

# University of Missouri South African Education Program report

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Dear UMSAEP committee

First and foremost, I would like to express my sincere gratitude to the University of Missouri South African Education Program (UMSAEP) and the University of the Western Cape for funding my research visit to University of Missouri, Columbia. The application was approved in 2015 for a 3 month research visit scheduled for October to December 2015. However, the visit was postponed and I only arrived in Missouri on 29 February 2016.

I left Cape Town (South Africa) on the 28<sup>th</sup> of February 2016 and 24 hours later I arrived at the University Avenue Bed and Breakfast in Missouri (United States of America) where I stayed for most of my visit. My first contact person from MU was Miss Kristina Conrad (Grant and Contracts Administrator) who helped me to open a bank account and gave me an orientation of MU and introduced me to Mrs Stephanie Harrison (Senior Business Support Specialist) who assisted with my registration into the MU system and helped me to acquire access cards to the labs and the office. Upon my arrival in the Institute of Green Nanotechnology and Cancer Nanotechnology Platform (Department of Radiology, MU), I was welcomed and introduced to the group members and the lab by Mrs Kavita Katti. Prof Kattesh Katti was out of the country at the time and scheduled to be back on the 12<sup>th</sup> of March. Dr Menka Khoobchandani facilitated with the recommended trainings (Environmental Health and Safety training) while I acclimatized myself to the new environment and lab regulations. This report summarises the research done and experiences during the three months of my research visit.

**Project title:** *In vivo* evaluation of the target specific delivery of peptide functionalized gold nanoparticles

### **Objectives of the research visit**

The main objective for this research visit was to strengthen the collaborative research between DST/Mintek Nanotechnology Innovation Centre (NIC) (Department of Biotechnology, UWC) and Institute of Green Nanotechnology and Cancer Nanotechnology Platform (Department of Radiology, MU). Collaborative between the two units already established between Prof Kattesh Katti and Prof Mervin Meyer. Prof Kattesh Katti has already visited UWC and our lab on several occasions and this was the first visit from our lab. The research visit introduced me to Prof Katti's lab and the wonderful nanotechnology-based research that he and his amazing team are currently working on. The visit was also aimed at investigating the targeted delivery of peptide functionalized gold nanoparticles (AuNPs) (which was generated in our lab) to prostate tumor sites in a mice model of prostate cancer developed by Prof Katti and colleagues. The proposed research was an extension of my PhD research project, which was limited to *in vitro* studies, since we had a problem with our animal facility and urgently required to test efficiency of the targeted AuNPs *in vivo*. The visit offered an opportunity to access Prof Katti's expertise in animal studies. Their lab already has an established animal model for prostate cancer published in reputable journals.

Therefore, this visit was a great opportunity for me to learn how radiolabelled AuNPs are synthesized, characterized, and how to develop a prostate cancer mice model. It was a completely new and exciting venture for me that will be transferred to my fellow colleagues in the NIC group.

As exciting as it was, it wasn't without challenges. As a new comer, whether you are experienced or not, MU requires all biomedical researchers to undergo and finish online and hands-on (lab and chemical safety and animal care and handling) trainings before commencing any laboratory work. Note to future visitors in the MU medical research labs: the dates for the hands-on training are fixed, therefore researchers need to inquire about it and arrange their trips in such a way that it falls within the dates of training. My first training took place 24 days after I arrived, it was quite frustrating for a researcher who was already set on starting to work the first day I arrived. After this, I could now work in the general lab but not in the tissue culture lab since I had to wait 2 weeks to do "Introduction to biosafety" training. The trainings I undertook are listed below.

**Online training:** a) Bloodborne pathogen online training 15/03/2016  
b) Chemical management online training 17/03/2016  
c) Basic Training for Animal Care and Use at MU  
d) Enrolment in the Occupational Health and Safety Program

**Hands-on training:** e) Introduction to lab safety - 23/03/2016  
f) Introduction to biosafety - 06/04/2016  
g) ACQA/OAR Rodent Handling Workshops -18/05/ 2016

At this stage, I had received all the necessary training required to carry out the objectives of the research visit. We managed to synthesize and characterize the targeted nanoparticles and test their effect and specificity on human prostate (PC-3) and pancreatic (Panc-1) cell lines cancer cell lines with exciting outcomes. These outcomes were further to be investigated in mouse models of prostate cancer to validate the targeted delivery of the nanoparticles *in vivo*. Unfortunately by the end of the training I was left with few days at MU and it wasn't enough to finish the animal work. Moreover, to carry out the proposed animal studies we were required to have animal ethics approval, the application process took longer than expected. So next time we'll consider getting ethics clearance before travelling to MU.

Despite the highlighted challenges, we managed to turn everything to our advantage and I had the time of my life! We decided to work on a new green nanotechnology project, the project was exciting for me since I had no experience in this kind of work. I was trained on green synthesis of metallic nanoparticles, in partnership with a brilliant PhD student Mr Velaphi Thipe (a fellow South African) in the Institute of Green Nanotechnology and Cancer Nanotechnology Platform. We used various berries to synthesize metallic nanoparticles, characterize their physico-chemical properties and test their effects on PC-3 and Panc-1 cell lines. In the process, I managed to investigate the specificity and *in vitro* effects using the

targeted-AuNPs on PC-3 and Panc-1 cells. Although we couldn't do the *in vivo* studies at the time, we plan to continue with this project with the help of Prof Katti's team and we hope the outcomes of this study will be published. Dr Menka Khoobchandani, Miss Kavitta Katti and Miss Kiandokht Panjtan-Amiri were very kind to teach me about AuNP trafficking mechanisms using dark field and transmission electron microscopy, and the use of co-culture assays to determine anti-angiogenic effects of the AuNPs on cancer cells. These assays are instrumental and crucial for nanotoxicology assessment, skills that will come in handy to my lab mates. I also had an opportunity to lecture in an international University, courtesy of Prof Katti who gave me one of his lectures. This gave me an opportunity to give a lecture to his undergraduate class about application of nanotechnology in medicine and introduce them to the research interests in the NIC group. He also allowed me to participate in undergraduate practical demonstration that took place weekly for a month. The practicals were focused on green synthesis of various metallic nanoparticles, which was a steep learning curve for me. I had a chance to visit various labs within the Department of Radiology that are collaborating with Prof Katti on nanotechnology research. I was also fortunate to attend seminars outside the scope of the proposed objectives, the Life Sciences Week 2016 that took place from 18-23/04/2016 and learn about the interesting research that MU is currently working on. I was lucky to attend three of the regular postdoctoral Career Development workshops as well. There was never a dull moment in MU with lots of exciting events taking place every week: entertainment, sports, career guidance and development.

My weekends were filled with exciting adventures thanks to all the excursions planned by Miss Kiandokht Panjtan-Amiri. I got to attend dinner parties arranged by Prof Katti and his colleagues to introduce me to different cultures that exist in Columbia (US).

### **Impact of the research visit**

The visit has been an eye opener to a lot of exciting nanotechnology-based research opportunities lying ahead of us, independently and in collaboration with the Institute of Green Nanotechnology and Cancer Nanotechnology Platform team. Possible opportunities for future endeavours between the two groups have been identified, that will be carried out at UWC and the other part in MU. The research visit was very productive and I plan to build on the research started at MU here at home and passing on the acquired skills to my colleagues, the most valuable being the use of green nanotechnology to synthesize metallic nanoparticles and identifying nanoparticles cellular trafficking mechanisms. The visit has generated an interest for using green nanotechnology to synthesize metallic nanoparticles and test their potential medicinal properties in both cells and animal models of various diseases (e.g cancer, obesity). We have a variety of medicinal plants in RSA with known biomedical effects and I am currently using some of these plants to train several group members in aspects of green nanotechnology. The data generated thereafter can be published in reputable nanomaterials journals. There is obviously going to be a follow-up visit, preferably by me but I believe this kind of exposure need to be passed on to other members as well.

During my visit I had an opportunity to meet one of Prof Katti's contacts and one of the leading scientists in the field of bionanotechnology in Brazil, Dr Ademar Lugau (Instituto Pesquisas Enegeticas e Nucleares). Interestingly his research group focuses on obesity, atherosclerosis, biomarker discovery and targeted nanomedicine; and this might lead to a possible future collaboration with his group. Yes, I have been very fortunate to receive the funding and I'll always value the time I spent in Columbia. I believe the training I received, the contacts that I made and the collaboration between the two groups, will continue to flourish for benefit of NIC and fellow UWC Biomedical researchers for years to come. The acquired skills are useful and necessary for on-going research projects within the DST/Mintek NIC and other postgraduate students at UWC working in similar research field. Together with Dr Jyoti Sharma, Dr Mustafa Drah (Postdocs) and Mr Abdulrahman Elbagory (PhD student); we are currently using some of SA plants to synthesize metallic nanoparticles and screen their biological effect in cell culture. We anticipate that at least one publication and one conference presentation will emanate from the research done in MU and the work we are currently busy with at UWC.

If the same opportunity to participate in this exchange program ever cross my path again, I would gladly grasp it without thinking twice. I wish beyond my wildest dreams that this exchange programs can be extended to ALL post graduates students (both from UWC and MU) as it is very insightful and serve as a platform to engage with international scientists and can help stimulate their intellect. I also urge our PIs to make fellow postgraduate students aware of such existing opportunities and take advantage of them. The experiences they bring are out of this world and can afford young minds and upcoming scientists to learn more about the wonderful world we live in. Words fail me to explain the exhilarating experience I had in Missouri in the lab and outside. Like they say: seeing is believing! I dare all my fellow UWC scientists to go out there and see for themselves. We all have our ideas of the US but being there personally, breathing American oxygen made me realize that we have what we need within ourselves to succeed, no matter the geographical location!

May UMSAEP grow and continue to broaden our research horizon, long live UMSAEP!

### **Acknowledgements**

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Special Projects in the Office of the Vice Chancellor, UWC) for his continued support for postgrad research. Miss Kristina Conrad and Mrs Stephanie Harrison (Department of Radiology, MU) I appreciate all your help and making me feel welcome. Brian and Kathy Slind (my hosts at the B&B), thank you very much for welcoming me into your home and allowing me to use your kitchen and utensils for dinner and supper.

My sincere appreciation to Prof Mervin Meyer for initiating this interaction and for all the unwavering support not only on the research visit but throughout the time I've spent under your supervision. We might not say it very often, this I speak for all the students in your lab when I say: you are a blessing to us and we are truly honored to be under your supervision. We are eternally grateful for having you as our mentor and building us into better scientists that we are today. We'll carry your name out there with pride. Stay blessed! I'll like to express my gratitude to Prof Kattesh Katti, Mrs Kavita Katti and his family (post graduate students) for all the interesting activities and kind hospitality you've shown to me and importantly for hosting me. I'm looking forward to lots of upcoming adventures! Dr Menka Khoobchandani, Miss Kiandokht Panjtan-Amiri and Mr Velaphi Thipe, thank you for your friendship, the interesting excursions and leisure activities you always had planned especially for me on weekends and most importantly for taking your time to teach and train me. It is very much appreciated, and I'll return the favor someday soon as I expect to see you this side. I also would like to express my gratitude to the friends I met in MU outside research activities: Dr George Chingarande, Dr Naphtali Mokgalapa and Ms Nomahlubi Manakaza. I'll cherish the time I spent with you guys.

**Thank you all for the exciting and memorable experiences, we have to do it again!**

Best Regards

Nicole Sibuyi

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