthetic MA mix adjuvant may have been too low to elicit a cellular immune response resulting in the absence of proliferating cells stimulated with Ag85A. In the case of the synthetic MAs no antibody responses were found, putatively as a result of the harsh methods required to prepare the vaccine solution at the desired concentration and volume for injection. Although all adjuvant formulations used in this study proved to be safe, the ELISA assessment revealed the impact that timing of vaccinations may have on the humoral response. This research contributes to understanding on how new adjuvant compounds can be tested for safety and efficiency in inducing the desired protective cellular and humoral immune responses in vaccine formulations.

University of Pretoria, Department of Biochemistry
January - December 2011
Honours Research title: **Immuno-affinity depletion of anti-cholesterol antibodies from TB patient and control sera to improve TB diagnosis with a lateral flow immunotest.**
A major problem in TB control is diagnosis, especially in countries like South Africa where HIV co-infection lowers the sensitivity and specificity of diagnostics, most of which rely on sputum samples. The current gold standard of TB diagnosis is mycobacterial culture, which may take several weeks to come to a conclusive decision. This may be fatal for HIV-TB co-infected patients, due to the antagonistic immune defences of the body against these diseases. Serological diagnostics, using a variety of antigens from *Mycobacterium tuberculosis* (*M. tb*), have been found to be unsuccessful in especially Third World countries, due to complications of poor living conditions, malnutrition, and vulnerability to a variety of other tropical infectious diseases including mycobacterial infection such as *M. avium*, which is not normally pathogenic to humans. We have previously published proof of principle that antibodies against cell wall mycolic acids (MA) from *M. tb* may be reliable biomarkers of active TB, even in HIV-TB co-infected patients. However, the universally present anti-cholesterol antibodies were shown to cross-react with MA, leading to false positive diagnosis in standard immunoassays. Aim: To determine if prior depletion of anti-cholesterol antibodies from human serum samples will improve the detection of anti-MA antibodies for TB diagnosis. Methods and Results: Immuno-precipitating cholesterol coated particles were mixed with human TB and control serum samples prior to testing the supernatants with Enzyme Linked Immuno-sorbent Assay (ELISA) against MA antigen. It was found that cholesterol coated particles had no effect on detection of either the anti-cholesterol or anti-mycolic acid antibodies but improved our understanding of why the so-called MARTI-biosensor method of real-time anti-MA antibody detection by competitive binding gives a more accurate outcome.

SPECIAL SKILLS AND LABORATORY TECHNIQUES

- Microbiology skills: aseptic and sterile techniques, optical microscopy, bacterial staining, plating methods (streak, spread), use of biological safety cabinets, media, and buffer preparation,
- Biochemistry and Cell & Molecular Biology skills: DNA extraction, plasmid DNA preparation, restriction enzyme digests, PCR, agarose gel electrophoresis, SDS-PAGE,

cloning, protein purification, protein concentration determination, ELISA, mammalian cell culture, preparation of cells for cryopreservation, use of haemocytometer.

- Experience in *Mycobacterium Tuberculosis* infection studies *in vitro* and *in vivo* in BSL 3 facilities, including culturing, animal handling, postmortem analysis.
- Chemistry skills: solution preparation, titrations, compound extractions and purification, separations, simple distillation, thin- layer chromatography, nanoparticle formulations
- Spectroscopy skills: UV, visible, flow cytometry
- Computer skills: programming (extensive use of Word, Excel, Access, and PowerPoint), typing (50 words/minute), PubMed.
- Certifications: BSL-3 accreditation, valid class B Driver's License

GENERAL WORK EXPERIENCE

Wits Health Consortium, Centre for Vaccines and Immunology, NICD
October 2019 – present
Research and Development Scientist. Joint staff position as Lecturer in Chemical Pathology, University of Witwatersrand. Research focus is on investigating assays that can detect novel biomarkers for Tuberculosis disease. Tasks include conducting lab assays, training and supervising medical scientist interns and post graduate students, writing of publications and grant applications, management of project funds, as well as laboratory maintenance. Concurrently completing second year of medical scientist internship, with focus in Immunology.

Kansas University, Department of Pharmaceutical chemistry
September 2018 - August 2019
Post-doctoral scholar. Research focus was on the discovery of unique paired heavy and light antibody chains (VH: VL) from patients who exhibit broadly neutralizing antibodies. Tasks include primer design and testing, B-cell isolation and culture, mRNA capture from single cells, amplification of VH: VL libraries with PCR, preparation of VH: VL libraries for next generation sequencing as well as laboratory maintenance. Research projects conducted independently as well as in a team.

CSIR, Materials Science and Manufacturing, Polymers and Composites
October 2014 – July 2018
PhD fellow. Main research focus was on antibody engineering – developing immunoglobulin tools specific to mycolic acids. Assisted in ongoing projects within the group including H37Rv culture maintenance for mycolic acid isolation, investigations into lateral flow assays, formulations for nanoparticle production, TB drug encapsulation, animal studies, as well as training of students and staff within group.
Gained proficiency in working independently and scheduling multiple tasks and working as a co- operative team member.

PUBLICATIONS AND PRESENTATIONS

Ranchod, H., Hong, H., Martinson, N., and Suchard, M. Exploring novel assay formats for

Indoleamine 2,3-dioxygenase as a TB biomarker. Poster presentation at Keystone eSymposium: Tuberculosis – Science Aimed at Ending the Epidemic. Virtual conference, December 2020

Ranchod, H., Howell, K.A., Li, Y., López Acevedo, S.N., Fahad, A.S., et al. Peripheral antigen experienced B cell repertoire sequencing for improved immune monitoring of antibody responses in Rhesus Macaques. Poster presentation at Keystone Symposium: Molecular Approaches to Vaccines and Immune Monitoring. Keystone, Colorado, February 2019

Ranchod, H., Ndlandla, F., Lemmer, Y., Beukes, M. Niebuhr, J., et al. 2018. The antigenicity and cholesteroid nature of mycolic acids determined by recombinant chicken antibodies. PLoS ONE 13: e0200298

Ranchod, H., Ndlandla, F., Lemmer, Y., Beukes, M., Niebuhr, J., et al. 2018. Bivalent recombinant chicken antibody tools for probing the antigenic and cholesteroid nature of mycolic acids from Mycobacterium tuberculosis. Poster presentation at Gordon Research Conference and Seminar: Antibody Biology and Engineering. Lucca (Barga), Italy, March 2018

Ejoh, V. and Ranchod, H. 2012. Towards understanding the specificity of biomarker antimycolic acid antibodies in active tuberculosis. Research presented at the 3rd. SA TB Conference. Durban, RSA, June 2012.

GRANTS

NRF Thuthuka funding, 2016-2018

AWARDS AND SCHOLARSHIPS

Nature Travel Award, 2018
NRF PDP scholarship, 2015-2017
Postgraduate bursary, University of Pretoria, 2015-2018
NRF Masters Innovation bursary, 2012–2013
Postgraduate bursary, University of Pretoria, 2012-2014
Academic award, University of the Witwatersrand, 2008

TEACHING EXPERIENCE

Teaching Assistant, 2012
Assisted in tutorial first year course “MLB111”. Tutored first year students; graded all written work and determined final grades.

Immunology Lecturer, current
Involved in lecturing basic Immunology courses to Molecular Medicine Honours students and Vaccinology Masters students.

REFERENCES

Available on request