ASP NEWS

Connect

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IN THIS ISSUE

President's Note

Dear Colleagues and Friends,

I hope you and your families are healthy and well. I am pleased to provide a note for the Winter newsletter, with updates on our winter council meeting, committee activities, postponed biennial meeting, special issues in *Photochemistry and Photobiology*, and other information.

We recently held a winter council meeting, and as always it has been wonderful to work with councilors, associate councilors, and officers of the ASP. My thanks go out to Mauricio Baptista, Theresa Busch, Houston Cole, Shobhan Gaddameedhi, Yu-Ying He, Joe Huang, Shakeela Jabeen, Masaoki Kawasumi, Dae Joon Kim, Verónica Bahamondes Lorca, Jonathan Lovell, Sherri McFarland, Girgis Obaid, José Robinson-Duggon, Martin Schnermann, Caradee Wright, Xiaojing Yang, Youngjae You, and Shiyong Wu. I also thank Associate Councilor Paul O'Mahoney for his efforts as he is now rotating off. In addition, I wish to thank the Editor-in-Chief, Jean Cadet, ASP Headquarters (Brett Burk, Jill Drupa, Lori Strong, Amy Sullivan, and Amy Wride-Graney), and also our assistant editor at Wiley (Andy Maldonado).

ASP Online Resources for Educators and Students Committee. My thanks go out to Caradee Wright, Huang (Joe) Chiao Huang, and Ruediger Birenheide for their efforts in maintaining the ASP website. The former *Photobiology for Kids* portion of the website has been reestablished as an

ASP Online Resources for Educators and Students site. There are links to a number of resources and programs, which are designed to engage students and professionals in our field. Further enhancements to the educators' portion of this website are also underway.

ASP Social Media Committee. I wish to thank Shakeela Jabeen and Houston Cole for their help managing some of the social media platforms of the ASP, publicizing upcoming webinars, newsletters, and journal articles from *Photochemistry and Photobiology*. Links to chapters of *Photobiological Sciences Online (PSO)* are added every two weeks (photobiology.info). Tabulations of social media statistics were also carried out by the committee and show a high usage of *PSO* on Twitter, Facebook, and LinkedIn.

Awards Committee. I am thankful to Xiaojing Yang of the *Awards Committee* for her efforts in chairing this committee, and for encouraging graduate students and postdoctoral fellows to apply for awards. The procedures for nominations and submission of materials are available on our website (https://photobiology.org/awards/):

Award categories include:

- ASP Research Award
- ASP New Investigator Award
- ASP Light Path Award
- ASP Editor's Student Research Award
- ASP Urbach Student Travel Award

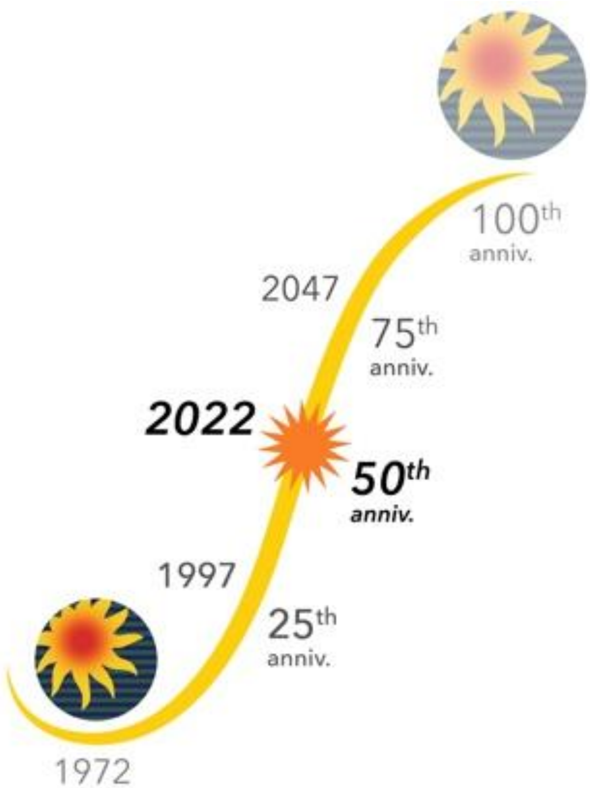
which will be presented at our ASP Biennial Meeting.

ASP Biennial Meeting. I regret to inform you that our April *ASP Biennial Meeting* in Albuquerque had to be canceled. Sadly, this represents the second of our biennial meetings that has been canceled due to the pandemic. We are planning for a possible meeting date in fall (possibly in September), and thus a new deadline for the submission of abstracts is August 1, 2022. I hope will work out as I look very much forward to seeing you. I will be happy to answer questions that you may have. Please also feel free to contact ASP Headquarters with additional questions, such as questions about hotel reservations and refunds: Amy (awride-graney@burkinc.com), Jill (jdrupa@burkinc.com), and Lori (lstrong@burkinc.com). Some updates to the microsite are still needed and are forthcoming. My thanks to Amy, Lori, Cooky, Ruedi, and Jill, for their help.

Past Presidents' Bridges-to-the-Future (BTTF) Symposium in 2022.

This year marks the 50th anniversary of the establishment of the American Society for Photobiology (https://photobiology.org/past-presidents-symposium-2022/). When we hold our

ASP Biennial Meeting, the 50th anniversary milestone will be celebrated with the BTTF symposium, which is being organized by Frank Gasparro and Albert Girotti. Plans will be to include the appearance of Dr. Kendric Smith (via Zoom), our founder and the first president of the ASP. To date, $10,000 has been raised for the symposium from past presidents and an industrial donor. These donations will provide for awards to three high school students. They will travel to the ASP meeting and be presented with Gold, Silver, and Bronze awards; the Gold winner will deliver a talk. As you can see from the image below, we are not only looking at the past fifty years, but we are also looking well into the future!



Happily, we are still holding webinars on the first Thursday of each month at 1:00 pm EST. I am grateful for the efforts of Shobhan Gaddameedhi and Masaoki Kawasumi on the *ASP Monthly Webinar Committee*. Our 13th ASP webinar will be on Thursday, March 3, 2022 from 1:00–2:00 pm EST, featuring David E. Fisher (Department of Dermatology, Massachusetts General Hospital, Harvard Medical School). The title of his talk will be "Melanocytes and pigmentation: targets and participants in photobiological signaling."

These webinars are meant to facilitate communications among photoscience researchers. The ASP Webinars are live sessions via virtual conference platform, including 45-min presentation and 10-min Q&A. ASP members and non-members can join the webinars with free registration. The webinars are then recorded and placed behind the ASP member wall, and thus we strongly encourage you to become an ASP member. Also, we welcome sponsors for our webinar series.

We look forward to an exciting year of webinar presentations in 2022. It is our hope that these ASP Webinars will attract more researchers to ASP and facilitate active discussion of photoscience research. For more information, please visit the webinar webpage: https://photobiology.org/webinars/

I am also grateful to Martin Schnermann, Girgis Obaid, and Youngjae You of the *Publications*

Committee. They are helping to promote our journal, with the intention to recruit submissions more broadly. One initiative to encouraging submissions to *Photochemistry and Photobiology*, the journal of the ASP. *Photochemistry and Photobiology* publishes a range of topics. including photodynamic therapy, photothermal therapy, photosynthesis, photobiomodulation, and a host of other subjects, such as fluorescent imaging probes. I am pleased to also note that a publisher's contract has been renewed with Wiley; my thanks to Brett Burk for his help with this.

I am delighted to inform you of the launching of the *Latin American branch of ASP (LatASP)*. I was delighted to work with Mauricio Baptista, José Robinson-Duggon, Verónica Bahamondes Lorca, and Andrés Thomas on this initiative. Council voted to approve the formation of *LatASP*, and the initiative was conducted in parallel with Dae Joon Kim and Verónica Bahamondes Lorca of the *ASP Membership Committee*, in their efforts in recruiting the membership of young faculty, postdocs, and students to foster their participation in the ASP. Related to this topic, the Executive Council is discussing the investment of a percent of unrestricted reserves of ASP per year toward growing the society and especially growing membership of younger photoscientists.

Update on special issues in *Photochemistry and Photobiology*. A special memorial issue for Karen Brewer in *Photochemistry and Photobiology* has appeared (guest editors: Sherri McFarland and Phoebe Glazer); it is in the January/February issue Volume 98, Issue 1, November/December 2022, Pages: 4-126. A special retirement issue for Edward L. Clennan in *Photochemistry and Photobiology* has also appeared. This special issue is in Volume 97, Issue 6, November/December 2021, Pages: 1166-1455. I am delighted to report there are additional special issues in *Photochemistry and Photobiology* that are in progress and will be appearing in the near future. They include a special issue on photocaging technology (guest editors: Martin Schnermann and Youngjae You), and a special issue devoted to the scientific achievements of Jean Cadet (guest editors: Paolo Di Mascio and Richard Wagner) to appear in the May/June issue. Furthermore, a 50th anniversary issue for the *American Society for Photobiology* is underway and should appear in late 2022 or early 2023.

Upcoming meetings and webinar:

- VI GRAFOB (Grupo Argentino de Fotobiología) will be held from May 3-6, 2022 at Rosario, Santa Fé, Argentina (https://grupoargentinodefotobiologia.info/site/site/grupar/pluginfile.php/69/mod_label/intro/vi%20grafob-1era%20circular.pdf)
- 28th IUPAC Symposium on Photochemistry (called PhotoIUPAC2022) will be held from July 17-22, 2022, at the Roeterseilandcampus of the University of Amsterdam, The Netherlands. (https://photoiupac2022.amsterdam/)
- A new monthly webinars series has been launched by the PanAmerican Society for Pigment Cell Research (PASPCR), which will take place on the third Tuesday of each month at 3:00-4:00 pm EST. Dr. Jonathan Zippin of the PASPCR is assisting with this series (jhzippin@med.cornell.edu).
- A day long symposium honoring the career and accomplishments of Michael Kasha will be held at the 263rd ACS National Meeting in San Diego, CA on March 23rd with a celebratory cocktail reception following the lectures. Ashley Arcidiacono is assisting with this celebration (ama18k@my.fsu.edu).

Lastly, we welcome sponsors for not only our symposia and meetings, but also our webinar series. Feel free to contact Amy Sullivan at ASP Headquarters if this opportunity interests you (email: sponsors@photobiology.org). Also, feel free to contact me with any general or specific questions that you may have.

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Meet a Photobiologist

Dr. José Robinson Duggon

Q: How did you become a photobiologist?

A: During my undergraduate studies in Panama, I carried out a research project involving isolation of various carotenoids, as we were interested in their role in photosynthesis. I then received Fulbright scholarship to carry out research on photoprotective effects of xanthophylls at the University of Connecticut. I subsequently finished my PhD in Chile, in the field of Cucurbiturils as drug delivery systems for photodynamic therapy applications.

Q: And what is your group working on now?

I returned to Panama in 2019, to the University of Panama to set-up my own lab, where I am currently the head of the Biochemistry Department. We recently secured a grant to study encapsulation of photosensitizers. I have ideas for manipulating host-guest chemistry to improve photosensitizer singlet oxygen yield, biodistribution and also activation. In addition, we are interested in studying light for creating reactive oxygen species to degrade microplastics. I am interested to look at application of PDT to tropical diseases such as Chagas disease.

Q: Is there a lot of photobiology research going on in Panama?

A: There are not many other scientists working on PDT. However, Panama is home to the Smithsonian Tropical Research Institute, which is an international research center that includes focus on photosynthesis and ecology.

Q: What are your thoughts on the ASP?

A: Although I have only been involved for a short time, I am now a council member of the ASP. I will do everything I can to motivate and spread photobiology to Panama and Central America. I would like to contribute as an active member of the ASP in making a bridge between North and South America for the young photoscientists in Central America, so our region could begin the process of integrating with colleagues that have a long tradition of active participation in the ASP. I think we need to concisely be able to inform people about photobiology, what it is, what it is used for, and why it is important.

Q: How do you see the field of photobiology moving forward?

Within my research area, there is still a lot of work to be done. Specifically, for PDT, in biodistribution, bioaccumulation and enhancing the singlet oxygen generation to improve the overall performance of photosensitizers used for PDT. In general, as photobiologist, we need to work more on different outreach programs to educate and disseminate knowledge about photobiology to the public and to other scientists.

Latin American branch of ASP (LatASP)

Mauricio Baptista, José Robinson-Duggon, Verónica Bahamondes Lorca, Alexander Greer, and Andrés Thomas

Several countries in Latin America, such as Argentina, Brazil, Chile, Mexico, Panama, and Uruguay, have universities with long traditions in research and high-quality Ph.D. degree programs. This has led to well-developed scientific communities in these countries. In addition, research is rapidly growing in several countries of Central America, the Caribbean, and Colombia. In the last two decades research productivity in photochemistry and photobiology has risen exponentially in Latin America, and now there are a number of internationally recognized groups investigating in topical areas of high impact in the photosciencces. These research groups regularly come together for several scientific meetings, where the biannual meeting of the Argentine group of Molecular Photobiologists (GRAFOB) and the Latin American congress on Photochemistry and Photobiology (ELAFOT) are likely the most relevant. Photochemistry & Photobiology journal has published special issues dedicated to the two last ELAFOT meetings. These conferences bring together around two hundred people, including participants from North America and Europe. They are all connected through both website and virtual meetings. However, there is no a formal Latin American society for photobiology.

Academic activities have nonetheless flourished in South-South and North-South collaborations. In particular, there are many successful collaborations and partnerships between research groups from North America and Latin America, many of them in the frame of programs of official institutions. In the past several years, there has been a steady increase in the participation of researchers from Latin America, in the ASP council, in ASP committees (including the Membership Committee), and in appointments of associate editors of Photochemistry & Photobiology.

Taking the above into account, the creation of a Latin American Society for Photobiology within the ASP was considered and formally approved by ASP council members. The idea has grown stronger, gained shape, and now is a concrete project supported by many scientists of the society. The Latin American branch of the ASP has now been launched, joining together research groups with place of work in Latin America and embracing a wide range of topics. The new branch will be identified with the acronym LatASP. Its main aim will be to expand the society to the South, with a Pan American perspective, which will favor the integration of valuable research groups from Latin American to the ASP, providing an enabling environment for new cooperation.

Dr. Hasan wins another award

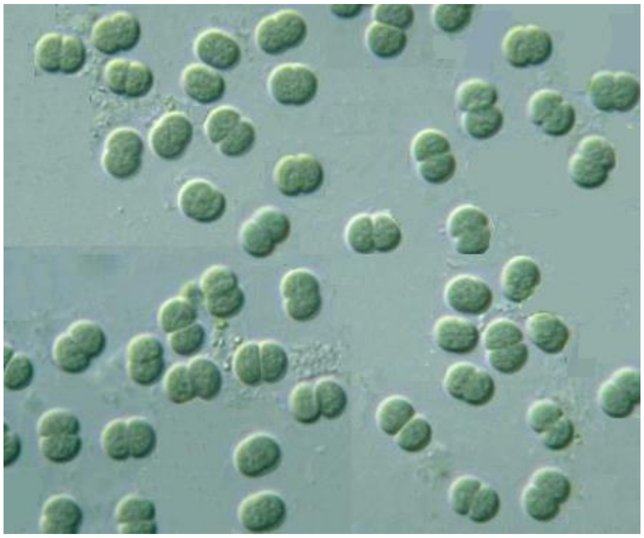
Tayyaba Hasan has won an award medal for Excellence in Photobiological Research,

We are delighted to report that Dr. Tayyaba Hasan has received a medal of recognition from the European Society for Photobiology: a 2021 Award for Excellence in Photobiological Research at their virtual Biennial Congress held September 2, 2021.

The Executive Committee of the ESP awards this medal to distinguished scientists whose research achievements in Photobiology are internationally acknowledged as outstanding and who have given crucial contributions to ESP activities.

Tayyaba Hasan, PhD, is a Professor of Dermatology and Professor of Health Sciences and Technology (Harvard-MIT) at the Wellman Center for Photomedicine, Harvard Medical School, Massachusetts General Hospital with over 35 years of experience in biomedical science. The focus of her research is in Photochemistry-based basic and translational biomedical sciences. The primary areas are the development of mechanism-informed combination therapies for cancer with expertise in photodynamic therapy (PDT) of cancer and non-cancer pathologies, development of in vitro and in vivo cancer models, associated immunotherapies and fluorescence imaging and diagnostics. She served as ASP President in 2010-2011 and has been an active member since 1982.

Photosystem II breakthrough



A Yale-led team of chemists has unveiled the blueprints for a key enzyme that may contain design principles for a new generation of synthetic solar fuel catalysts.

The research, led by Yale's Gary Brudvig and Christopher Gisriel, uses cryo-electron microscopy on a microorganism called *Synechocystis* to get an extreme close-up picture of Photosystem II, the enzyme in photosynthesis that uses water as a solar fuel, enabling researchers to observe how the enzyme works.

The study, [which appears in the journal Proceedings of the National Academy of Sciences](), was co-authored by researchers from the University of California-Riverside, Boston College, and City University of New York.

Photosynthesis is the mechanism by which plants and certain microorganisms, like *Synechocystis*, use sunlight to synthesize food from carbon dioxide and water — and fill the atmosphere with oxygen as a byproduct. At the heart of photosynthesis is Photosystem II, an enzyme that oxides water molecules, taking away their electrons to use as fuel.

Scientists have long sought ways to mimic this process to create more efficient solar fuel catalysts, by studying Photosystem II from *Synechocystis*. But without a clear picture of Photosystem II's molecular structure in *Synechocystis*, it has been challenging for scientists to understand the results of their experiments.

Previous work led by Yale created a snapshot of Photosytem II from *Synechocystis* in an "immature" stage, before the enzyme was capable of water oxidation. That work allowed the researchers to better understand how the enzyme is built.

In the new study, the researchers were able to see the enzyme in *Synechocystis* in its mature, active form, with all of the protein subunits and activity that is present during water oxidation. The observation, made possible by cryo-electron microscopy technology at Yale's West Campus, offers one of the closest, most detailed looks ever accomplished for Photosystem II in *Synechocystis*.

"At this resolution, we can see amino acids, small-molecule co-factors, and water molecules that are used in the mechanism of water oxidation," said Brudvig, the Benjamin Silliman Professor of Chemistry in the Faculty of Arts and Sciences and director of the Energy Sciences Institute at Yale's West Campus. Brudvig is the study's corresponding author.

With this new, up-close view of Photosystem II from *Synechocystis*, the researchers say they'll be able to introduce tiny changes to the enzyme — such as mutating individual amino acids — to see how those changes affect the enzyme's function.

"The main goal is to understand the chemistry of water oxidation," said Gisriel, a postdoctoral associate in chemistry and the study's first author.

-Yale News

Insight into far red photosynthesis

A team of researchers led by Penn State scientists has identified the location of changes in the photosynthetic apparatus of some cyanobacteria — formerly known as "blue-green algae" — that allow the organisms to grow using far-red light. Using high-resolution cryo-electron microscopy (cryo-EM), the researchers pinpointed locations in two photosystem complexes within the cyanobacteria that incorporate alternate versions of chlorophyll pigments. These alternates are attuned to longer wavelengths, which allows the cyanobacteria to efficiently use far-red light to perform oxygen-evolving photosynthesis. Considering that the energy available in far-red light is equivalent to 15% of total solar radiation reaching Earth, this ability gives these organisms an advantage in competing with plants and other cyanobacteria for light for photosynthesis.

The structures are described in two papers appearing online in the Journal of Biological Chemistry and could eventually help researchers engineer crop plants that can use a broader wavelength spectrum of light for growth.

"If you would have asked me 10 years ago if you could grow most cyanobacteria in far-red light, I would have laughed," said Donald A. Bryant, Ernest C. Pollard Professor in Biotechnology and professor of biochemistry and molecular biology at Penn State, and the leader of the research team. "But it turns out that if you put them in far-red light, some cyanobacteria activate a set of about 20 genes that allow them to modify their photosynthetic apparatus and the chlorophylls that they produce so that they can use far-red light for photosynthesis. Since making that discovery in 2013, we have been trying to understand how that works."

Cyanobacteria are bacteria that obtain energy through oxygen-producing photosynthesis and are found almost everywhere, including extreme environments like hot-springs, deserts, and polar regions. They are among the oldest organisms on Earth, and their ability to produce oxygen through photosynthesis is thought to have been important to change in the early Earth's atmosphere that paved the way for the evolution of diverse and complex life forms. They are also important model organisms, with potential applications for bioethanol production, as dietary supplements, and as food colorings.

When grown under normal, "white" light conditions—that is, visible light, which ranges from violet light with a wavelength of about 400 nm to red at 700 nm — cyanobacteria harvest that light using mainly chlorophyll a, which absorbs light with wavelengths up to a maximum of about 700 nm. When grown in far-red light (up to about 800 nm), some terrestrial cyanobacteria convert a portion of that chlorophyll a into chlorophylls d and f, which absorb longer wavelengths of light. These alternative forms of chlorophyll give such organisms the ability to harvest far-red light and use it efficiently for photosynthesis, which allows those cyanobacteria to thrive in low- or filtered-light environments, such as occurs under plants or trees.

Structures of photosystem I (right) and photosystem II (left) from cyanobacterial cells grown in far-red light. Two new studies identified the locations of changes in these complexes that allow the cyanobacteria to use far-red light for photosynthesis. When grown in far-red light, cells replace several molecules of chlorophyll *a* with chlorophyll *f* (pink glow) in the photosystem complexes and a single chlorophyll *a* is replaced with chlorophyll *d* in photosystem II (red glow). This single chlorophyll *d* molecule is the functional center of photosystem II and is the site where light triggers the electron transfer that initiates the process of water oxidation to produce oxygen. Credit: Girsiel, et al. JBC 297, 101408 and Gisriel, et al. JBC 297, 101424.

"We knew from isolating and characterizing the complexes that photosystem I contains 7 to 8 chlorophyll f molecules, and that photosystem II contains one chlorophyll d molecule and 4 to 5 chlorophyll f molecules, along with about 90% of the original chlorophyll a, so we wanted to know where those changes occurred in the complexes," said Bryant. "One way to figure that out is to determine the structure of the complexes, but because they are so large and complex — and the chemical differences are so minor — it was extremely challenging."

The photosystem I and II complexes are very difficult to crystallize — because they are very large, membrane-bound complexes — so X-ray crystallography, a standard laboratory method for determining the three-dimensional structures of molecules, was not likely to work. The researchers then turned to cryo-EM, but the tiny differences between the forms of chlorophyll molecules stretched the limits of cryo-EM resolution to detect. The chlorophylls differ at only a few atoms of similar mass.

Most of the time, the oxygen atoms are tied up in hydrogen bonds, so the researchers can look for hydrogen-bond donors that are close to the right places in the chlorophyll molecules. By applying this method and others to the structures determined using cryo-EM, they were able to identify the locations of chlorophyll f molecules in the two photosystem complexes and the position of the single chlorophyll d molecule in photosystem II as well.

"Identifying the structural basis for how this far-red light-absorption occurs in nature is an important step forward," said Gisriel, first author of both studies. "The identification of the precise locations in the photosystem I and II complexes where the alternate forms of chlorophyll are incorporated could open up the doors for exciting future applications. For example, crops could potentially be engineered to harvest light beyond the visible spectrum. In addition, two crops could potentially be grown together, with shorter crops, using the filtered far-red light from their shaded locations beneath taller crops. Alternatively, plants could be grown closer together because of better light capture in the leaves beneath the canopy."

In addition to Bryant and Gisriel, the research team for the first paper, titled "Structure of a photosystem I-ferredoxin complex from a marine cyanobacterium provides insights into far-red light photoacclimation," includes, David A. Flesher, Gaozhong Shen, Jimin Wang, Ming-Yang Ho and Gary W. Brudvig. Funding was provided by the U.S. National Science Foundation and the U.S. Department of Energy, Office of Basic Energy Sciences, Division of Chemical Sciences.

The research team for the second paper, titled "Structure of a monomeric photosystem II core complex from a cyanobacterium acclimated to far-red light reveals the functions of chlorophylls d and f," includes Gaozhong Shen, Ming-Yang Ho, Vasily Kurashov, David A. Flesher, Jimin Wang, William H. Armstrong, John H. Golbeck, M.R. Gunner, David J. Vinyard, Richard J. Debus and Gary W. Brudvig.

-source: PSU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