ASP NEWS

Connect

Winter 2019 **vol. 48 (1)**

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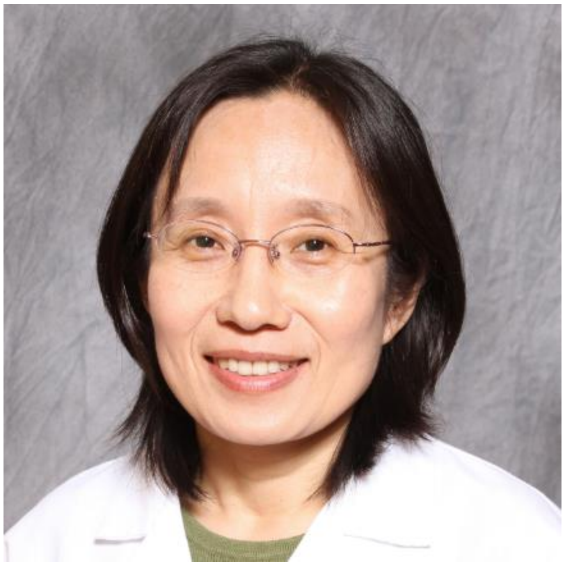
President's Note



Dear ASP members and colleagues,

Happy New Year!

Here I would like to share with you a few exciting updates.

1. We finally decided venue for the ASP 2020 meeting. It will at Sheraton Great Chicago, Chicago, on June 27-30, 2020. The hotel is right in downtown Chicago, next to the Chicago river. Among several options, we have chosen Chicago, based on several considerations, including easier travel for many potential US and international attendees, the suggestions from the 2018 Tampa meeting survey, local photobiology community, and local attractions. Please put it on your calendar. More information will be coming soon.

2. We had a productive winter council meeting on Nov. 30, 2018. The EC and council discussed several emerging issues at the ASP, including the finance, journal, committees, 2018 Tampa meeting, 2019 evening symposia, and 2020 ASP biennial meeting.

3. The ASP will collaborate with the PanAmerican Society for Pigment Cell Research (PASPCR), in the form of joint symposium at the annual or biennial meeting of each society.

4. The second off-year ASP 2019 evening symposium is coming soon, May 9-10, 2019, in Chicago. We are looking forward to a dynamic program and fruitful interactions.

You can find our more details from the meeting website:

http://photobiology.org/2019site/index.html

5. ASP will continue to collaborate with ESP, holding the ASP-ESP joint symposium at the upcoming 2019 ESP meeting. Alec Greer, President Elect, will be the co-chair of the ASP.

Wish you and your family a happy, healthy and successful 2019!

Yu-Ying

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Our Society – Our Journal

Dear ASP Members,

As Editor in Chief of Photochemistry and Photobiology, it is my distinct pleasure to invite you to submit your high quality research manuscripts to our society's own journal.

Photochemistry and Photobiology has been published 1962 and it is no overstatement that our journal has been instrumental in publishing breakthrough research that defined our field reaching far beyond our discipline.

Please see our newest issue online here:

Members and friends of ASP, I encourage you to take advantage of the visibility and impact associated with the journal.

When looking for fair peer review and rapid high quality publication, please consider publishing your research in Photochemistry and Photobiology.

And remember... Our Society – Our Journal.

With my best wishes,

Jean Cadet

Tom Daugherty, 1933-2018

Thomas Dougherty, PhD, the developer of modern photodynamic therapy (PDT) and Chief Emeritus of Roswell Park's Photodynamic Therapy Center, passed away Tuesday, October 2, 2018.

"He was undoubtedly the major influence in bringing PDT into the realm of cancer therapy," said David Kessel, PhD, Professor of Pharmacology at Wayne State University School of Medicine in Detroit.

In 1970, Dougherty left a lucrative job with the DuPont chemical company to join Roswell Park's Department of Experimental Biology as a research associate. Here he developed PDT, a cancer treatment that combines laser light with a nontoxic, light-sensitive drug. The process kills cancer cells directly and also shuts down blood vessels in the margin around the tumor, reducing the chance that cancer cells left behind will be able to grow. Studies indicate that it also stimulates the immune system to track down and kill cancer cells throughout the body.

Although PDT was first discovered more than a century ago in Germany, until Dougherty's breakthrough, researchers had failed to find ways of using light-sensitive compounds to treat disease. Dougherty successfully treated cancer with PDT in preclinical models for the first time in 1975. Three years later, he conducted the first controlled clinical study in humans.

In 1994, the FDA approved PDT with the photosensitizer Photofrin® for palliative treatment of advanced esophageal cancer. Today it is also FDA-approved for the treatment of specific types of lung cancer and Barrett's esophagus, a condition that can lead to esophageal adenocarcinoma. Roswell Park now offers PDT using next-generation photosensitizers and provides off-label treatment of gynecologic malignancies, head & neck cancer and dysplasia, and certain skin cancers.

After selling his company, Photofrin Medical, Inc., to Johnson & Johnson in 1984, Dougherty used the proceeds to establish The Oncologic Foundation of Buffalo, which initially funded PDT research at Roswell Park. "Tom's foundation gave me my first grant, which allowed me to begin to investigate the role of PDT in anti-tumor immunity," recalls Sandra Gollnick, PhD, now Director of Roswell Park's Photodynamic Therapy Center. "He was a great man, a visionary and a good friend."

The foundation later expanded its mission to support initiatives at Canisius College, the American Brain Tumor Association, and Hauptman Woodward Medical Research Institute. It also funded a program that taught University at Buffalo medical students "how to deal honestly and compassionately with terminally ill patients," in Dougherty's own words.

A graduate of Canisius College, Dr. Dougherty earned a PhD in chemistry from The Ohio State University. He was the recipient of numerous accolades and awards for his work, including the Lifetime Achievement Award from the American Society for Photobiology. He was the author or co-author of more than 200 publications and held more than 50 patents.

Nancy Oleinick, PhD, Professor Emerita of Radiation Oncology at Case Western Reserve University School of Medicine in Cleveland, remembered Dougherty as "a superb scientist, a gentleman, a visionary and a cheerleader for PDT." Added David Kessel, "Tom certainly left the world a much better place for his being part of it. He was one of the 'good guys' of whom there can never be enough."

Scientists engineer shortcut for photosynthetic glitch, boost crop growth by 40 percent

Plants convert sunlight into energy through photosynthesis; however, most crops on the planet are plagued by a photosynthetic glitch, and to deal with it, evolved an energy-expensive process called photorespiration that drastically suppresses their yield potential. Today, researchers from the University of Illinois and U.S. Department of Agriculture Agricultural Research Service report in the journal Science that crops engineered with a photorespiratory shortcut are 40 percent more productive in real-world agronomic conditions.

"We could feed up to 200 million additional people with the calories lost to photorespiration in the Midwestern U.S. each year," said principal investigator Donald Ort, the Robert Emerson Professor of Plant Science and Crop Sciences at Illinois' Carl R. Woese Institute for Genomic Biology. "Reclaiming even a portion of these calories across the world would go a long way to meeting the 21st Century's rapidly expanding food demands—driven by population growth and more affluent high-calorie diets."

This landmark study is part of Realizing Increased Photosynthetic Efficiency (RIPE), an international research project that is engineering crops to photosynthesize more efficiently to sustainably increase worldwide food productivity with support from the Bill & Melinda Gates Foundation, the Foundation for Food and Agriculture Research (FFAR), and the U.K. Government's Department for International Development (DFID).

Photosynthesis uses the enzyme Rubisco—the planet's most abundant protein—and sunlight energy to turn carbon dioxide and water into sugars that fuel plant growth and yield. Over millennia, Rubisco has become a victim of its own success, creating an oxygen-rich atmosphere. Unable to reliably distinguish between the two molecules, Rubisco grabs oxygen instead of carbon dioxide about 20 percent of the time, resulting in a plant-toxic compound that must be recycled through the process of photorespiration.

"Photorespiration is anti-photosynthesis," said lead author Paul South, a research molecular biologist with the Agricultural Research Service, who works on the RIPE project at Illinois. "It costs the plant precious energy and resources that it could have invested in photosynthesis to produce more growth and yield."

Photorespiration normally takes a complicated route through three compartments in the plant cell. Scientists engineered alternate pathways to reroute the process, drastically shortening the trip and saving enough resources to boost plant growth by 40 percent. This is the first time that an engineered photorespiration fix has been tested in real-world agronomic conditions.

"Much like the Panama Canal was a feat of engineering that increased the efficiency of trade, these photorespiratory shortcuts are a feat of plant engineering that prove a unique means to greatly increase the efficiency of photosynthesis," said RIPE Director Stephen Long, the Ikenberry Endowed University Chair of Crop Sciences and Plant Biology at Illinois.

The team engineered three alternate routes to replace the circuitous native pathway. To optimize the new routes, they designed genetic constructs using different sets of promoters and genes, essentially creating a suite of unique roadmaps. They stress tested these roadmaps in 1,700 plants to winnow down the top performers.

Over two years of replicated field studies, they found that these engineered plants developed faster, grew taller, and produced about 40 percent more biomass, most of which was found in 50-percent-larger stems.

The team tested their hypotheses in tobacco: an ideal model plant for crop research because it is easier to modify and test than food crops, yet unlike alternative plant models, it develops a leaf canopy and can be tested in the field. Now, the team is translating these findings to boost the yield of soybean, cowpea, rice, potato, tomato, and eggplant.

"Rubisco has even more trouble picking out carbon dioxide from oxygen as it gets hotter, causing more photorespiration," said co-author Amanda Cavanagh, an Illinois postdoctoral researcher working on the RIPE project. "Our goal is to build better plants that can take the heat today and in the future, to help equip farmers with the technology they need to feed the world."

While it will likely take more than a decade for this technology to be translated into food crops and achieve regulatory approval, RIPE and its sponsors are committed to ensuring that smallholder farmers, particularly in Sub-Saharan Africa and Southeast Asia, will have royalty-free access to all of the project's breakthroughs.

Source: Claire Benjamin, RIPE Project

We need YOU!

Please submit content (science highlights, suggested links, personal stories, etc) to ASP News. Email: jflovell@buffalo.edu or Huang.Huang-Chiao@mgh.harvard.edu

Scientists Capture Photosynthesis in Unprecedented Detail

Grab some popcorn: Lawrence Berkeley National Laboratory (Berkeley Lab) scientists have succeeded in capturing a more detailed picture than ever of the steps in the reaction mechanisms in photosynthesis, the process by which plants use sunlight to split water and produce oxygen while making the carbohydrates that sustain life on Earth.

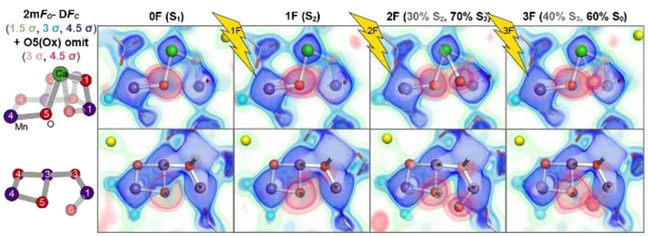
"It's like a molecular movie," said Vittal Yachandra, one of the lead scientists on the study. "We're collecting more and more of these snapshots. The idea is eventually to have a continuous story of how water is split into oxygen, and how plants do that using sunlight."

The study was published in Nature and included an international team of researchers from Berkeley Lab, SLAC National Accelerator Laboratory, Humboldt University of Germany, Umeå University and Uppsala University of Sweden, and the Diamond Light Source in the UK.

"We hope a better understanding of photosynthesis and the guiding principles we learn from these studies can then be applied to develop artificial photosynthetic systems, which is a way to produce fuels from sunlight, water, and carbon dioxide," said Junko Yano, also one of the lead scientists.

The team used SLAC's Linac Coherent Light Source (LCLS) X-ray laser to capture atomic-scale images of Photosystem II, a protein complex found in plants, algae, and cyanobacteria responsible for splitting water, in action. Berkeley Lab's Advanced Light Source (ALS), a particle accelerator that generates bright beams of X-ray light, was essential for optimizing the crystals for the X-ray laser experiments.

Two years ago, the scientists – led by Yano, Jan Kern, and Yachandra in Berkeley Lab's [Biosciences Area]() – forged a technique to capture two steps of the water-splitting cycle. In the latest study they used the same technique, which took years to develop, to capture six images in the process with more detail than ever before – three times more data in each snapshot, to be precise. Berkeley Lab Biosciences researchers Nicholas Sauter and Paul Adams, also co-authors of the paper, developed critical software and algorithms that provided a completely new way of analyzing the data from the X-ray laser.



First frames of a movie of the water oxidation reaction in nature: Light-induced changes observed at the Mn cluster of photosystem II as it goes through its catalytic cycle. (Credit: Berkeley Lab)

"Previously the picture was more blurred and it was difficult to see details," said Kern, lead author of the new study. "Now we have a sharper picture for these six steps. We estimate that if we get another five or 10 snapshots along the last step in the reaction, that will really tell us what is going on in detail."

Added Yano: "In 2016 we showed we could see structural details that are useful. Now we have several frames of the movie where we can see the details of the chemistry taking place in real time."

Source: Lawrence Berkeley National Laboratory

Upcoming Photobiology Events

39th American Society for Laser Medicine and Surgery Annual Conference
March 27-31, 2019, Denver CO.
https://www.aslms.org/annual-conference-2019

IPA World Congress.
June 28-July 4, 2019, Boston
https://www.ipaboston2019.org

Photosynthesis Gordon Research Conference.
July 21-26, 2019, Newry, ME.
http://www.grc.org/photosynthesis-conference/2019

17th International Congress on Photobiology & 18th Congress of the European Society for Photobiology,
Aug 25-30, 2019: Barcelona, Spain
http://www.iuphotobiology.org

ASP NEWS

Published Quarterly by the American Society for Photobiology
www.photobiology.org

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