ASP NEWS

AMERICAN SOCIETY FOR PHOTOBIOLOGY

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IN THIS ISSUE

President's Note

Dear ASP members and friends,

It is my pleasure to extend my warm winter greetings to all of you.

Here are a number of exciting developments that all ASP members and friends should be aware of:

1. As you know, the upcoming ASP meeting is scheduled for 12-15 May 2018, Tampa Marriott Waterside Hotel & Marina, a breathtaking venue with all state of the art accommodations ensuring an enjoyable and productive meeting.

Visit our conference mini-website for complete and continuously updated information: http://photobiology.org/2018minisite/

Importantly, abstract submission (deadline March 14, 2018) and registration (early registration deadline April 12, 2018) are now open.

Moreover, you can download our preliminary program.

2. In March 2018, all ASP members will have the opportunity to elect a number of ASP officers. Specifically, two new council member positions will have to be filled. In addition, ASP members will vote for a secretary, and most importantly, a new President-Elect. Tenure of new ASP officers will start at the end of the Tampa meeting, May 15, 2018. Instructions for (self)-nominations will be sent out soon, together with a detailed timeline of the upcoming election process.

3. In early March, ASP members and friends will receive a call for 'ASP award' nominations identifying deserving individuals that have excelled serving our society and our scientific discipline to be honored during our Tampa meeting in May. The newly assembled awards committee (members: Sherri McFarland, Tadeusz Sarna, Lisa Kelly, Huang-Chiao (Joe) Huang, Bryan Spring, Jonathan Lovell, Giuliano Scarcelli, Georg Wondrak, Yu-Ying He, David Kessel, Thierry Douki) will be chaired by Imran Rizvi.

4. We are also already moving forward with early preparations to identify a location for our society's biannual meeting in 2020 !

I very much hope that you share my excitement about these recent developments and activities, and I will be happy to welcome all of you to a vibrant ASP 2018 meeting in Tampa.

As always, feedback and suggestions are quite welcome.

best regards
GEORG

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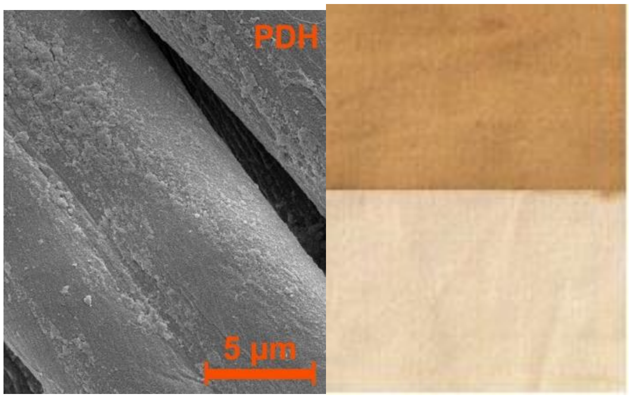
P&P: Solar Self-Cleaning Cotton

There has been demand for self-cleaning materials in different aspects of human life. In recent past, these materials have proven their importance in applications like self-cleaning window glasses and floor tiles. Development of self-cleaning textiles is the next step in this direction. Such self-cleaning textiles could not only save a lot of water and chemicals used in cleaning, but also save the environment from the effluent load generated during cleaning of textiles.

Generally, textile surface treated with photo-catalysts like TiO_2 utilize sunlight to decompose dust, dirt and other stains from it. In presence of light of appropriate energy, excitation of photo-catalyst produces electrons and holes. The photo-excited electrons and holes can rapidly reduce the atmospheric oxygen and water to generate superoxide radicals (O_2•−) and hydroxy free radicals (•OH). These radicals are highly reactive and hence can take part in decomposition of dust, dirt and other organic stains present on textile surface.

A recent report in Photochemistry and Photobiology, the official journal of the ASP (*Development of Cotton Fabrics with Durable UV Protective and Self-cleaning Property by Deposition of Low TiO2 Levels through Sol-gel Process*, Mishra and Butola, P&P, DOI:10.1111/php.12888, 2018) demonstrates the development of wash durable self-cleaning cotton fabric after deposition of a thin coating of TiO_2 on its surface. A low amount of TiO_2 on fabric surface via sol-gel method and a subsequent hydrothermal treatment was able to reduce the color strength of the coffee stain by more than 80%. These cotton fabrics also had a UPF rating of 50+ which is considered excellent. Moreover,



Self-cleaning ability of TiO_2 treated stained cotton fabric (before and after exposure of light)

these properties were attained at TiO_2 levels of less than 0.1 % on fabric weight basis and the impact of TiO_2 deposition on fabric tensile strength and air permeability was marginal. The image above shows fine deposition of TiO_2 on a cotton fiber (left) reduction is coffee stain color when exposed to sunlight for 8 hours (right).

-B S Butola

Meet a Photobiologist

Laser tissue welding (LTW) is a light-initiated approach for tissue approximation. This technology involves light activation of an absorber to generate localized heat that facilitates interdigitation of soft tissue at the molecular level, achieving an immediate fluid-tight seal. Over thirty years of preclinical and clinical studies have already demonstrated LTW to be effective for closing wounds and to create liquid-tight seals with several other advantages, compared to standard suturing and stapling techniques. Huang-Chiao Huang, newsletter co-editor for the American Society for Photobiology, spoke with his former Ph.D. Advisor Dr. Kaushal Rege, Professor of Chemical Engineering at Arizona State University (ASU), Tempe to discuss LTW, his research lab, and much more.

Kaushal Rege, Arizona State University

Q: You are trained in Chemical Engineering. Can you tell us your journey to become a Photobiologist?

So a little bit about me is that I am trained as a Chemical Engineer. I am originally from India and completed my undergraduate education in India. I did my doctoral work in the field of biomolecule separations under the mentorship of Professors Steven M. Cramer and Jonathan S. Dordick at Rensselaer Polytechnic Institute (RPI) where I learned quantitative analyses and scientific thinking at the molecular level. It was also a time when nanotechnology was emerging as a breakthrough area in science. I started to learn about nanomaterials, particularly about carbon nanotubes, from my colleagues and collaborators. When I moved to work with Prof. Martin L. Yarmush, MD, Ph.D., at the Center for Engineering in Medicine (CEM), Massachusetts General Hospital, Shriners Hospital for Children, and Harvard Medical School in Boston, I brought my molecular-level thinking, but now to different kinds of problems. Specifically, I focused on prostate cancer and delivering peptide drugs using molecular conjugates. It was for that project that I received a fellowship from the Congressionally Directed Medical Research Programs (CDMRP) of the Department of Defense (DOD). I also worked on stimuli-responsive nanoscale systems. During this postdoctoral training, I learned a lot about nanoparticles and drug delivery, and that where's my entry into Nanotechnology, Biomedical Sciences and Engineering began.

When it comes to photobiology, this was somewhat of a late entry in terms of my career. I did not do photobiology-related work as a graduate student or as a postdoctoral fellow. I started working in this area as an Assistant Professor at ASU, essentially with you, my former Ph.D. student Dr. Huang-Chiao Huang. My interest in nanotechnology and cancer was always there. The piece that got added on was the photothermal effect, and this is not alien to chemical engineers, as we often deal with heat (and mass) transfer. We are quite familiar with heat dissipation, thermal modeling and the use of heat. What gets me interested in the Photobiology field is how we can use heat and therefore the conversion from light to heat for killing cancer cells. I saw a lot of potential in the Cancer Photomedicine field. Of course, there were other people working in the area, but we saw some new opportiunities for original contributions at the molecular and nanoscale level. We first contributed to enhancing the stability of nanoparticles, making sure that the properties were maintained. So these were a lot of fundamental studies initially. Coming back to the heat transfer aspect, we also facilitated heat modeling to understand the system. So it was all, to some extent, a chemical engineer's view at photobiology to start with. Later, we worked on nanocomposites, for example using polypeptides (e.g. elastin-like polypeptide) embedded with gold nanorods. We envisoned the use of these nanocomposite materials not only as drug delivery platforms, but also as sealants for soft tissues. This is where my LTW research started. We saw an opportunity in a field that is truly multi-disciplinary, and can benefit from a synergistic combination of bioengineering and photobiology perspectives. At that time, we were well equipped and strong enough in these areas to make meaningful contributions. So that's how our journey in LTW started.

Q: Can you talk about the limitations and opportunities in the field of laser tissue welding?

There has been some very interesting work in laser-activated tissue sealing that has been done over the past three decades. The bottleneck continues to be the search for good materials that can seal rapidly, maintain the tissue mechanical strength, and hopefully, promote tissue repair and healing. From my understanding, there will likely not be one solution for all conditions or applications. The advantage of our library of nanocomposite materials is that you can achieve a fluid-tight sealing in a very short amount of time - a couple minutes or shorter, as our results showed that. We have tested our technology for sealing incisions in mice skin and showed that our nanocomposites perform better than conventional suturing, especially when it comes to immediate sealing. So in cases where the rapid tissue sealing is absolutely required, I think our material will be extremely useful. One of the issues is that the heat dissipation and control really need to be looked at carefully. Some studies have already implemented feedback control to minimize undesired normal tissue thermal damage. But again, the feedback control is based on materials that were likely not optimized. So we think the discovery of better materials to improve thermal management is essential for meaningful success. Several new materials are now available since the time of people focused on chromophore (dyes). For example, with the advances of imaging devices and nanotechnology, scientists have started investigating and characterizing nanoparticles more carefully and accurately. As a result, localizing the heat flow and controlling material and heat transport is easier and more precise, combined with newer aspects of properties from new materials.

Traditionally, suture and stables serve one function, which is mechanical approximation. Although some sutures have antibacterial properties, other multifunctional attributes are largely missing. Another particular advantage for LTW using nanocomposite materials is related to their multi-functionality for rapid sealing, preventing infection and light-triggered drug release, which are very useful for traumatic injuries. And there are other applications that our material would be very useful, such as improving the precision and lower the cost for microsurgery, which may not be easy to achieve using sutures or staples. Overall, I think the main limitation is finding the right kind of material for the right kind of application. And that has to come with repeated investigations (together with physicians and business people), which is what we are trying to do. In addition, it is critical to bring in some other engineering approaches not only for materials characterization and development, but also for thermal management, understating the system better, and of course, the standard investigation using ex vivo and in vivo models, including more relevant models as we move forward. I think it is this integration that will make the next step forward. I am not saying that has not happened at all, I think some parts have been looked into. However, a wholistic picture needs to emerge in this field for success in the clinic.

Q: What is your philosophy for mentoring and running a thriving research lab?

My philosophy is to be a facilitator. I view Ph.D. students as very creative individuals who may not have been introduced to do science in depth. As a result, my role is to train them to think deeply, to ask meaningful questions, to formulate hypotheses and test them. The other part of the training is to educate them on how to disseminate and communicate findings, typically by presenting research findings, submitting manuscripts and peer-review publications. Students (graduate, undergraduate, high school) and postdocs who come to me are often already motivated by scientific questions. There is oftentimes an element of self-motivation that brings them to my lab. This could be because of a personal story, a scientific curiosity, or a combination of these things. If these students have the motivation, that is more than half of the story, and then the subsequent point is to see what other factors are necessary to make them successful. Every individual has his /her own strengths and personality. Therefore, one particular mentoring style will not work for all. Without deviating too far from my own personality, I try to tailor the mentoring plan for each individual over a period of time. So the strengths are really amplified. I tell all my students the Ph.D. process is not just about doing the science, coming to the lab and writing the papers, to some extent it's about self-discovery – learning what are you good at (for example, experiments or modeling), can you write or think well, are you a hard worker, creative person, or both? There are so many things embedded in what we think may be mundane; ultimately, it is not just about “I'm going to stay in the lab for a few years and then get a Ph.D.” The very good student uses this period of time for at least some self-discovery. By the end of the period, they can be independent thinkers, not only about the science but also about themselves. They know what they are good at, what they can do well or when to look for help/collaborators. These intangible self-discovery processes are just as important as the scientific knowledge, and will together set them up for a successful career.

Q: What else do you enjoy doing besides science?

I am really fortunate to have a wonderful family. It's great to spend time with them and be involved in their pursuits. Balancing is sometimes tough, but it works for the most part. I play squash regularly and we have a core group of people that play together. As you know, I also learn Indian classical vocal music, and I am still a student there. I think everybody in academia needs to be a student of something so that we don't lose touch with how difficult things can be when one is learning in real-time. The complicated aspects that I encounter during my classical vocal lessons keep me humble and always keep me aware that a student may understand certain material easily, but there also might some things, big or small, that they can get stuck at. It is my duty to help them work at it. This is what I've learnt from my academic and music mentors. I think what helps me strive to be a better teacher is the fact that I am still a student. This has been very eye-opening for me.

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

P&P: Solar UV at the Ocean

Most people enjoy spending time on, or at the edge of, the ocean, especially during the summer months when appreciable areas of the body surface may be exposed. The coast is widely regarded to be a high-risk location for sunburn yet there exist confusing statements about just how significant solar UV radiation reflected from, and transmitted into, the sea is in terms of erythemal exposure.

In a recent paper in Photochemistry and Photobiology, the official journal of the ASP (*The solar ultraviolet environment at the ocean*. Mobley and Diffey, P & P, DOI:10.1111/php.12885, 2018), this subject was explored by using atmospheric and oceanic radiative transfer models to compute solar UV spectral radiances onto horizontal and vertical plane surfaces over water. The radiances were used to estimate erythemal exposures due to the sun and sky, as well as from radiation reflected by the sea surface and backscattered from the ocean.

The authors estimated that the contribution of UV radiation reflected from the ocean to the overall solar UV exposure of an upright human person at the ocean edge or on the open sea varies between about 10-20% depending on orientation with respect to the sun. In absolute terms, irrespective of the height of the sun in the sky and the direction a person is facing with respect to the sun, the contribution of surface reflected and backscattered UV radiation from the sea is never more than equivalent to a UV Index of 0.7. For a sunbather, who is lying supine on a beach or the deck of a boat, there is no contribution from UV radiation reflected from the ocean to their erythemal exposure.

There is little doubt that the seaside is a high-risk location for sunburn and it seems that the reason people get sunburnt at the coast has more to do with the absence of buildings or trees, which often block much of the sky in cities, than with reflectance by the water surface or even beach sand.

UV index values of 6 or more can be encountered by swimmers to depths of several meters if the sun is high in the sky. Not until the sun falls low in the sky (solar zenith angles >60 degrees) is the UV index in the low risk range of roughly 2 or less, either above or below the sea surface. Thus for clear waters and mid-day times, inviting to swimmers, UV radiation penetrates deep enough that swimming offers little protection against sunburn.

-Brian Diffey

Book Review: *Sun Protection: a Risk Management Approach*

IOP Publishing Ltd 2017

ISBN 978-0-7503-1377-3 (ebook); ISBN 978-0-7503-1378-0 (print); ISBN 978-0-7503-1379-7 (mobi); DOI 10.1088/978-0-7503-1377-3

The book is aimed at readers who wish to understand the links and relationships between the seemingly disparate sciences of climatology, physics, photochemistry and photobiology that combine to result in observable clinical effects in the skin resulting from sun exposure, such as sunburn, skin cancer and photoageing.

The text explores how the clinical changes that result from excessive sun exposure can be prevented, or minimized, by the adoption of various risk management strategies that include modifying the quality and quantity of terrestrial solar UV radiation; adopting patterns of behaviour, both in location and time, that will reduce exposure to solar UV radiation; making use of physical barriers such as shade and clothing, together with the application of topical sunscreens; making people more resistant to the effects of solar UV radiation and countering the damage already done; and stabilizing, repairing and rehabilitating the damage caused by excessive sun exposure by means of medical and surgical techniques.

The text is written at a level that should make the book understandable by readers from a wide range of disciplines, and is combined with an extensive number of photographs and diagrams

-Brian Diffey

Upcoming Photobiology Events

Photosensory Receptors and Signal Transduction Gordon Research Conference, March 4-9 2018, Barga, Italy. grc.org/programs.aspx?id=12955

ASP biannual meeting, May 12-15 2018, Tampa, FL. photobiology.org/2018minisite

5th ESP Photobiology School, June 10-16, 2018, Brixen/Bressanone, South Tyrol, Italy. www.photobiology.eu/photobiology_school.

PDT and Photodiagnosis 2018, September 19-22, 2018, Munich, Germany. http://pdt2018.com/

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

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