ASP NEWS

Fall 2019 **vol. 48 (3)**

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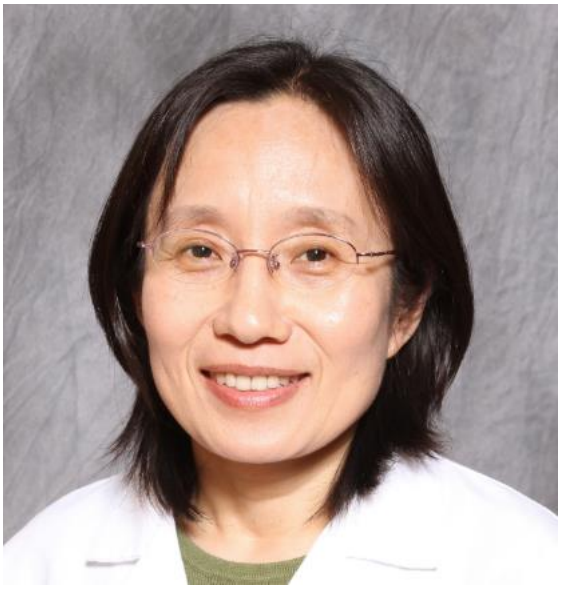
Abstract submission for ASP 2020:
http://photobiology.org/2020site/abstracts.php

Please the ASP Secretariat if you are interested to exhibit or be a sponsor:
Headquarters@photobiology.org

President's Note



Dear ASP members and colleagues,

Hope you enjoyed summer. Here I would like to share with you several updates.

First of all, the second off-year ASP 2019 evening symposia was successfully held on May 9-10, 2019, in Inn of Chicago, Chicago. We had an outstanding and diverse lineup of speakers in both the Photodamage and Photochemistry sessions. We have also attracted additional interest from our members and non-members who attended the symposia. The program details can be found at the meeting website: http://photobiology.org/2019site/

Second, the ASP 2020 meeting planning is in full swing. The meeting will be held at the Sheraton Grand Chicago hotel, in Chicago, IL from June 27 – 30, 2020. This features keynote lectures by:

Martin Schnermann (NCI, NIH)
John D'Orazio (University of Kentucky)
Xiaojing Yang (University of Illinois at Chicago)
David Sliney

With the help of the co-chairs and the organizing committee, we have put together an exciting tentative program, including cutting-edge symposia on a wide range of topics. Sessions will

address recent advances in the following emerging areas:

- DNA damage repair and response
- Molecular mechanism of UV damage and tumorigenesis
- Photomedicine and PDT (photodynamic therapy) for treatment of cancer and other diseases
- Photobiology and photodamage of the eye
- Photochemistry
- Photoreceptor biology
- New applications of photobiology in imaging, drug delivery, and medicine.
- Other topics related to the ASP mission

Social events. Those events are planned for discussion and networking among attendees. Those times include ample coffee breaktime, lunch time, poster sessions, a welcome reception, a banquet, and a mentor luncheon designed for young scientists to interact with leaders in photobiology. Three highlights of the meeting specific for young scientists are:

- A communications skills workshop run by the associate councilors, who are part of the ASP council and associate members of the ASP. This workshop will give attendees the opportunity to learn, practice and receive feedback on skills for thesis defense, presentations, and short elevator talks.
- Publishing forum. This is a new event for the 40th ASP meeting and a great idea from our associate councilors. It will open with lectures about publishing one's work, given by selected associate editors from our Journal Photochemistry and Photobiology (PnP). The topic will cover publishing in PnP as well as other scientific journals in general.
- A grant writing workshop opens with lectures on how to prepare grant applications, given by established investigators who have extensive successful grant application experience, followed by a question and answer session.

Venue. The Sheraton Grand Chicago hotel is ideally located in the heart of downtown Chicago, overlooking the Chicago River. It is within walking distance of many attractions, including the Riverwalk, Millennium Park, Michigan Avenue, the Art Institute of Chicago, and so on. In addition to providing a vibrant venue for scientific exchange, Chicago is an attractive place for fun, history, and cultural exploration. Located in the Midwest region, Chicago is an important center of international trade, technology development, biotechnology, photobiology, and skin biology research/medicine. The city is well connected with local public transport including buses, city trains, and Metra trains, allowing attendees to get around the city with ease. Furthermore, Chicago is served by many domestic and international flights at both O'Hare and Midway Airports, allowing attendees to travel to the conference conveniently.

We look forward to seeing all of you at the ASP 2020 meeting. Enjoy the rest of the summer!

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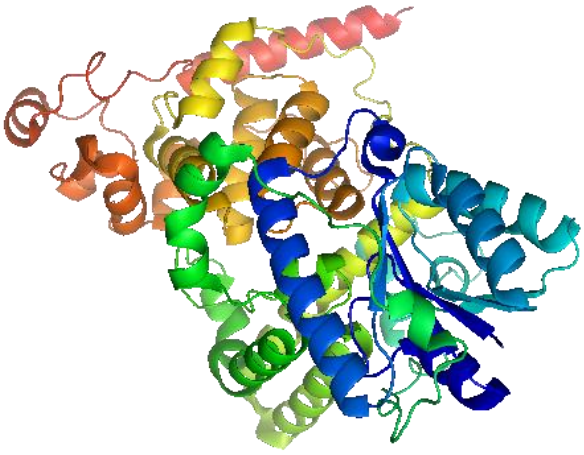
Non-image light sensing mechanism of circadian neurons in fruit flies



Crytochrome protein

University of California, Irvine researchers reveal how an ancient flavoprotein response to ultra violet (UV), blue and red light informs internal circadian processes about the time of day.

The study, led by Todd Holmes, a professor in the Department of Physiology and Biophysics at the UCI, "Distinct mechanisms of Drosophila CRYPTOCHROME mediated light-evoked membrane depolarization and in vivo clock resetting" and was published in *Proceedings of the National Academy of Sciences*.

Phototransduction is relatively well characterized in the eyes and other external photoreceptors in animals for image-forming vision. Much less understood are phototransduction mechanisms in non-eye photosensitive cells, including central brain neurons. In the UCI School of Medicine-led study, researchers revealed how blue and ultra violet (UV) light create a sustained light response which is key to a form of non-image-forming vision that averages environmental light levels to determine the time of day and inform internal circadian processes. Red light evokes a light response but less sustained.

"Image-forming vision works so rapidly that humans and likely other animals perceive the visual world as a continuous process," said Holmes. "Our eyes capture moment to moment changes in light that enable us to see objects and movement, even when moving from bright to dark surroundings. An entirely different type of vision, the non-image-forming vision, is important for informing us about the time of day, based on the color and intensity of light. It is a slower visual process that captures an average of light levels rather than moment to moment changes in light."

Using *Drosophila melanogaster*, commonly known as fruit flies, researchers discovered that non-image-forming vision in invertebrates relies on redox chemistry of a light sensitive protein called Cryptochrome. Biological redox chemistry is typically associated with metabolism.

"The protein ancestors of Cryptochromes were ultraviolet light-activated DNA repair enzymes that appeared in evolution well over 3 billion years ago before the appearance of our present day oxygen rich atmosphere that protects us from harmful ultraviolet radiation. These first light sensing mechanisms evolved when single cell organisms developed the ability to repair their DNA damaged from UV light after coming too close to the surface of water. At that time, there was no life on land. It is remarkable that this ancient form of non-image forming vision persists to the present day."

Light is the primary regulator of circadian rhythms and evokes a wide range of time-of-day specific behaviors. By gaining an understanding of how insects respond to short wavelength light, researchers hope to develop new, environmentally friendly alternatives to controlling harmful insects, such as mosquitoes and flies, and reduce the need for toxic pesticides.

-source: UC Irvine

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

Meet a Photobiologist

-Dr. Praveen Arany,
President of WALT; past-president of the NAALT

Q1: When did you become a scientist?

When I was doing my initial dental pathology clinical training in India, I read an article about wound healing using light stimulation. I had my doubts but then I started doing research on it. It 1999 and we had access to a 904 nm laser in our dental department, which we applied to tooth extraction sockets. We found that the laser-treated sockets healed better. So my first experiment was actually a human clinical study. After seeing the results, I gained faith in photobiomodulation (PBM). I actually became a scientist because I wanted to learn how light can impact our biology and improve health. Beyond the more well understood mechanisms (e.g. vision and vitamin D metabolism), there is a lot to learn about how our body responds to light.

Q2: How did you your training influence you?

After completing my dental training in India, I did more training in India and then at the NIH with Anita Roberts, who discovered TGF-beta. So I studied TGF-beta signaling. Unfortunately, I was the last postdoc to join her lab, and she passed away while I was there. As I started exploring how TGF-beta could be modulated by light to improve wound healing, I realized that to run a lab I would need a PhD degree. I obtained this from David Mooney's lab at Harvard, where I studied molecular details about how light activates the TGF-beta complex in the context of dental stem cells. I went back to the NIH as a clinical investigator were I focused on mucositis; oral ulcers due to cancer treatments. Finally, I moved to SUNY Buffalo to start my own lab.

Q3: And what does your lab focus on now?

My primary focus is still PBM in the oral cavity. I also study how biomaterials can be used with light to influence molecular pathways besides TGF-beta activation, which we understand now. We have also expanded beyond dentistry to other diseases. We collaborate with experts in other fields to determine whether PBM can work in those diseases. We have been funded for studies with stroke, Parkinson's, Alzheimer's, and chronic wounds. Our focus is always the fundamental biological mechanisms of PBM, whereas our collaborators have the disease models and expertise.

Q4: How is the field of photobiomodulation and low-level light therapy progressing?

As the past president of the North American Association for Photobiomodulation Therapy (NAALT), and the current president of the World

Association of Laser Therapy (WALT), I can say that the field has progressed greatly in recent years.

In 2015 the term low-level light therapy was phased out in favor of photobiomodulation (PBM). So PBM is the official term.

The field has been held back by a lack of solid mechanistic understanding. This has prevented photobiomodulation to become mainstream.

However, there are now three well-understood molecular mechanisms for PBM. WALT and NAALT also identified 9 clinical indications in which PBM has shown clear clinical efficacy. One of the recent landmarks in the field is acceptance of photobiomodulation as a standard of care for cancer associated mucositis in the mouth.

Q5: What are the mechanisms of PMB?

Inside the cell, cytochrome C oxidase is the most well described PBM mechanism. Light absorption by this protein in the mitochondria can stimulate ATP production and generate low amounts of reactive oxygen species with beneficial effects. The second mechanism relates to photosensitive receptors on the cell membrane, non-visual opsins. TRPV1 has been implicated for pain relief for example. The third mechanism is the extracellular activation of the TGF-beta, which can be linked to wound healing and stem cell differentiation

Q6: How does TGF-beta absorb light

It does not directly absorb light, but contains a redox sensitive methionine residue that is able to absorb local ROS created by light. This triggers downstream activation. Mutation of that amino acid with a non-oxidizable one changes the whole complex so it cannot be activated.

Q7: What are pressing issues for PBM?

One of the questions is the light source. The field is divided between laser and LEDs. LEDs have shown some clinical benefit and are easier to implement in devices. Lasers are more powerful but have narrower therapeutic windows. Wavelength is also a key concern. Near infrared light can penetrate deeper, but there are also wavelength dependent effects.

I would like to see PBM more broadly practiced. With the recent acceptance of PBM for mucositis, I believe that major medical device companies could start moving into the PBM field as a result. Of course, many small companies are able to make devices for use that are being sold for various purposes. But bigger companies like Philips and Johnson and Johnson are expressing interest in light research related to PBM.

Q7: You have been involved with WALT, NAALT, ASLMS, SPIE and OSA. What ASP?

I have attended some ASP meetings in the past. I am not sure if there has been as much PBM focus in recent years. I know of Kendric Smith, who invited me to my first ASP conference 2008 in San Francisco. I attended a later one in Wisconsin. I enjoyed those meetings, as multidisciplinary mechanisms, for example learned from photosynthesis biology, could be applied to other fields of research such as PBM. PBM is truly photobiology. I think PBM should have a presence in the ASP.

-We caught up with Dr. Arany in Buffalo

Sunlight impact on the Microbiome

In a first study to show that skin exposure to UVB light alters the gut microbiome in humans.

Published in *Frontiers in Microbiology*, the analysis suggests that vitamin D mediates the change - which could help explain the protective effect of UVB light in inflammatory diseases like MS and IBD.

Sun exposure, vitamin D levels and the mix of bacteria in our gut are each associated with risk of inflammatory conditions like MS and IBD. Scientists hypothesize that a causal chain links the three.

Exposure to UVB in sunlight is well-known to drive vitamin D production in the skin, and recent studies suggest that vitamin D alters the human gut microbiome. However, that UVB therefore causes gut microbiome changes, via vitamin D production, has so far been shown only in rodents.

In a new clinical pilot study, researchers tested the effect of skin UVB exposure on the human gut microbiome.

Healthy female volunteers (n=21) were given three one-minute sessions of full-body UVB exposure in a single week. Before and after treatment, stool samples were taken for analysis of gut bacteria - as well blood samples for vitamin D levels.

Skin UVB exposure significantly increased gut microbial diversity, but only in subjects who were not taking vitamin D supplements during the (winter) study (n=12).

"Prior to UVB exposure, these women had a less diverse and balanced gut microbiome than those taking regular vitamin D supplements," reports Prof. Bruce Vallance, who led the University of British Columbia study. "UVB exposure boosted the richness and evenness of their microbiome to levels indistinguishable from the supplemented group, whose microbiome was not significantly changed."

The largest effect was an increase in the relative abundance of *Lachnospiraceae* bacteria after the UVB light exposures.

"Previous studies have linked *Lachnospiraceae* abundance to host vitamin D status," adds Vallance. "We too found a correlation with blood vitamin D levels, which increased following UVB exposure."

This indicates that vitamin D at least partly mediates UVB-induced gut microbiome changes.

The results also showed some agreement with mouse studies using UVB, such as an increase in *Firmicutes* and decrease in *Bacteroidetes* in the gut following exposure.

"In this study we show exciting new data that UVB light is able to modulate the composition of the gut microbiome in humans, putatively through the synthesis of vitamin D," Vallance sums up.

The study is not designed to show the exact mechanism by which the microbiome changes occur, but both UVB and vitamin D are known to influence the immune system.

"It is likely that exposure to UVB light somehow alters the immune system in the skin initially, then more systemically, which in turn affects how favorable the intestinal environment is for the different bacteria," suggests Vallance.

"The results of this study have implications for people who are undergoing UVB phototherapy, and identifies a novel skin-gut axis that may contribute to the protective role of UVB light exposure in inflammatory diseases like MS and IBD."

-source Frontiersin

Upcoming Photobiology Events

Jun 27-30, 2020, Chicago
ASP Biennial Meeting
http://burkclients.com/ASP/meetings/2020/site/

Jul 12-17, 2020, Amsterdam, Holland
28th IUPAC Symposium on Photochemistry
https://www.aanmelder.nl/iupac2020

Aug 2-7, 2020, Rotorua, New Zealand
International Congress on Photosynthesis Research 2020
http://www.ps2020.nz/home.html

Aug 6-9, 2020, Arlington, VA
NAALT/WALT 2020
https://www.naalt.org/event/naalt-walt-ald-2020/

October 26-30, 2020, Nancy, France
PDT2020
http://www.pdt2020.com/

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

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