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EDITORIAL

Photosynthesis and the environment

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Nearly 240 years after Joseph Priestley's influential experiments involving a mouse, a plant and a bell jar the need and desire to study photosynthesis and the environment has not diminished. In fact, it is well recognized that the relationship between photosynthesis and the environment is key to understanding the health of our planet, in addition to providing clean air, water and food security across the globe. Although there is a wealth of information, scaling across time (femtosecond to gigayear) and space (angstrom to globe), on the response of photosynthesis to changing environmental conditions there is still much to be learned about the interaction between photosynthetic processes and the environment in which it happens. In fact this has never been truer as our planet's climate changes at unprecedented rates and the population of humankind continues to grow (both in number and girth).

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With this in mind we present a special issue of Photosynthesis Research entitled, "Photosynthesis and the Environment", which is a compilation of exciting new work on photosynthesis and the environment at a range of scales from the biophysical and molecular to the physiological and biogeochemical, including evolutionary and ecological perspectives. Integration across these scales and the merging of traditionally distinct approaches are key features of the work. The research ideas presented here come from some of the best early career researchers in photosynthesis whom have received their Ph.D. within 15 years of 2013. We solicited early career scientist for this review issue as they can potentially provide a unique perspective on the future of photosynthesis research. Additionally, these scientists are in the trenches of training the next generation(s) of interdisciplinary scientists as well as engaging the non-scientific community about the importance of both fundamental and applied photosynthetic research.

We've organized the structure of this special issue scaling from large to small. The first publications address issues relating to global modeling of photosynthesis (Dietze 2013), the use of biochemical parameters to constrain these models (Rogers 2013), and the influence of climate (Desai 2013) and seasonal changes (Stoy et al. 2013) to canopy level photosynthesis. At the physiological level, manuscripts discuss the use of leaf optical measurements (Ainsworth et al. 2013), the role of internal CO_2 diffusion (Buckley and Warren 2013), the thermal acclimation of photosynthesis (Way and Yamori 2013), and the thermal response of different photosynthetic functional types (Yamori et al. 2013). Following this, a set of manuscripts addresses integration of photosynthesis with other key processes including water use and respiration; specifically discussing genetic variation in water use

efficiency (Easlon et al. 2013), the role of redox state on stomatal regulation (Busch 2013), and the interaction of mitochondrial metabolism and photosynthesis (Araújo et al. 2013). The special features of C_4 photosynthesis are then discussed both in terms of natural variation in C_4 Kranz (Covshoff et al. 2013), and single-cell C_4 photosynthesis (Sharpe and Offermann 2013). Ultimately, at the molecular and biochemical level, manuscripts address circadian regulation of photosynthesis (Dodd et al. 2013), Rubisco (Cavanagh and Kubien 2013), Rubisco activase (Mueller-Cajar et al. 2013), pigment regulation of light harvesting (Holleboom and Walla 2013), pigment biosynthesis (Sobotka 2013), thylakoid reactions (Johnson and Ruban 2013) and thylakoid organization (Sznee et al. 2013).

We are excited about the findings and opinions presented here and the discussion of future research directions collected in these manuscripts. As for many centuries, this is an exciting time to study photosynthesis, and it is clear that this area of research has a bright future that will assimilate much more valuable knowledge as this multidisciplinary field continues to move forward.

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