Phytogen May 2020

Phytogen – May 2020

15 May 2020



Welcome to Phytogen for May 2020. In this issue are reports from ASPS award lectures by Ros and Monika. Reflecting on both of these lectures has been especially enlightening and inspiring and hopefully you can draw some encouragement when considering the last few months and for the months to come.

We really (in real-life) look forward to seeing our fellow colleagues, researchers, teachers and students someday once COVID-19 abates. We hope you are managing to keep up with us in the digital world in the meantime. Tweet to us: @asps_ozplants and Facebook Image from favpng.com

Science is objective – with a dash of social context: What I learnt from my own 2019 JG Wood Award Lecture

Prof Ros Gleadow, Monash University

President of The Global Plant Council and a Past-President of ASPS



Science is objective and progresses step-by-step. That's what we are all taught and largely that is true. As I've gone on as a scientist, though, it's dawned on me that our science is also influenced by the society in which we live. In my JG Wood lecture, I outlined how my work on cyanide-producing plants, and plant defence theories more generally, has progressed over the years. I described how knowledge of cyanogenesis has built-up incrementally with input from plant physiology, molecular genetics, taxonomy, biochemistry and ecology[1],[2]. I set this in the context of the principles governing how plants allocate resources to growth and defence, and how that may be affected by climate change[3]. About 5-10% of plants produce cyanogenic glucosides, nitrogen-containing secondary metabolites that break down to release hydrogen cyanide when plant tissues are disrupted, for example when they are munched by herbivores. They can also be used to transport and store nitrogen and may even play a role in mitigating oxidative stress.

The paradigms in which I have operated over my career and used to form hypotheses and aid in interpretation reflect the socio-economic context in which they were in vogue surprisingly well. All have merit, but it is worth thinking about the eras when many of these theories were formulated and gained popularity. In the 1960s, for example, the emphasis was on optimal allocation[4] and coevolution (think summer of love). In the 70s this became less friendly, with the advent of ''arms race'' terminology (think Cold War). In the 80s defence theories were all about resource availability[5] and in the 90s the emphasis was clearly on trade-offs and economics (economic rationalism). This progressed further to the "big house, big car" hypothesis[6] where you end up with haves and have-nots. All of these theories have limitations, and all are true in some circumstances, but it is sobering to realise our science may not be so objective after all.

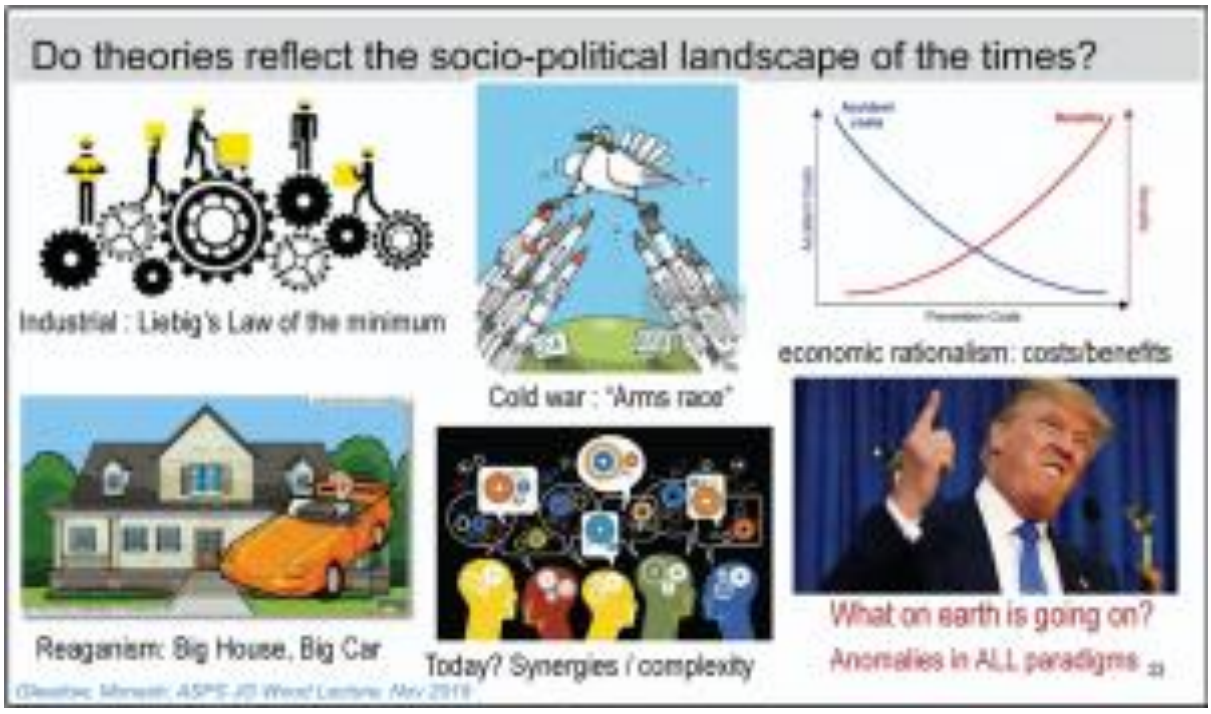

Figure: Somewhat provocative final slide from Ros Gleadow's JG Wood Lecture on plant defence theories. November 2019.

So where are we now? We are moving towards an overriding, global theory that accounts for complexity and interrelationships. This was clear in the title of my talk: S*tress, Defence and Photosynthesis are Entangled* (think Globalisation?). As I prepared my talk, I turned my thoughts

to current world politics and realised the whole world has gone mad! No one knows what's going on! (see Figure). Since November, the world has been shaken by the outbreak of COVID-19. While this pandemic continues, we're all in some kind of holding pattern. When it's finally over, and it will eventually be over, no doubt theories of defence will also change to reflect our new world. I wonder what that will be? Will it be about preparedness and (hopefully) compassion? Or will it be more ruthless. Perhaps we should start thinking about this right now so we can be on the front of the new wave of plant defence theories. Take care and stay safe,

Ros Gleadow, May 2020

[1] McKey D. 1974. Adaptive patterns in alkaloid physiology. *American Naturalist* 108: 305-320.

[2] Gleadow RM, Woodrow IE (2002) Constraints on the effectiveness of cyanogenic glycosides in herbivore defence. *Journal Chemical Ecology*, 28, 1301-1313.

[3] Gleadow RM, Johnson A, Tausz M (2013) Crops for a future climate. *Functional Plant Biology* 40: 3-6.

[4] Gleadow RM, Møller BL (2014) Cyanogenic glucosides- synthesis, physiology and plasticity. Annual Review of Plant Biology 65: 155-85.

[5] Coley PD, Bryant JP, Chapin III FS (1985) Resource availability and plant anti-herbivore defense. *Science* 230: 895-899.

[6] Reznick D, Nunney L, Tessier A (2000) Big houses, big cars, superfleas and the costs of reproduction. *TREE* 15: 421-425.

Mitochondrial Machineries for import, assembly and proteolysis:

2019 Jan Anderson Award Lecture

Dr Monika Murcha, University of Western Australia.



Monika Murcha is a Senior Lecturer at the School of Molecular Sciences, at the University of Western Australia (UWA). She obtained her PhD in Plant Molecular Biology at UWA and was successful in obtaining an ARC Post-doctoral fellowship followed by an ARC Future Fellowship. Monika established her own laboratory at the School of Molecular Sciences in 2014 and has continued her strong collaboration with Plant Energy Biology researchers at UWA and nationally. Monika Murcha's research has shown that the import of proteins and tRNA from the cytosol is a vital biological point of control for regulating mitochondrial activity, mass and number. She has also uncovered key transporters and receptors necessary for regulating organelle biogenesis, which are indispensable for energy production and optimal plant growth and development.

I am fortunate enough to be able to work towards something that is truly fascinating to me, understanding the complex molecular interactions in the cell that can regulate mitochondrial activity. When I first started my Honours project under the supervision of Prof. James Whelan, I was isolating mitochondria from pea leaves and carrying out protein uptake assays to determine if protein import uptake is a developmentally regulated process. Which it is, and since then I have continued to look for answers to such questions. I have identified key transporters and receptors are vital for regulating the rate of protein import and tRNA into plant mitochondria[1, 2]. I have discovered dynamic interactions between the mitochondrial protein import apparatus and the respiratory chain[3], and most recently, identified novel regulators required for their assembly[4]. The joy I get from working in the lab and making discoveries, collaborating with brilliant scientists and passing on my skills and knowledge to my students is unbeatable, but being recognised by the ASPS by receiving the 2019 Jan Anderson award is truly amazing.

1. Murcha et al., Plant-Specific Preprotein and Amino Acid Transporter Proteins Are Required for tRNA Import into Mitochondria.*Plant Physiol.* 2016 Dec;1724:2471-2490.
2. Wang et al., The mitochondrial protein import component, TRANSLOCASE OF THE INNER MEMBRANE17-1, plays a role in defining the timing of germination in Arabidopsis. *Plant Physiol.* 2014 Nov;1663:1420-35.
3. Wang et al., . Dual location of the mitochondrial preprotein transporters B14.7 and Tim23-2 in complex I and the TIM17:23 complex in Arabidopsis links mitochondrial activity and biogenesis. *Plant Cell.* 2012 Jun;246:2675-95.
4. Ivanova et al.,. A Mitochondrial LYR Protein Is Required for Complex I Assembly. *Plant Physiol.* 2019 Dec;181(4):1632-1650.

Remember, Monday (today) is……

Fascination of Plants Day 18 May 2020

Share your online/digital events on Twitter @PlantDay18May with the hashtags #FoPD and #plantday Also tweet to us: @asps_ozplants

Events for your calendar:



iLEAPS – OzFlux postponed until 2022 new dates soon……

Mark your Calendars

for 9 to 12 February '21

SAVE THE DATE

www.leaps-ozflux.org

iLEAPS - OzFlux

joint Conference 2021

The research platform 'iLEAPS' (Integrated Land Ecosystem-Atmosphere Processes Studies) is one of several Future Earth research initiatives, with the critical goal of bringing together researchers from a variety of fields related to land-atmosphere exchange processes.

This includes, but is not limited to carbon, water and trace gas exchange, land use change, atmospheric composition, and the societal and related environmental issues.

We are proud to host the 6th iLEAPS Science Conference in February 2021, in the vibrant city of Auckland, in conjunction with the yearly conference of the Australian/New Zealand Network for eddy covariance measurements (OzFlux).

For all inquiries, please contact us at:

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iLEAPS - OzFlux

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Keynote Speakers

We're pleased to welcome the below keynote speakers to the iLEAPS - OzFlux Joint Conference 2021.



Distinguished Professor Graham Farquhar

Distinguished Professor, Australian National University, Research School of Biology

Professor Graham Farquhar has undertaken and led research across a broad range of fields and scales, from integration of photosynthesis with nitrogen and water use of plants, stomatal physiology, isotope composition of plants and global change. He is a Fellow of The Australian Academy of Science and of the Royal Society and a Foreign Associate of the U.S. National Academy of Sciences. He has over 380 research publications and has received many awards for his research, including the Order of Australia Officer (2018), the Kluk Prize for Nutrition (Kluk), 2019, the Prime Ministers Prize for Science (2019) and the Kyoto Prize for Basic Sciences (2019). He was named 2018 Senior Australian of the Year for his contributions to world food security.

Graham is Distinguished Professor of the Australian National University's (ANU) Research School of Biology and a Chief Investigator of the Australian Research Council's Centre of Excellence for Translational Photosynthesis.



Distinguished Professor Belinda Medlyn

Western Sydney University, Hawkesbury Institute for the Environment

Belinda Medlyn is distinguished Professor of Ecosystem Modelling at the Hawkesbury Institute for the Environment, Western Sydney University. She is one of the world's leading ecosystem modellers, with over 25 years of experience in modelling responses of vegetation to environmental change. Her research seeks focuses on translating information from plant and ecosystem scale experiments to develop models predicting vegetation responses to elevated carbon dioxide, rising temperature and drought. She has been instrumental in international model intercomparison projects evaluating ecosystem models against Free-Air



You can email us at the communications website if you have upcoming events to promote, virtual and face-to-face. Please also send us any enlightening stories to share.

Take care and stay safe.