ASP NEWS

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President's Note

It is my pleasure to extend my warm greetings to all of you wishing you a Happy and Eventful New Year 2017.

After our society's successful and well-received biannual meeting held in Tampa, May 21-26 last year, 2017 offers the opportunity to follow up with a number of ASP signature events including:

- 1st ASP Presidential Symposium, San Diego, CA, April 6-7, 2017, and online abstract submission is now open until February 20. For more information please follow the following weblink: http://www.photobiology.org

- Preparations for our 2nd ASP Associate symposium to be held in summer 2017 are well on their way, and we will invite all associate members to contribute to the success of this event in the very near future.

ASP will also be well represented at the following international events that will take place during the course of 2017:

- 16th International Photodynamic Association, World Congress, Coimbra, Portugal, June 8-13, 2017; http://www.ipa2017.qui.uc.pt/

- 13th International Conference on Tetrapyrrole Photoreceptors of Photosynthetic Organisms (ICTPPO) will be held in Chicago, July 9-13, 2017; http://ictppo2017.org.uic.edu/

- 17th Congress of the European Society for Photobiology (ESP), Pisa (Italy), September 4-8, 2017; http://pisa2017.photobiology.eu

In addition, later in 2017 a very special event is planned celebrating the 50th anniversary of the society's flagship journal Photochemistry and Photobiology. As you might know, our journal has been published since 1962, and it is no overstatement that the journal has been instrumental in publishing breakthrough research that defined our field reaching far beyond our discipline.

Lastly, I would like to mention that we are already in the process of initiating preparations for our society's next vibrant biannual meeting to be held May 12-15, 2018, a photobiological signature event that will require the early engagement of our wonderful membership body. I will follow up with specific information on opportunities for engagement and leadership later this spring.

I very much hope that you share my excitement about these upcoming activities. Please do not forget to renew your ASP membership status or consider joining our great society in 2017. Feedback and suggestions etc. are always welcome.

With warm regards,

GEORG

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On the Staging of Conferences

Conference meeting sites

reasonably optimal

not so much

Groups of otherwise highly competent scientists can revert to more primitive states when confronted with unfamiliar problems. I recall back in the days of the 'Federation' meetings in Atlantic City when the dilemma of where to have dinner could pose a major challenge. Often, I had finished eating at a local place only to emerge and be confronted by the same group that had congregated on the Boardwalk 45 min earlier, still trying to decide on an acceptable site. 'That place any good?' I would often be asked.

A somewhat similar level of uncertainty can occur when the site for a scientific conference is being selected. My outlook is that the ideal site can be easily reached by direct flights from major cities, has some other nearby attractions if this will be turned into a family event, is adjacent to housing, with less expensive living arrangements for students. When I organized a meeting of the International Photodynamic Assn in 2009, this was at the Red Lion Hotel in Seattle. The city is easily accessible by air from anywhere; the hotel is a taxi ride from the airport with the meeting site actually within the hotel. For larger meetings, there is a convention center nearby.

I recall in this context, an ESP meeting in Padova which was notable for violating several of these rules. A memorable event involved a bus ride to a 'scenic view' for dinner, up a road clearly marked 'NO BUSES' in several languages. Since this was an evening event, the scenic view was strictly that of darkness. A somewhat less precarious example was the recent ASP meeting in Providence where the hotels were far from the conference site and, as someone remarked, it was 'uphill both ways'. San Diego was much less problematic, aside from the intrinsic level of entropy at the Hard Rock Hotel.

It is interesting to note in this regard that the next IPA meeting can only be reached (except for the locals) by a flight to Lisbon, a taxi ride to the train station, a 2 hr train ride and then another taxi to the suggested hotel which is one mile from the meeting (up a 'very steep' hill). It should be an adventure.

-David Kessel, PhD

Meet a Photobiologist

Irene Kochevar, Professor at Harvard Medical School. Former ASP president

Background: *Photochemical tissue bonding (PTB) is a light-initiated approach for tissue repair and modification. This technology involves, the application of a photosensitizing dye to the tissue and followed by light irradiation to induce photochemistry that crosslinks tissue proteins. Pilot clinical studies have already demonstrated PTB to be safe and effective for closing skin wounds, with less scarring compared to standard suture closure. Huang-Chiao Huang, Ph.D., newsletter editor of American Society for Photobiology, spoke with the Irene E. Kochevar, Ph.D. Professor of Dermatology at Harvard Medical School to discuss PTB, her research lab, and much more.*

ASP News: My name is Huang-Chiao Huang and I'm a Research Fellow at the Wellman Center for Photomedicine (WCP), Massachusetts General Hospital (MGH) and Harvard Medical School (HMS). Today, it's my pleasure to have a chance to talk to Irene Kochevar, who is a photochemist and biochemist; and she is a Professor of Dermatology at

Harvard Medical School and a senior faculty member at the Wellman Center for Photomedicine. Irene, thank you so much for being here today.

Irene E. Kochevar, Ph.D.: It's my pleasure to join you today.

ASP News: I appreciate it. Photochemical tissue bonding (PTB) is a sutureless repair method receiving increasing attention for a wide range of surgical applications. Today, we can first talk about some of the PTB work that is exciting to you right now.

Dr. Kochevar: My background is in photochemistry, and the driving force behind my research has always been trying to understand photochemistry in biological systems. What is exciting right now is that we are studying the mechanisms for PTB in tissue, actually cornea because it is transparent. The rose bengal photosensitizer we use associates very strongly with collagen (of the cornea), so really it is the photochemistry of rose bengal associated with collagen. Others have already shown that rose bengal forms dimers/trimers or other aggregates, so it's not just a single rose bengal molecule in solution that is being studied. Moreover, you have limited oxygen in tissue during PTB. Initially Type II (singlet oxygen) photochemistry may occur, and the tissue oxygen is consumed. Then the primary reaction is non-oxygen dependent. I think we are finally doing the studies that will help us understand what is going on in tissue at both molecular and microenvironment levels. So all that is very challenging and exciting and I believe that understanding the mechanisms will allow us to increase the efficiency of PTB, and shorten the time for clinical treatment. This leads to the other half what is exciting right now. There are a lot of the things that Dr. Robert Redmond and I have been working on for quite a while (maybe 10-15 years), and these PTB projects are now only one or two steps always from clinical applications. Most important now is finding clinicians who are committed enough to spend the time to do the studies, to really carry through in patients. Within two years I hope to see something happening in the clinic.

ASP News: There was a photochemical "nanosuture" technology company. In your opinion, what is the key to translating PTB into clinical practice? What are the potential promising applications, and would there be any benefit combining PTB with standard suturing techniques?

Dr. Kochevar: MGH licensed our photocrosslinking technology to a small company that, unfortunately, wasn't ready to go forward. The license is now back with MGH and we are looking at other commercial avenues, which seems to be moving along. In my opinion, the key to translating PTB into clinic boils down to getting the right clinical collaborator who is willing to drive the technology. Combining PTB with sutures is entirely appropriate. Applications like rejoining peripheral nerves will just be spectacular since typically, it takes 6-10 microsurgery sutures and more than an hour to repair a 2-mm diameter nerve. If you can combine PTB with just 2 sutures to achieve the same (or even better) outcome as using 6-10 sutures, you can save a lot of time. Also, for skin wound repair, deep sutures are used to bring the wound edges together. Then we use PTB to seal the surface

against the infection and reduce the scarring.

ASP News: Thank you for sharing your ongoing PTB work, which is very exciting with great clinical potential. Let's take a step back and talk about how did you become interested in science and how did you get involved in light-activated tissue repair.

Dr. Kochevar: I was always curious about natural processes. I like to grow plants and I am interested in biology. I guess it's really just pure curiosity, and it sort of went from biology to biochemistry to chemistry. In graduate school I joined a biochemistry program. However, I really wanted to learn more at the molecular level, and that motivated me to change into the chemistry major at Michigan State University, working in a lab of a young photochemist. After a Ph.D., I did a postdoc in New York and then took an industry job. The most important thing I learned in the industrial research laboratory is the reality of focusing on producing a real material. This was very different than investigating triple state chemistry, my Ph.D. training, which wasn't connected to a real life application.

After the industrial job, I was a postdoc with another photochemist at Columbia University. While there, I was introduced to research in the dermatology department on porphyria, a light sensitivity disorder. This began my interest in photomedicine. My first NIH grant was on UV-induced changes in cell membranes and I continued this work when I joined the Wellman Center. I was also interested in the drug phototoxicity, and I started looking at basic photochemistry of photosensitizers in cells. Our laser-assisted tissue repair studies started later with Dr. Robert Redmond. If I remember correctly, we were both inspired by Tom Flotte's interest in photothermal laser tissue welding and decided to use photochemistry, rather than heat, for light-activated tissue repair.

ASP News: What do you enjoy about running your own research lab? And as a former president for ASP, what is your advice to students and scientists considering a career in photochemistry and photobiology?

Dr. Kochevar: What I really like is the independence. You make it or fail on your own. The other part I enjoy the most is just really getting to know other scientists and collaborate with them. When you go to a meeting and talk to someone who is working on something very similar, suddenly all barriers disappear, even though you see the person once the year or email occasionally, and that is the real joy.

I think I would give the same advice to a person going into photochemistry and photobiology, as I would give to everyone. Find a problem or area that you are truly interested in. For example, if you think nanomedicine is really fascinating, and you must join that force. The struggles of research may not be worth it if you have no interest in the research field. I have always been interested in light, biology, and chemistry, which have been my driving forces. Also "find a great mentor", someone who can help you along the way; that is just so important. Photochemistry and photobiology are very applicable; you need to understand the fundamentals well, so that you can think in depth. If a new problem arises, you can easily draw on that source

of in-depth knowledge. Doing all things superficially might not get you really far.

ASP News: I am certain the students and postdocs will find your advice very helpful, and we thank you again for joining us today to talk about photochemical tissue bonding and your exciting research. If you would like to learn more about Dr. Irene E. Kochevar and her program, please find here website online at: http://wellman.massgeneral.org/faculty-kochevar-pi.htm.

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

Sunlight Energizes T cells

Georgetown University Medical Center researchers have found that sunlight, through a mechanism separate than vitamin D production, energizes T cells that play a central role in human immunity.

Their findings, published in Scientific Reports, suggest how the skin, the body's largest organ, stays alert to the many microbes that can nest there.

"We all know sunlight provides vitamin D, which is suggested to have an impact on immunity, among other things. But what we found is a completely separate role of sunlight on immunity," says Gerard Ahern, PhD, associate professor in the Georgetown's Department of Pharmacology and Physiology. "Some of the roles attributed to vitamin D on immunity may be due to this new mechanism."

They specifically found that low levels of blue light, found in sun rays, makes T cells move faster — marking the first reported human cell responding to sunlight by speeding its pace.

"T cells, whether they are helper or killer, need to move to do their work, which is to get to the site of an infection and orchestrate a response," Ahern says. "This study shows that sunlight directly activates key immune cells by increasing their movement."

Ahern also added that while production of vitamin D required UV light, which can promote skin cancer and melanoma, blue light from the sun, as well as from special lamps, is safer.

And while the human and T cells they studied in the laboratory were not specifically skin T cells — they were isolated from mouse cell culture and from human blood — the skin has a large share of T cells in humans, he says, approximately twice the number circulating in the blood.

"We know that blue light can reach the dermis, the second layer of the skin, and that those T cells can move throughout the body," he says.

The researchers further decoded how blue light makes T cells move more by tracing the molecular pathway activated by the light.

What drove the motility response in T cells was synthesis of hydrogen peroxide, which then activated a signaling pathway that increases T cell movement. Hydrogen peroxide is a compound that white blood cells release when they sense an infection in order to kill bacteria and to "call" T cells and other immune cells to mount an immune response.

"We found that sunlight makes hydrogen peroxide in T cells, which makes the cells move. And we know that an immune response also uses hydrogen peroxide to make T cells move to the damage," Ahern says. "This all fits together."

Ahern says there is much work to do to understand the impact of these findings, but he suggests that if blue light T cell activation has only beneficial responses, it might make sense to offer patients blue light therapy to boost their immunity.

The work appeared in Scientific Reports in December.

-source: Georgetown University Medical Center

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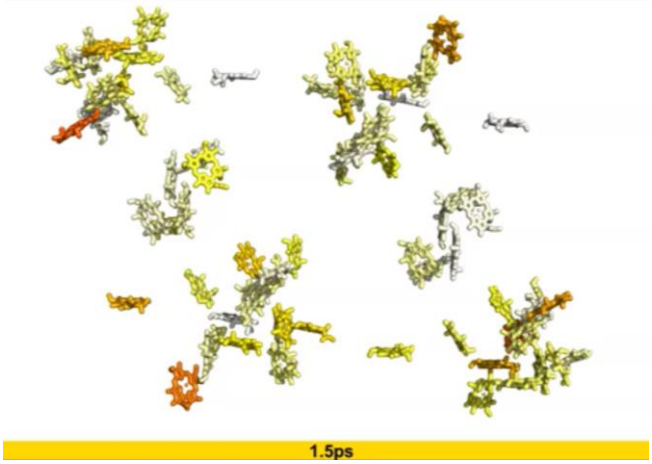
Measuring Energy Transfer in Photosynthesis

Using ultrafast imaging of moving energy in photosynthesis, scientists have determined the speed of crucial processes for the first time.

During photosynthesis, plants harvest light and, though a chemical process involving water and carbon dioxide, convert this into fuel for life. A vital part of this process is using the light energy to split water into oxygen and hydrogen.

This is done by an enzyme called Photosystem II. Light energy is harvested by 'antennae', and transferred to the reaction centre of Photosystem II, which strips electrons

from water. This conversion of excitation energy into chemical energy, known as ‘charge separation’, is the first step in splitting water.



It was previously thought that the process of charge separation in the reaction centre was a ‘bottleneck’ in photosynthesis - the slowest step in the process - rather than the transfer of energy along the antennae.

Since the structure of Photosystem II was first determined 2001, there was some suggestion that in fact it could be the energy transfer step that was slowest, but it was not yet possible to prove experimentally.

Now, using ultrafast imaging of electronic excitations that uses small crystals of Photosystem II, scientists from Imperial College London and Johannes Kepler University (JKU) in Austria have shown that the slowest step is in fact the process through which the plants harvest light and transfer its energy through the antennae to the reaction centre.

The new insights into the precise mechanics of photosynthesis should help researchers hoping to copy the efficiency of natural photosynthesis to produce green fuels.

Study author Dr Jasper van Thor said: “We can now see how nature has optimised the physics of converting light energy to fuel, and can probe this process using our new technique of ultrafast crystal measurements.

“For example, is it important that the bottleneck occurs at this stage, in order to preserve overall efficiency? Can we mimic it or tune it to make artificial photosynthesis more efficient? These questions, and many others, can now be explored.”

Although the researchers could determine which step is faster, both steps occur incredibly quickly – the whole process takes a matter of nanoseconds (billionths of a second), with the individual steps of energy transfer and charge separation taking only picoseconds (trillionths of a second).

The team used a sophisticated system of lasers to cause reactions in crystals of Photosystem II, and then to measure in space and time the movement of excitations of electrons – and hence the transfer of energy – across the antennae and reaction centre.

The resulting movie of the movement of excited electrons across minute sections of the system revealed where energy is held and when it is passed along. This proved that the initial step of separating charges for the water-splitting reaction takes place relatively quickly, but that the light harvesting and transfer process is slower.

Dr van Thor added: “There had been clues that the earlier models of the bottleneck of photosynthesis were incorrect, but until now we had no direct experimental

proof. We can now show that what I was lectured as an undergraduate in the 1990s is no longer supported."

The work appeared in Nature Communications.

-source: Imperial College London

Upcoming Photobiology Events

March 2, 2017

26th Annual Meeting of the Photomedicine Society

Orlando, Florida

http://www.photomedicine.org/currentmeeting.php

April 5-9, 2017

American Society for Laser Medicine and Surgery 37th Annual Conference

San Diego, California

https://www.aslms.org/annual-conference

April 6-7, 2017

2017 ASP Presidential Symposium

San Diego, California

http://photobiology.org/wp/

June 8-13, 2017

16th International Photodynamic Association World Congress

Coimbra, Portugal

http://www.ipa2017.qui.uc.pt

July 16-21, 2017

Gordon Conference: Photosynthetic Plasticity: From the Environment to Synthetic Systems

Sunday River, Maine

https://www.grc.org/programs.aspx?id=11914