

FACULTY OF NATURAL SCIENCES



Department of Biotechnology

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*The Secretary*

*University of Missouri Student and Academic Exchange Program Committee*

*International Relations Office*

*University of the Western Cape*

*Bellville*

Dear Ms Andrews

**REPORT ON THE RESEARCH VISIT OF PROF LUDIDI TO THE UNIVERSITY OF MISSOURI**

I would first like to take this opportunity to thank the University of Missouri Student and Academic Exchange Program (UMSAEP) for granting me the opportunity and funding to visit the laboratories of Prof Robert Sharp, Dr Melvin Oliver and Prof Zhanyuan Zhang at the University of Missouri (MU) in Columbia.

The visit was targeted at establishing collaborative research between the laboratories of these three researchers and my laboratory and also to provide an opportunity for me to receive training in the genetic transformation of maize and soybean (which are important crop species in both South Africa and the United States of America). I was in Columbia from 31 March 2014 to 01 June 2014.

The UMSAEP office at MU arranged logistical issues pertaining to my travel and accommodation, which was done efficiently and flawlessly. The allocated award of USD 10 0000 was used to pay for my accommodation at Extended Stay America (70 W Business Loop, Columbia), my airline ticket, car rental and part of my subsistence costs. These costs completely exhausted the award. The rest of the costs (research and training costs for transformation of soybean and maize together with the further subsistence costs during my time in MU) were covered by my grant from the National Research Foundation (NRF) of South Africa.

Prof Sharp, Dr Oliver and I had several discussions on the various aspects of the proposed collaborative research. After agreeing on the best approach to investigate the role of phytosterols (with focus on squalene, lanosterol and cycloartenol) and hydroxycinnamic acids of the phenylpropanoid pathway (with focus on caffeate and ferulate), I did experiments to determine the most suitable approach to impose the ideal level of water deficit stress that limits maize growth without causing extensive cell death. This was established from my experiments using deep Perspex tubes and is now being implemented in my laboratory at the University of the Western Cape (UWC). This interaction has resulted in the establishment of collaborative agreement between these three laboratories (Sharp, Oliver and Ludidi) on the transcriptomic, proteomic and metabolomics investigation of the role of phytosterols biosynthesis pathways and hydroxycinnamic acid biosynthesis pathways in maize water deficit stress, with a view of using the outcomes of the investigation towards enhancing maize tolerance to drought. As part of the collaboration, Prof Sharp will identify MU researchers who will visit UWC in February/March 2015 for further interaction to initiate active research collaboration between MU plant scientists and UWC, selected University of Cape Town (UCT) and selected Stellenbosch University (SU) plant scientists, with MU and UWC spearheading and leading the collaboration. This visit will certainly include Dr Oliver and Dr Priya Voothuluru (postdoctoral fellow in Prof Sharp's laboratory, who was instrumental in the discussions on the aspects of hydroxycinnamic acids in maize drought responses).

Prof Sharp also arranged for me to meet Prof William Flok (Department of Biochemistry, MU). Prof Flok was very much interested in the phytosterol component of the project and we discussed avenues of collaboration on the Southern African leguminous medicinal plant *Sutherlandia frutescens* (cancer bush/balloon pea). My discussions with Prof Flok have resulted in an initiative to formalize collaboration between his laboratory and mine on the transcriptomic, proteomic and metabolomics analysis of *Sutherlandia* that is focused on understanding how and why this plant accumulates sutherlandiosides (glycoside derivatives of the phytosterols cycloartenol/lanosterol) in quantities much larger than other plants accumulate these cycloartane glycosides. This is important because there is evidence of interference of sutherlandiosides with therapeutic drugs against tuberculosis and HIV. Another important aspect of the work on the cycloartane glycosides is that the relatively drought tolerant nature of *Sutherlandia* compared to crop legumes and we thus will investigate if the high level accumulation of cycloartane glycosides in *Sutherlandia* plays a role in conferring drought

tolerance in *Sutherlandia*, which would provide clues for improvement of drought tolerance in crop legumes such as soybean. Because of an established body of research on *Sutherlandia* in Dr Nokwanda Makunga's laboratory at Stellenbosch University (SU), Prof Folk and I decided to seek involvement of Dr Makunga in the *Sutherlandia* cycloartane glycoside project. Prof Folk will be travelling to Cape Town in the last two weeks of July and we (Prof Folk, Dr Makunga and I) will meet to discuss the way forward in implementing the research project collaboration.

I received training in the transformation of maize and soybean through UM's Plant Transformation Core Facility under the auspices of Prof Zhanyuan Zhang, who is the Director of the Core Facility. I am now competent in the technology used in Prof Zhang's laboratory for the transformation of both soybean and maize. A 'Materials Transfer Agreement' (MTA) has been signed between MU and UWC for the transfer of biological materials required for the soybean and maize transformation and experiments will be underway at UWC to perform the plant transformations in as soon as the outstanding plasmid DNA required for the transformation reaches UWC in the next few weeks. Furthermore, Prof Zhang's laboratory will be in constant communication on progress in plant transformation technologies at UWC and engage each other's laboratories in widely accessing the transformation services offered by MU and explore possible avenues for further improvement of the efficiency of the transformation and for expanding the work into transformation of other crop species of interest to UWC, such as sorghum that Prof Bongani Ndimba in my department at UWC has interest in, given that Prof Zhang's laboratory already has an established service in the transformation of sorghum.

The visit to MU has thus been highly beneficial to my research group at UWC and will continue to bring benefit to both MU and UWC.

Yours truly,



Ndomelele Ndiko Ludidi



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