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I am very privileged to the President Elect of the *Association of Applied Biologists* and the Editor in Chief of *Food and Energy Security*. The need for sustainable food production and the growing uncertainty of the impacts of a changing climate has had a dramatic impact on the ethos and directions of basic and applied science research. The *Association of Applied Biologists* spearheads these developments, providing a focal point for the interactive exchange of information and opinions between disciplines.

Throughout my career, I Christine Foyer have been fascinated by plant reduction-oxidation (redox) biology, firstly in terms of the regulation of energy production in photosynthesis and respiration, and secondly with regard to associated redox processing and signalling under optimal and stress conditions. I have sought to identify and characterise the functions of key plant oxidants, antioxidants and other redox proteins. Work for my PhD thesis led to the foundation of the "Foyer-Halliwell-Asada" cycle that processes hydrogen peroxide in plants. When I started my PhD studies, the topic of hydrogen peroxide production and metabolism in plants was in its infancy. While it had been established that superoxide and hydrogen peroxide were produced by chloroplasts, there were no known systems for removal of these reactive oxygen species (ROS) from organelles other than peroxisomes, in which catalase is localised. After demonstrating that ascorbic acid and glutathione were present in chloroplasts, I was able to isolate and characterise two important enzymes that were able to regenerate the reduced forms of these antioxidants using reducing power in the form of NADPH, provided by the photosynthetic electron transport chain. Based on this information, we proposed for the first time that ascorbate and glutathione function together in chloroplasts to remove ROS and so protect the thiol-modulated enzymes of the Benson-Calvin cycle from oxidative inactivation. Although I did not know it at the time, studies generated a new area of research on plant redox metabolism, which continues to break new boundaries' today. This early work was followed by the demonstration of the importance of chloroplast oxidants and antioxidants in preventing over-reduction of the electron transport chain, and the related importance of the "water-water cycle" in the regulation of photosynthesis.

Since then my lab has explored the regulation of ascorbate and glutathione synthesis and the functions of these antioxidants in synthesis mutants or in transformed plants that overexpress biosynthetic enzymes. As early in the 1990's, my lab was studying the effects of increased of

glutathione synthesis capacity in transgenic poplar trees. My interests in the diverse functions of ascorbate and glutathione in plants continues to the present day. I am also interested in a range of redox-modulated proteins and enzymes such as cysteine proteases that are important in the regulation of chloroplast protein turnover and senescence, especially in when plants are exposed to environmental stresses.

Rothamsted Research Conference in 1994: There are many people, who guide and shape our scientific ideas. In this photograph, Christine is standing next to Alfred Keys and David Walker on one side and Ingo Flugge and Peter Lea on the other.

The pathway of ascorbate synthesis is particularly interesting because the final enzyme in the pathway, L-galactono-1, 4-lactone dehydrogenase is located in mitochondria, where it is bound to respiratory Complex I. The activity of this enzyme influences respiratory electron flow between Complex III and IV. Ascorbate synthesis in plants is therefore intimately associated with the regulation of the respiratory electron transport chain. In addition, to the ascorbate pool within cells, I have also been interested in the role of ascorbate in the apoplast/cell wall compartment of plant cells, where ascorbate is the only abundant low molecular weight antioxidant. Interesting, the apoplastic ascorbate pool plays key roles in cell signalling from the regulation of photosynthesis to plant defence responses. These functions are related to the apoplastic production of hydrogen peroxide, which is not only required for plant pathogen responses but also the systemic transmission of shoot signals such as light and high atmospheric CO_2 levels to roots in order to optimize beneficial interactions with mycorrhizal fungi or defences against root nematodes. There is now a general acceptance the concept that ROS and antioxidants function in the redox signalling hub that is a central integrator of metabolic and environmental signals.

I have always been interested in the development of new methods and the application of innovative tools to characterize the genes, enzymes and other proteins responsible for the acclimation of plants to environmental stress. This has often involved collaborations with other laboratories, that have resulted in publications reporting for example a reference-grade wild soybean genome (**Xie *et al*., 2019**. *Nature Communications.* **10**, 1216. CLICK HERE) and the application of Direct RNA Sequencing using Oxford Nanopore Technology with exceptional read length to demonstrate the complexity of *Arabidopsis thaliana* transcriptomes (**Zhang *et al*., 2020**. *Nucleic Acids Research. doi: 10.1093/nar/gkaa588*. CLICK HERE).

Gordon Research Conference on CO_2 fixation in Green plants held in 1996. International meetings of this type foster life-long collaborations and friendships. In this photo, Christine is in the middle with her eyes closed against the sunshine. She is standing next to Alison Kingston-Smith and Renate Scheibe. It is interesting to see if you can recognize any of the other famous faces in this gathering.

It is very rewarding to see that my work is well cited and that I am listed on the Thomson Reuters IP and Science official list of Highly Cited Researchers that are ranked within the top 1% (most cited works) for the subject field and year of publication, earning a mark of Exceptional Impact. Science is a wonderful career with many rewards but it is particularly pleasing that the work that one does is of interest to others and has impact. While I have also undertaken basic research, my work has always been mindful of the needs of agriculture. I have been particularly interested in capacity building in Africa, where I have has long-standing collaborations with Professor Karl Kunert (University of Pretoria) and Professor Anna-Maria Botha-Oberholster (University of Stellenbosch), which have facilities participation in capacity building projects. Much of this work has focussed on the importance of legumes to African agriculture.

Anna-Maria and Karl Kunert (University of Pretoria) 'Worldwide University Network (WUN) CROP-FS team'. Christine is standing in between Ashwani Pareek and Sneh Pareek, who is next to Om Parkash, who leads the network. Directly behind her is Anna-Maria Botha-Oberholster. Anna-Maria is standing next to Karl Kunert.

Anna-Maria Botha Oberholster in her wheat trials in StellenBosch.

As is the case with many other scientists, my research interests have more recently addressed issues related to climate change. I am particularly interested in the notion that high atmospheric

CO_2 levels may be perceived by plants as a stress. Within the context on my own research, it is clear that high CO_2 shifts the cellular redox balance from metabolic hydrogen peroxide production in photorespiration to RBOH-mediated apoplastic ROS generation. Not only do such concepts drive new research initiatives, for example into novel plant CO_2 sensors such as carbonic anhydrase but they also provide new insights into the regulation of plant defences e.g. that there might be high CO_2 effects on plant systems that are largely independent of the direct effects of high CO_2 on carbon metabolism.

Current advances in plant science and technology provide unprecedented possibilities for the production of resilient high-yielding crops and sustainable forests. However, their potential contribution is currently constrained by widespread societal opposition to some new technologies that are perceived as "genetic modification" in both western and developing regions of the world. Heightened public and policy scrutiny of such innovations is deeply rooted in consumers' intrinsic care about the food supply. Public sentiment about "incomprehensible" scientific innovations has been the driving force behind hesitant policymaking perpetuating regulatory uncertainty for research groups that stifles much needed private and public investment in research. The current COVID-19 environment has rightly facilitated a major re-direction of much basic research funding. However, it is important to remember that food security i.e. "the state of having reliable access to a sufficient quantity of affordable, nutritious food", and healthy diets underpin the ability of each person to fight diseases such as the present pandemic. Continued research into basic and applied plant science has therefore never been so urgent.

Christine H. Foyer, 15/07/2020