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REMEMBRANCE

In memoriam of Professor Bridgette Barry (March 1, 1957–January 20, 2021)

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Abstract
We remember our colleague and friend, Bridgette Barry. Bridgette's numerous seminal contributions to photosynthesis research, beginning with her discovery that two functionally differentiated, redox active tyrosines are involved with the action of the oxygen-evolving complex, continue to impact studies of Photosystem II in laboratories around the world. Dr. Barry was widely recognized for employing clever adaptations of spectroscopic tools to probe unique experimental systems. Taken as a whole, she developed an in depth understanding of how biological proton coupled electron transfer reactions are subject to exquisite control over direction and kinetics. Bridgette dedicated significant time and energy in service to the scientific community. She was committed to her lab members and cared deeply that they each achieve their goals. She was an important role model and promoted women in her department and beyond. Bridgette will be deeply missed by the international scientific community and by those of us who had the honor to know her.

Professor Bridgette Barry.

Photograph courtesy of the Department of Chemistry and Biochemistry and the Institute for Bioengineering and Bioscience, Georgia Institute of Technology.

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On January 27, 2021, we lost Bridgette Barry, a dear colleague, professor, mentor, role model, friend, and brilliant scientist. Bridgette will be deeply missed by the international scientific community and by those of us who had the honor to know her.

Bridgette received her A.B. in Chemistry with High Honors at Oberlin College. She then joined Professor Rich Mathies's group at the University of California, Berkeley for graduate studies in Chemistry. Bridgette's PhD work in the Mathies lab was focused on obtaining resonance Raman spectra of visual pigments in individual photoreceptors from vertebrates. In the 1980's, when one could not simply purchase an off the shelf Raman microscope, this was an ambitious goal. Bridgette was not deterred. She proceeded to master all aspects of the project. She not only constructed a Raman microscope operating at cryogenic temperatures; she learned to dissect the eyes from the vertebrates. The amusing stories of Bridgette's encounters with frogs and geckos have become legendary. Bridgette's successful accomplishments paved a path for the entire field of Raman microscopy.

After receiving her PhD in 1984, Bridgette began post-doctoral research with Professor Jerry Babcock at Michigan State University (MSU). Following her post-doctoral position, Bridgette joined the faculty of the Department of Biochemistry, Molecular Biology, and Biophysics at the University of Minnesota (1988–2003). In 2003, she moved to the School of Chemistry and Biochemistry at the Georgia Institute of Technology (Georgia Tech) (2003–2021).

At MSU, Bridgette was introduced to photosynthesis research, and, like many of us, was 'hooked'. As a post-doc, Bridgette published a series of seminal papers. She devised a clever scheme for selective isotopic labeling of the Photosystem II (PSII) reaction center (rc) protein, as required for Electron Paramagnetic Resonance (EPR) analysis, pulled together resources from four different laboratories, and provided the first *definitive* evidence that two functionally differentiated, redox active tyrosines from the PSII rc protein are involved with the action of the photosynthetic oxygen evolving complex (oec). (Barry and Babcock 1987) These findings were *major breakthroughs*. The identity of the co-factor that links the oec with the PSII chlorophyll centered photo-driven electron transfer reactions had been debated for at least thirty years, prior to the publications from Bridgette and her collaborators. The resolution of this issue opened entirely new directions of international research focused on elucidating the mechanism of photosynthetic oxygen evolution.

Bridgette's significant accomplishment was an early example of the scientific creativity and leadership she demonstrated throughout her career. She tackled challenging questions by marshalling the tools and resources of chemistry, biochemistry/physics, and molecular biology to design unique experimental systems to take full advantage of vibrational and magnetic resonance spectroscopies. At the same time, Bridgette developed clever adaptations of these methodologies to achieve her goals. We mention two noteworthy examples.

Bridgette extended the methodologies of difference (light minus dark) FTIR to include isotopic editing; thereby facilitating the assignment of vibrational modes to specific protein residues. In the accompanying Commentary to Bridgette's PNAS publication (Babcock 1993; MacDonald et al. 1993), Jerry Babcock wrote "… they [Barry et al.] have broken new ground by developing techniques for using vibrational spectroscopy on isotopically labeled preparations of the water-oxidizing reaction center … The extension of labeling techniques to vibrational spectroscopy … expands the applicability of the technique by providing the means to assign observed vibrational modes to specific amino acid residues…" The high-resolution of FTIR allowed Bridgette to observe the structural differences between the two redox-active tyrosines of Photosystem II.

Bridgette's time-resolved FTIR studies revealed previously unknown short-lived protein-centered intermediates and demonstrated unambiguously that they are coupled with the photon coupled stepwise water oxidation (S-states). In his Commentary, accompanying another of Bridgette's PNAS papers, (Barry et al. 2006; Bricker 2006) Terry Bricker wrote, "These results are quite unexpected and will place significant constraints on proposed mechanisms that are responsible for the photosynthetic oxygen evolution process. …It is expected that these [Barry's] studies will stimulate a number of future investigations …".

Taken as a whole, Bridgette developed an in-depth understanding of how biological proton coupled electron transfer reactions (PCET) are subject to exquisite control over direction and kinetics. Indeed, in recent years, she and her group succeeded in engineering a robust PSII-inspired peptide scaffold which exhibits a proton coupled electron transfer reaction and a reversible, coupled conformational change of the peptide backbone (Hwang et al. 2017). Similarly, she demonstrated proton coupled electron transfer in a ribonuclease reductase-inspired beta hairpin maquette (Pagba et al. 2015).

Bridgette dedicated significant time and energy in service to the scientific, Georgia Tech, and greater Atlanta communities. She held editorial roles at the Journal of Physical Chemistry (senior editor focusing on biochemical and biophysical related manuscripts) and at the Biophysical Journal. She organized several international symposia. In recognition of her accomplishments and service, she was appointed Fellow of the American Chemical Society (ACS) and American Association for the Advancement of Science (AAAS). She was a driving force behind several biophysics activities at Georgia Tech, such as a Molecular Biophysics Training Program and the highly successful Molecular

Biophysics Research Review, a welcoming forum for scientists across disciplines, at all career stages to discuss their ongoing research. This popular forum was widely attended by participants from Georgia Tech and the greater Atlanta area.

Bridgette was committed to her lab members. She cared deeply that they each achieve their goals. She was always available for guidance, both scientific and otherwise. Even when recovering from significant illness she was present, communicating virtually with her group (ten years before the world discovered Zoom and the like). She instilled a joy and enthusiasm for science; many of her students and postdocs now hold successful careers in academia, industry, and research laboratories.

Bridgette was an important role model and promoted women in her department, at conferences, and though various activities. Professor Raquel Lieberman, Georgia Tech commented: "Bridgette was an excellent female role model for me. She was fully dedicated to her students and her science. She was focused on these two priorities and set healthy boundaries at work to stay on task, even as her illness progressed. Her example was a very important one for me, as someone who, especially as an assistant professor, was not good at saying 'no' to various opportunities to serve on committees across campus. Even today, I find myself stopping to consider how Bridgette would have handled a situation and have changed my course of action from my gut reaction, all for the better."

Bridgette was incredibly generous and fought for women when needed, with the same calm, and intelligent demeanor that she applied to everything she approached. Joanne Stubbe of MIT described this by writing "Bridgette and I have been soul mates through our love of tyrosyl radicals and their role in Biology and through our experiences as female scientists in a 'man's world'. Few of us do science that has an impact as big as the discovery of Yz and Y_D of the oec. For love all things tyrosyl radical-mediated, Brigette's lab continued to study the PCET in the oec and in ribonucleotide reductases. She was curious, passionate, and persistent, and will be missed by all in the radical world."

Bridgette never missed a beat; her research continued with the same intensity and joy even at times when she faced serious health issues. Bridgette's passing is mourned by her husband Dr. Peter Dardi and her many friends and colleagues. Through her outstanding science, she changed the way people think. As a friend and colleague, she made the world a better place.

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