Final thoughts

With all those wonderful projects happening all over the country I would like to end by letting you know what to look forward to in the last issue from the SAAB student council 2012.

We will show you what the SAAB student T-shirts look like and how to order them.

Give you pointers on how to have fun, fit-in and meet people at a SAAB conference.

Introduce you to the possible candidates who will become the SAAB student council 2013.

I would like to acknowledge all the people who really helped with this third issue. I know this time of the year is very busy and all your time is spent on your project, so I say thank you for your time. This issue is truly beautiful thanks to all your work.

By: Sarah Stanton
SAAB student President 2012

3rd Student Council News Letter

November 2012

GEOGRAPHY
GC-MS
SPECIES
LATIN
DNA
ANATOMY
RESEARCH
BOOKS
SAAB
BOTANY
CHEMISTRY
PHYSIOLOGY
TAXONOMY
BOTANY
BARCODING
POLLINATION
ART
ESSENTIAL OILS

SAGP SAAB Student Council

The Diversity Of Plant Science

Foreword

By Ashton Kim Ruiters

Plant Science in it's purest form is actually a grand mixture of all things. From trekking up a mountain in search of a rare species, to focusing in front of a microscope or a computer screen to understand it's internal complexities. Plant Science definitely is diverse. In this news letter, we meet an interesting little pollinator with a new story to tell. We also learn more about the biotechnology explorations and then discover how cell culture is moving us forward. And while we are moving forward, let us begin to consider our SAAB student council for 2013. Maybe you would like to be a part of it?

Enjoy the read!

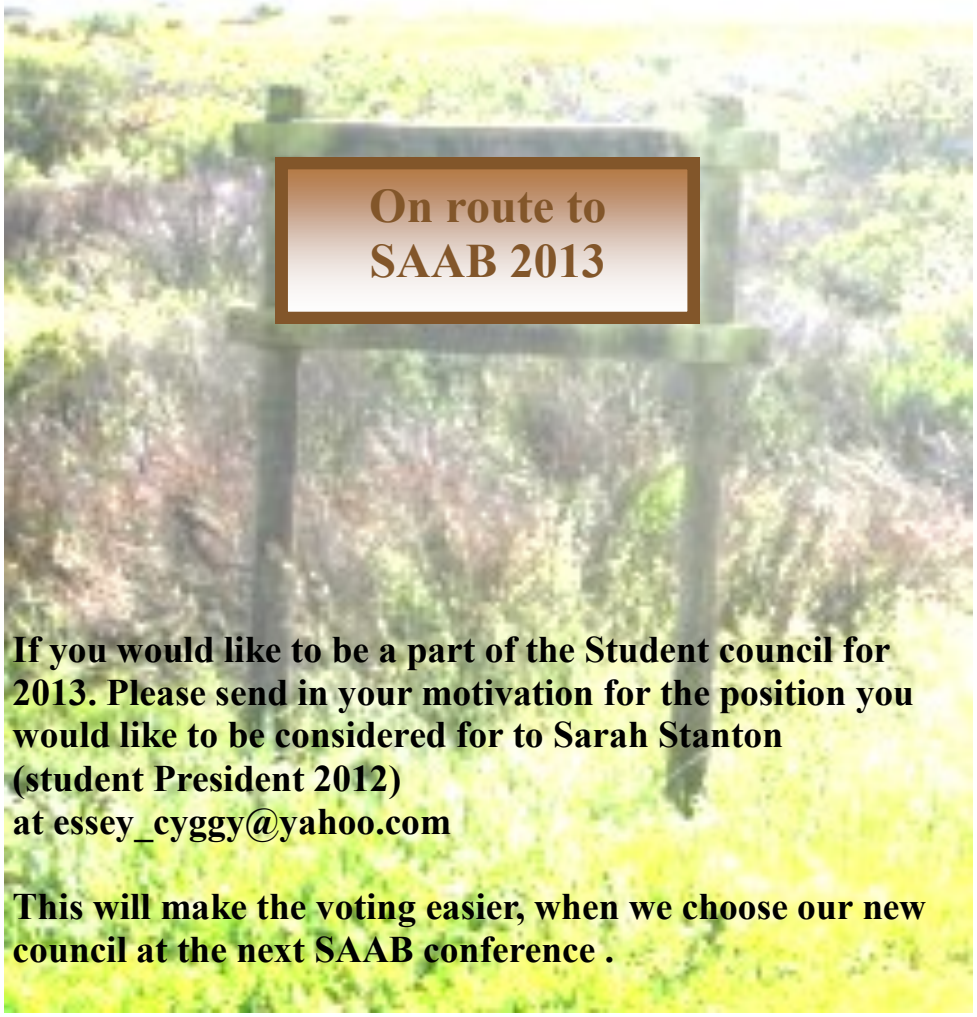
Long tongue fly pollinated Proteas of the Swartberg Mountains

By Ethan Newman
Department of Botany and Zoology, Stellenbosch University

Becoming rather irritable in the searing heat above Gysmanshoek pass, I have been diligently staying still for the last 3 days, next to a good patch of *Tritoniopsis revoluta*. Like clockwork, at 10' AM, a loud buzz, unlike that of a carpenter bee, but more similar to the sound of a miniature helicopter fills the autumn air. My heart skips a beat and the adrenalin rushes through my blood. Frantically, I grab my net. At first glance, an enormous charcoal-black fly appears with orange tufts on both sides of its abdomen. It possesses one of the longest proboscides of any insect in the animal kingdom. Its presence easily rivals that of the mythical beasts of the Cape Floral Kingdom; such as the high altitude Stag beetles, cave dwelling peripatus and the rarely seen giant oil collecting bee *Rediviva gigas*.

Figure: The long proboscid fly *Prosoeca longipennis* visiting *Protea punctata* on the slopes of the Swartberg Mountain. Photo: Ethan Newman

Coming soon…
Motivations for SAAB Student council



If you would like to be a part of the Student council for 2013. Please send in your motivation for the position you would like to be considered for to Sarah Stanton (student President 2012) at essey_cyggy@yahoo.com

This will make the voting easier, when we choose our new council at the next SAAB conference .

The Maize eQTL group is mining the maize genome for genes that convey resistance against *Cercospora zeina*, a fungus of great economic importance. Expression Quantitative Trait Loci (eQTLs) are areas on a chromosome that possess many genes involved in a desirable trait; in our case, resistance against a fungus. Breeders use this information to assist them in their hybrid breeding strategies. This is performed by crossing a desired yielding hybrid with your hybrid that possesses resistance to the fungus. In addition, many of the genes that convey resistance are of great interest, and are thus genetically engineered into maize plants to determine their direct effect on the plant.

The *Cercospora zeina* group is the group I am part of. We study the causal agent of Grey Leaf Spot on maize in southern Africa. *C. zeina* has become of vital importance globally as this pathogen can reduce yields by 65% in moderately resistant cultivars. Our studies focus on understanding the pathogen as a whole; determining the toxins the fungus may produce *in planta*, potential pathogenicity genes and their mode of pathogenicity, in addition to understand its population diversity. This pathogen is of global importance, and so is a subject of international collaboration with the United States.

Dr Bridget Crampton is the founder of the Cereal Foliar Pathogens Research Group. As a former CSIR staff member and a remarkable scientist, Dr Crampton has gained insight into many facets in biotechnology and its techniques in various biological fields of study. This broad knowledge base has enabled her to take on various projects. She is currently supervising the *Cercospora zeina* group projects and has branched into another maize foliar pathogen, *Excerhilum turcicum*, the causal agent of Northern Corn Leaf Blight (NCLB). What's more NCLB is a major threat to maize production and so is of great economic importance. These projects are aimed at better understanding the pathogens biology and molecular diversity, to gain better insight into developing control strategies to assist farmers from commercial to small-scale farms.

A little bit of background into biotechnological research in the Plant Science department at the University of Pretoria, has provided insight into what biotechnologists do. However, we have the freedom to work on problems that have been identified in industry, in nature and that affect the economy. This allows scientists to engage in a battle for the betterment of humanity, lending purpose to our everyday lives.

Entranced, as I watch the fly hovering, it momentarily lines up with the nectar guides on the lower petals of the flower and carefully inserts its proboscis. As quick as it arrived, it disappears, swiftly flying off to who knows where. I then remember that I forgot to net it and make it suffer for science. This is long tongued fly pollination at its best!

The fly

For the past 6 years, my supervisor,Dr Bruce Anderson, and I have been tracking this specific species of long proboscid fly across the Southern and Eastern Cape of South Africa, by observing autumn flowering plants with extremely long nectar tubes.The long proboscid Nemestrinid fly *Prosoeca longipennis* (Nemestrinidae) was first described in 1858 by the Dutch entomologist H. Loew, and according to Bezzi's key of African Nemstrinidae 1924, *P. longipennis* has been captured several times in South Africa but only one female specimen up till then existed in collections. It was only after more than 70 years that *P. longipennis* made its appearance in the literature again. With no surprise it was re-discovered by the pioneers of South African long tongued fly
pollination; John Manning and Peter Goldblatt, who in 1995 wrote a short Veld and Flora article on their observations of the plants it pollinates.

Bruce and I have been interested in the different interactions that these specialist flies share with the flowers they pollinate in the Southern Cape. In addition to Manning and Goldblatts initial description of the pollination guild, we have uncovered 12 more plants pollinated by *P. longipennis* which are included across five different plant families of the Amaryllidaceae, Orchidaceae, Iridaceae, Campanulaceae and Geraniaceae.

A first for Proteas

However, neither Bruce nor I were prepared for what we were to discover up in the Swartberg Mountains. Bruce and I joined our own father of South African pollination biology, Prof Steve Johnson, on our annual field trip to search for the pink orchid *Disa porrecta*.

In advance we were kindly informed by Swartbergs botanical expert Jan Vlok, that the road to the top had been washed away by the heavy rains that had fallen the previous week. Bruce, Steve and I, braced ourselves for the steady hike towards the top.

With temperatures beginning to soar above 25 degrees, we eventually came close to the top. I vaguely heard Bruce murmuring that he would not be surprised if the small Proteas we had been seeing could potentially be pollinated by our fly, as the flowers wear the same colour as many of the flowers pollinated by *P. longipennis* in the area. Bruce's words were hardly cold when Steve shouted "Nemestrinid! Nemestrinid!" Extraordinarily, we saw our long tongued flies happily sipping nectar from one inflorescence to the next on the white sugarbush, *Protea punctata*.

Excited, the three of us marveled at the perfect match between the fly's proboscis length and the length of the Protea's pollen presenters, and I hoped that this first record of a long proboscid fly visiting Proteas would be a discovery worthy of publication. We swiftly grabbed the nets from our heavy packs. This time the flies suffered for science, as we swooped several from mid-air into the killing jar. The flies did not die in vain as they were taken back to the lab to be observed for pollen loads. As a possibility exists that they may be robbing nectar, and may not make proper contact with the reproductive parts of the flowers. We also conducted pollinator observations for 3 days to confirm whether the flies were regular visitors, and not visiting the flowers only by chance. In addition we measured the flower colour, to test whether it is similar in colour to co-existing *P. longipennis* pollination guild members. We also measured the nectar sugar concentration to test whether it falls into the category of insect pollinated plants with a high nectar concentration and low nectar volume.

To introduce the Molecular Plant-Pathogens Interactions laboratory, I would like to begin with our boss. Prof Dave Berger is the founder of the Molecular Plant-Pathogens Interactions laboratory. He is an esteemed scientist with great experience in various fields from bacteriology to genetics, plant pathology, biotechnology assisted crop breeding, and bioinformatics. Under his supervision we conduct a myriad of research studies in currently three groups; the *Arabidopsis* group, Maize eQTL group and the *Cercospora zeina* group.

The *Arabidopsis* group is investigating the relationship between *Ralstonia solanacearum* and *Arabidopsis* as a model for the *Eucalyptus-Ralstonia* pathosystem. The research being conducted is emphasizing the development of a platform to understand a pathosystem as a whole and in particular for hosts. Plants, like humans, have an immune system. How well that immune system can perform against a pathogen will determine how well that plant survives. Elucidating the pathways that enable a plant to withstand a pathogen, assists plant breeders and geneticists to assist crops better withstand a pathogen. *Ralstonia* has a wide host range and as such presents a global challenge to control. *Ralstonia* is of great importance in Asia and with global trade as it is the fear of this pathogen spreading and becoming more virulent is enough for us to take it seriously. As a result, numerous studies were performed at the beginning of the millennia to understand the immune system this plant has against the pathogen.

Figure: Maize leaves displaying disease symptoms caused by A. *Excerhilum turcicum*, causal agent of Northern Corn Leaf Blight, and B. *Cercospora zeina* the causal agent of Grey Leaf Spot (GLS). Early GLS lesion development is observed in B. Both these diseases may result in entire leaf lesion coalescence. (Pictures taken by Mischa Muller)

Them Plants Have Genes…

By Mischa Muller

Biotechnology is a term that was coined by Karl Ereky, an agriculturist engineer, in 1919. Karl Ereky did not work on plants however, he worked with livestock. His conceptual idea of biotechnology emerged through his belief that if management incorporated lessons from philosophy, economics, biology and chemistry; larger problems, such as famine in Hungary could be prevented or at least greatly alleviated. Biotechnology is thus a broad field that incorporates many subjects. In modern times, one could say it is the molecular application of sciences that develops something innovative and useful to industry, but biotechnology is more than that.

Biotechnology is an exciting reason to wake up every morning and head to work. It is that realization that you will be tackling questions today that may impact on the world tomorrow. Biotechnology is all the discoveries you make and that have been made, which enable you to see a problem from various perspectives, and perhaps apply an unconventional idea to solve that problem creatively. The greater aim of biotechnological research is to apply scientific discoveries to solve problems for the betterment of humanity, plants and animals.

Recorded applications of science can be dated back to Louis Pasteur,. His discovery of the fermentation process was of such great importance that it is a process used commercially in industry today. But the purpose of all this history is to view this field as not a new field, but to realize that scientists today in all different subject fields perform biotechnological thinking in their everyday lives.

As a fellow student embarking on a journey to build a career for myself in biotechnology, I sit writing with excitement as the field of biotechnology in plant science alone is so versatile, expanding into agriculture, horticulture and the more intricate studies of classifying and dating plants. However, biotechnology is more commonly known for the highly controversial genetically modified crops, it is not always understood or acknowledged by the public in pharmaceuticals, medicinal plant science, stem cell research, cancer research and treatment, and molecular research in all fields.

Genetically modified crops are the most well-known biotechnological application which is somewhat understood and yet misunderstood. And so to put this field into perspective, I would like to describe the importance of some of the research the Molecular Plant-Pathogens Interactions laboratory and Cereal Foliar Pathogens Research Group conducts. Therefore I will be discussing plant science biotechnology with emphasis on crop breeding and plant-pathogen interactions to safeguard global food production.

From our results we found large numbers of *P. punctata* pollen grains on the body of the flies, and this, together with consistent pollinator observations and close similarity in flower colour to its congeners confirms *P. longipennis* pollination of *P. punctata*. In addition to *P. longipennis* as a pollinator, we observed butterflies (*Aeropetestulbaghia*) as co-pollinators of *P. punctata* in the Swartberg. We also captured three additional species of shorter proboscid Nemestrinids, which would often settle on the flowers. However these were not such effective pollinators because their foraging behavior did not allow them to make very good contact with the reproductive parts of the flower.

This remarkable discovery is only the second record for long proboscid fly pollination in the South African Proteaceae, (*Leucospermum tottumsubsptottum*) and a first for the genus *Protea*. *Protea punctata* is also well represented in the mountains of the Cederberg and Riviersonderend. It would be interesting to investigate whether these populations are also pollinated by long proboscid flies. Our observation reflects that South Africa's florally diverse garden still has many discoveries to be made by the observant pollination biologist, that's willing to spend time in those remote places, far off the beaten track.

Acknowledgements

Thanks go to Annelise and Jan Vlok for introducing us to the site and to Swartberg Nature Reserve for their friendly and efficient help to make it possible to perform research in the reserve.

For more information and references. Contact Ethan Newman at newmando@sun.ac.za

THE IMPACT OF CELL CULTURE CYTOTOXICITY ASSAYS ON ADVANCES IN MEDICINAL PLANT SCIENCE

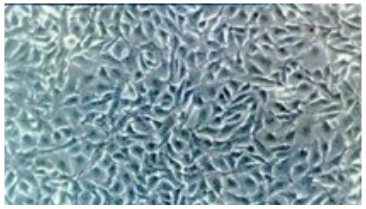
Smeetha Singh (University of Pretoria)

With the onset and rise of many ailments in South Africa as well as the world, many people are turning to alternative treatments. A surprising number of individuals already use alternative medicinal treatments such as Ayurveda or Acupuncture. The main reason for people turning to these alternatives is due to the inadequacy of conventional medicine.

The use of plant compounds or derivatives for the treatment of diseases is more common than it may seem. Many cosmetics, creams and supplements include plant derivatives. The link between plants and potential remedies is currently becoming stronger and more prominent.

Many industries are focusing on using plant derived compounds as their actives for the treatment of skin problems, oral care and nutritional supplements, amongst others. For this reason, substantial research and experimentation is carried out on plants with medicinal value. The results obtained by testing extracts on cell lines in a cell culture lab may lead to valuable information regarding the toxicity of the extract.

The cytotoxic analysis of plant extracts involves growing and culturing a cell line that is relevant to the study. Such as the use of mouse/human skin cells (as shown below) for an extract that has potential to be used as an active in a topical cream.



Once the cells are grown in the appropriate quantity, they can be plated in a specific sterile manner. The plant extract/compound is then added to the cells to observe what happens. The objective is to determine at what concentration of extract the cells die, if they die at all. This experiment is indicative of the safety of an extract for medicinal use.

Additional clinical trials will be the ultimate indication of safety, but if an extract is toxic to specific cell lines, it will not qualify to a clinical trial. There are many other experiments that can be carried out in a cell culture lab, all of which requires sterile working conditions. The growth of any bacteria or fungi in a cell culture lab is a nightmare to the technicians as well as a threat to the cells. Regular and intensive cleaning, with the abundant use of ethanol generally keeps everything in order.

The impact cell culture has had on the scientific world is huge and valuable. With constant advances in methods and techniques in cell culture, the future role it will play in science will definitely be imperative.