Mosquito 'invisibility cloak' discovered (BBC News, September 2013)
A naturally occurring substance found in human skin could yield a viable alternative to existing mosquito repellent, scientists say. They say the chemical, 1-methylpiperazine, could help render people "invisible" to the insects by completely blocking their sense of smell… Read more

Treat the fungus among us with nontoxic medicinal compound (Science Daily, September 2013)
A Kansas State University microbiologist has found a breakthrough herbal medicine treatment for a common human fungal pathogen that lives in almost 80 percent of people. A medicinal herb called Gymnema sylvestre, used by diabetic people in developing countries to help control sugar levels, was found to be nontoxic and able to block the virulence properties of the a common human fungal pathogen called Candida albicans… Read more

Biofortified pearl millet 'can combat iron deficiency' (SciDevNet, August 2013)
Pearl millet bred with more iron through a special breeding process — called biofortification — can address the nutritional deficiencies of children and women in Africa and Asia, two trials have shown. … Read more

**RECENTLY PUBLISHED BOOK**

**Computational Chemogenomics**
To be published: November 2013

This book focuses on applications of compound library design and virtual screening to expand the bioactive chemical space, to target hopping of chemotypes to identify synergies within related drug discovery projects or to repurpose known drugs, to propose mechanism of action of compounds, or to identify off-target effects by cross-reactivity analysis. Both ligand-based and structure-based *in silico* approaches, as reviewed in this book, play important roles for all these applications. Computational chemogenomics is expected to increase the quality and productivity of drug discovery and lead to the discovery of new medicines.
New Collaboration Grant between South African and Tanzanian Research Groups

Prof. Oleg Reva (University of Pretoria) and Drs. Sylvester Lyantagaye and Donatha Tibuhwa (University of Dar es Salaam) have received an NRF-RISA funded collaboration grant with funding of R200,000 for RSA participants and USD 2200 for Tanzanian participants allocated for 2013-2015. A new PhD fellowship grant was also obtained from SABINA for 2013-2015, allowing Liberata Mwita from Tanzania to continue her work on this project at the University of Pretoria with co-supervision by Dr. Lyantagaye.

The project aims to investigate the possibility of using plant growth promoting *Bacillus* as an ecologically safe replacement for chemical pesticides to control bacterial and fungal diseases of agricultural plants. Agricultural plants in the focus of this project are the cashew tree (*Anacardium occidentale* Linn) and cassava (*Manihot esculenta*), which are the main cash crop and the leading source of income for over 280,000 households in South-Eastern Tanzania.

The promotion of plant growth and the control of plant disease are pressing needs for the 21st century, driven by a burgeoning human population and the demand for high quality food that is free from unacceptable levels of chemicals such as herbicides and pesticides. Unfortunately, this increased demand has led to agricultural practices that actually increase the disease pressure on plants. It has been estimated that approximately one third of food crops are destroyed every year, mainly due to attack by pathogenic fungi. Limitations of the current major strategies against fungal diseases, the use of chemical fungicides and the use of resistant plant cultivars, point to a need to develop new agricultural practices to address these challenges.

The use of bio-control agents is one strategy with the potential to supplement and even eventually supplant the use of synthetic chemical pesticides. Such an approach reproduces the synergistic and mutualistic interactions between plants and microbes that have evolved naturally in the environment, allowing agricultural crops to benefit. Thus inoculating crops to increase the abundance of a particular microbe, such as certain bacteria from the rhizosphere, in the vicinity of a plant can suppress fungal disease without producing lasting effects on other organisms in the ecosystem. Such use of micro-organisms to improve crop yield is long-established and has wide acceptability.

*Bacillus subtilis* and *B. amyloliquefaciens* are the best characterised and genetically most amenable Gram-positive bacterium. They are widely used in bioproducts for the pharmaceutical, biotechnology, detergents and food industries, and as plant growth-promoting biopesticides. *Bacillus* species are well-established and important colonisers of the plant rhizosphere. The selection or development of strains to enhance these applications will require a detailed understanding of the mechanisms used by this bacterium to colonise the rhizosphere and of the nature and function of gene products expressed during microbial growth *in vivo*. Genes that are essential for efficient propagation *in vivo*, and are activated in response to relevant *in vivo* signals, are most likely to contribute to *in vivo* fitness. The study of these genes is expected to lead to a better understanding of those microbial traits which are the most ecologically relevant. The complete genome sequences of 12 extremely active *Bacillus* strains are available and will be used in this study. Six of the strains have already been assembled and registered as bio-projects at NCBI and Gold-Card.

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**Project Display Name** | **GOLD ID** | **NCBI Project ID**
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*Bacillus atrophaeus* UCMB-5137 | G/21363 | 176885
*Bacillus amyloliquefaciens* UCMB-5007 | G/21364 | 176887
*Bacillus subtilis* UCMB-5014 | G/21365 | 176886
*Bacillus amyloliquefaciens* UCMB-5140 | G/21366 | 176888
*Bacillus amyloliquefaciens* plantarum At1 | G/21367 | 176703
*Bacillus amyloliquefaciens* At2 | G/21368 | 176701

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**SABINA NEWS**

**Powdery Mildew Disease of Cashew tree**

Cashew, introduced in East Africa in the 16th century by the Portuguese, is the most important Tanzanian export crop in terms of foreign exchange earnings. However, the country’s annual production has been in decline from the mid 70’s, resulting in a large loss of revenue for both growers and the government. Several factors contributed to this decline, such as Powdery Mildew Disease caused by fungus *Oidium anacardi Noack*, some unknown fungal diseases and macrofungi parasites, in association with climate change, poor supply of fungicide for the control of cashew leaf and nut blight disease, and other social and market problems.
Pelly Malebe awarded Women in Science Doctoral Fellowship

The Department of Science and Technology hosted the Women in Science Awards on the 16th of August 2013 to recognise and award excellence by women scientists and researchers. The awards were aimed at profiling women scientists and researchers as role models for younger scientists and researchers. The DST also rewarded younger women who are starting their careers as emerging researchers and scientists.

The Minister of Science and Technology, Mr Derek Hanekom presented Pelly Malebe with the Women in Science Awards Doctoral Fellowship. Candidates were judged on the quality and performance in their studies, relevance of their research, past and present achievements, and their career plans as per the application criteria given.

Pelly's work focuses on increasing the understanding of the genetic basis of drought tolerance in plants, particularly the tea plant, *Camellia sinensis*. Her research aims to identify and develop molecular markers for drought tolerance in *C. sinensis*, with the potential output of robust molecular markers that can be used in a selection process to develop drought-tolerant crop varieties. This would increase tea yields in the global tea industry and improve food and job security. Pelly has already been able to file a provisional patent based on the results of the research she conducted during her Master’s, with the final filing underway with the African Regional Intellectual Property Organization and in India, Sri Lanka, China and South Africa.

Winners were requested to participate in public awareness initiatives led by the DST. Pelly was interviewed on Power FM (98.7) on Monday 19 August. A short profile on her was also included in a Mail & Guardian newspaper article on this year's Women in Science Awards at the end of August. You can read the article here.

More information on Pelly's work will be featured in a future newsletter.

Non-toxic melanin production inhibitors from *Garcinia livingstonei* (Clusiaceae)


The stem bark of *Garcinia livingstonei* is used traditionally as a skin lightening agent. This study aimed to isolate and identify compounds responsible for the observed skin lightening activity of *Garcinia livingstonei* and to evaluate their cytotoxicity. Constituents of the stem bark and fruits of *Garcinia livingstonei* were isolated using chromatographic techniques and structures were determined using 1D and 2D NMR and MS analysis. MeWo cells were used to evaluate the cytotoxicity and impact on melanin levels of extracts and compounds isolated, *in vitro*. Twelve known compounds, morelloflavone (1), morelloflavone-7′-sulphate (2), guttiferone A (3), sargaol (4), isojacareubin (5), 6-deoxyisojacareubin (6) and in addition to the common triterpenoids, betulin, betulin aldehyde, lupeol, lupenone, euphol and stigmasterol were isolated in this investigation. Morelloflavone, morelloflavone-7′-sulphate and sargaol were found to be considerably less cytotoxic and more effective as skin lightening agents than hydroquinone. In conclusion, a range of compounds was isolated from the stem bark and fruit of *Garcinia livingstonei*. Although the bark extract contained the cytotoxic guttiferone A, it was found to be less toxic than hydroquinone, and morelloflavone, the 7′-sulphate derivative and sargaol show potential for development as depigmentation/skin lightening agents.
Analysis of protein thermostability Enhancing factors in industrially important *Thermus* bacteria species

Kumwenda B, Litthauer D, Tastan Bishop O, Reva O, *Evolutionary Bioinformatics*, 9, 327-342

Elucidation of evolutionary factors that enhance protein thermostability is a critical problem and was the focus of this work on *Thermus* species. Pairs of orthologous sequences of *T. scotoductus* SA-01 and *T. thermophilus* HB27, with the largest negative minimum folding energy (MFE) as predicted by the UNAFold algorithm, were statistically analyzed. Favorable substitutions of amino acid residues and their properties were determined. Substitutions were analyzed in modeled protein structures to determine their locations and contribution to energy differences using PyMOL and FoldX programs respectively. Dominant trends in amino acid substitutions consistent with differences in thermostability between orthologous sequences were observed. *T. thermophilus* thermophilic proteins showed an increase in non-polar, tiny, and charged amino acids. An abundance of alanine substituted by serine and threonine, as well as arginine substituted by glutamine and lysine was observed in *T. thermophilus* HB27. Structural comparison showed that stabilizing mutations occurred on surfaces and loops in protein structures.

Monoterpenep bisindole alkaloids, from the African medicinal plant *Tabernaemontana elegans*, induce apoptosis in HCT116 human colon carcinoma cells


*Tabernaemontana elegans* is a medicinal plant used in African traditional medicine to treat several ailments including cancer. The aims of the study were to identify anti-cancer compounds, namely apoptosis inducers, from *T. elegans*, and hence to validate its usage in traditional medicine. Six alkaloids, including four monomeric indole and two bisindole alkaloids, were isolated from the methanolic extract of *T. elegans* roots. The structures of these compounds were characterized by 1D and 2D NMR spectroscopic and mass spectrometric data. These compounds, along with a 7th compound previously isolated from the leaves of the same species, were evaluated for *in vitro* cytotoxicity against HCT116 human colon carcinoma cells by the MTS metabolism assay. The cytotoxicity of the most promising compounds was corroborated by flow cytometry assays. Selected compounds were next studied for apoptosis induction activity in HCT116 cells, by evaluation of nuclear morphology following Hoechst staining, and by caspase-3 like activity assays. Among the tested compounds, the bisindole alkaloids tabernaegantine C and tabernaegantine B were found to be cytotoxic to HCT116 cells at 20µM, with tabernaegantine B being more cytotoxic than the positive control 5-Flourouracil, at a similar dose. These induced characteristic patterns of apoptosis in HCT116 cancer cells including, cell shrinkage, condensation, fragmentation of the nucleus, blebbing of the plasma membrane and chromatin condensation. Further, general caspase-3-like activity was increased in cells exposed to tabernaegantine C and tabernaegantine B, corroborating the nuclear morphology evaluation assays. These compounds were characterized as potent apoptosis inducers in HCT116 human colon carcinoma cells and as possible lead/scaffolds for the development of anti-cancer drugs. This study substantiates the usage of *T. elegans* in traditional medicine to treat cancer.

Review: Marrubin


The ethno-medicinal approach to drug discovery represents one of the most important sources of new and safe therapeutic agents to the challenges confronting modern medicine and daily life. Many of the traditionally important medicinal plants contain active molecules or ones that serve as precursors to biosynthesized secondary metabolites to which the biological activity could be attributed. Marrubin is one such compound and is a potentially valuable compound which exists in high concentrations in many traditionally important Lamiaceae species which have demonstrated excellent pharmacological properties with commendably high safety margins. Marrubin’s attributes include a low turnover, high stability and little catabolism, which are core characteristics required for therapeutic compounds and nutraceuticals of economic importance. In addition, marrubin is considered a potential substrate for potent active compounds viz; marrubinic acid, and marrubenol. The contribution of marrubin to drug discovery thus needs to be put into prospective due to its ready availability, potential applications and ease of modification. This short review highlights the most important chemical and pharmacological aspects reported on marrubin.

Modulation of the antibiotic activity by the essential oils of *Origanum vulgare* and *Coriandrum sativum*


Medicinal plants had been used by traditional populations as a way to treat diseases for centuries. Currently, despite the search of the pharmaceutical industry for different kinds of drugs, the bacterial mechanisms of resistance against anti-microbial drugs are a real problem to the health. *Origanum vulgare* and *Coriandrum sativum* are medicinal plants with essential oils of a known antibacterial activity. The essential oils were assayed for their antibacterial and modulatory antibiotic activities by gaseous contact method. Both essential oils demonstrated modulatory activity mainly when associated with gentamicin and vancomycin. These natural products demonstrated an interesting potential to be studied in association with antibiotics to elaborate new drug formulations, or to be used as functional foods.
This review evaluates and documents the uses and medicinal value of the genus *Tulbaghia*. The existing gaps in knowledge and possible means for greater development are highlighted. Findings within the literature based on their traditional uses and scientific evaluation indicate that *Tulbaghia violacea* remains the most widely used species. Compiled data indicate their efficacy in several *in vitro* and *in vivo* pharmacological properties such as antimicrobial, anti-hypertensive, antioxidant and anti-cancer activities. Some phytochemicals which are partly associated with the exhibited bioactivities have been identified and isolated from *Tulbaghia violacea* and *Tulbaghia alliacea*. The increasingly high usage, especially of the underground organs, as well as the incessant reliance on the wild population, will eventually affect their abundance and possibly make them susceptible to extinction. The great potential of the genus Tulbaghia, particularly other less popular species, remains to be exploited. Further studies on the structure-activity relationship of some of the isolated compounds may improve their biological potency. Their characteristic alliaceous aroma may also be of great interest to the food industry seeking novel source of unusual aromas to satisfy increasing consumer demands. In order to derive the much anticipated benefits from the species without compromising their conservation status, the use of different biotechnological approaches highlighted in this review will certainly guarantee their continuous availability.

Conservation strategy for *Pelargonium sidoides* DC: Phenolic profile and pharmacological activity of acclimatized plants derived from tissue culture

*Pelargonium sidoides* DC (Geraniaceae), a popular medicinal plant used in folk medicine in the treatment of respiratory-related infections has gained international prominence due to its usage in several herbal formulations. This has led to high demand and the subsequent decimation of wild populations. Using plant tissue culture techniques, *Pelargonium sidoides* plants were cloned in vitro, acclimatized under greenhouse conditions and evaluated for their phytochemical content and pharmacological activity. Phenolic content in extracts of *in vitro*-derived, greenhouse-acclimatized and wild *Pelargonium sidoides* plants were analyzed using UPLC-MS/MS. The oxygen radical absorbance capacity (ORAC), 2,2-diphenyl-1-picryl hydrazyl (DPPH) radical scavenging activity and minimum inhibitory concentration (MIC) of the extracts against bacterial and fungal strains were evaluated. Similarities in phenolic profiles were identified confirming the chemical signatures that characterize *Pelargonium sidoides* plants. Extracts of greenhouse-acclimatized and wild plants exhibited comparable antimicrobial and antioxidant properties. Overall, the study highlights the potential of integrating plant tissue culture technologies in conservation strategies of medicinal plants. In particular, the results strongly suggest the feasibility of both large-scale cultivation and plant part substitution as alternative solutions to the current destructive overharvesting practices of wild *Pelargonium sidoides* populations.

The phytochemical and antimicrobial activities of *Terminalia laxiflora* Engl. & Diels root bark extract

The root bark of *Terminalia laxiflora* Engl. & Diels is used traditionally as to prevent and cure diarrhoea in infants and children, aid digestion and relieve constipation in adults. As quality antibiotics are rarely available human pathogens are fast developing resistance to synthetic drugs yet medicinal plants are scantily validated. This has necessitated the investigation of *T. laxiflora* root bark for its phytochemical and antimicrobial values. Petroleum ether, aqueous and ethanolic extracts of *T. laxiflora* root bark were tested using the agar well diffusion technique on the following microorganisms: *Shigella sonnei*, *Salmonella typhi*, *Klebsiella aerogenes*, *Escherichia coli*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Penicillium chrysogenum*, *Aspergillus flavus*, *Lasidiophia discoarea* and *Saccharomyces cerevisiae*. *T. laxiflora* showed the presence of alkaloids, flavonoids, tannins, saponins and cardiac glycosides as its non-nutritive metabolites. Ethanoic and aqueous extracts of the plant root were found to be potent on all the bacteria used at minimum inhibitory concentration of 58mg/ml and 54mg/ml respectively. Besides, ethanolic extract also reacted with *Penicillium* sp and *Aspergillus* sp while the aqueous and petroleum ether extracts were non reactive on all of the fungi used. The pharmaceutical use of this extract may be found to be bactericidal and weakly fungistatic in properties.