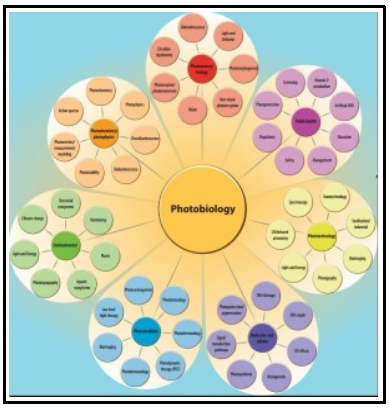
# ASP NEWS

**Autumn 2012** **vol. 41(4)**

## Message from ASP President




The new ASP "flower" (see left and the last page of this newsletter), is a graphical representation of all of the specialties and sub-specialties that fall under the broad topic of photobiology. This was unveiled at the Montreal meeting in June 2012 and was very well received. Some of the best aspects of the image are that it clearly shows how multi-disciplinary photobiology is and that there is a place for everyone interested in some aspect of light and life in the ASP.

**David Mitchell** (President, 2009-2010) suggested several years ago that we should update and expand the list of areas of interest in photobiology. He made a heroic effort to catalog this information. **Don Forbes** (Secretary, 2008-2015) suggested putting this information in graphical form and made the original "doodle". **John Streicher** (Treasurer, 2009-2015) asked his wife, **Aimee Streicher**, to give us some feedback on the "doodle" and Aimee, who is a graphic designer, created the "flower".

I will be working with the Membership Committee to discuss and implement reorganization of our divisional structure based on the relationships shown in the flower. We hope to have an update for you in the next newsletter. Because this could have wide-reaching effects, from Council membership to scientific program organization to the layout of *Photochemistry and Photobiology*, we value comments from the membership. Please send me an e-mail me at **Gaillard.beth@gmail.com**

## IN THIS ISSUE



The ASP has been serving the diverse photobiology community for 40 years. If you are interested, the website has a page on ASP history **www.photobiology.org/asp.php?id=10**

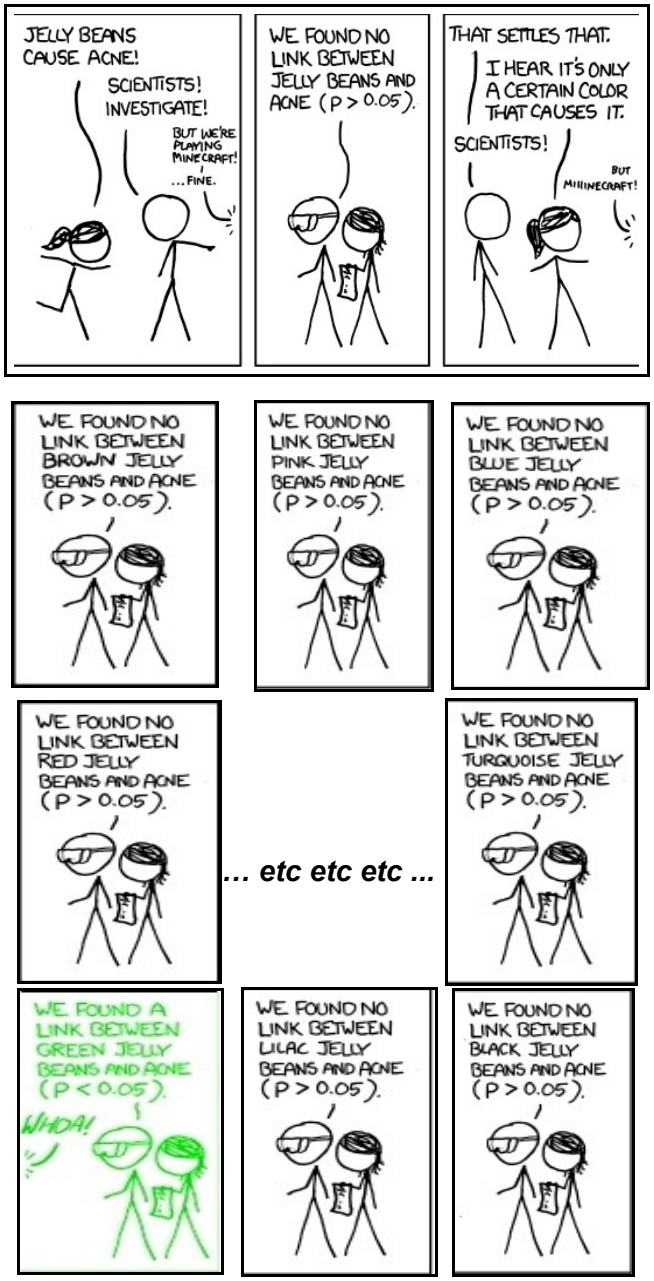
On a different topic, the Council has started reviewing some of our organizational documents that may need updating. An increasing number of government agencies, small businesses, universities, and professional societies are adopting anti-harassment policies to promote a safe environment for their members and to provide a framework for handling alleged incidents of harassment. In light of this, we have added an anti-harassment policy to our Code of Ethics (**www.photobiology.org/asp.php?id=3**, at thebottom). This new policy takes effect immediately.

I look forward to hearing from you.

**-Beth Gaillard, ASP President**

## Green Jelly Beans Cause Acne

**… or the problem with multiple comparisons**




-adapted from Randall Monroe (www.xkcd.com)

### It's All Elementary

**Q:** What do you do with a dead chemist?

**A:** Barium!

… I would tell another science joke, but all the good ones Argon.

**-Linda Hardwick**

# Letter from the Editor

This issue features a picture of the "ASP Flower" on the last page, a design that shows the multidisciplinary nature of photobiology. We hope that use of this graphic in promotion of ASP activities will make those doing research in diverse specialties feel more welcomed into the community of photobiologists and in the ASP in particular.

This issue also includes an article by **Imran Rizvi**, our new Associate Councilor. Several years ago, we had to do some arm-twisting to get volunteers for this position. It was heartening to see so many associate members vying for this job in Montreal. Imran looks forward to hearing your ideas about how he can serve the associate members so he can share these ideas at the January council meeting.

One topic at the upcoming council meeting will certainly be the ASP meeting in 2014. ASP has signed a contract for this conference with the Hard Rock Hotel in San Diego, from June 14-18, 2014 See **www.HardRockHotelSD.com** for more info.

Finally, I have a brief note on page 6 about the recent finding (to be published in *Photochem Photobiol*) that CFL bulbs emit biologically significant levels of UVC and UVA radiation. This surprising finding, from research conducted in the lab of **Miriam Rafailovich**, has been widely reported in the press. As of October 7, a simple Google search for "**Rafailovich AND CFL**" yields more than 10,000 results.


## *ASP News*

*Published quarterly by the American Society for Photobiology*

**www.photobiology.org**

**Editor**

Peter A. Ensminger
256 Greenwood Place
Syracuse, NY 13210
Tel: 315-478-6024
E-mail: ensmingr@twcny.rr.com

## Message from Associate Councilor

Imran Rizvi, newly elected ASP Associate Councilor

Hello ASP Members, especially fellow Associate Members!

I am excited to serve as your Associate Councilor, and look forward to working with President **Beth Gaillard** and the new council members to continue to attract young scientists and engineers to the photobiology community. My goal over the next two years is to identify key opportunities to increase awareness and interest in the ASP among postdoctoral fellows and young scientists.

The two major areas of focus will be to identify a core group of untapped scientific venues where young investigators have presented promising photobiology-related work and to define ways in which these young photobiologists can be attracted to the ASP. One such example, among many others, is *The Intel International Science and Engineering Fair*, the world's largest pre-college science competition. In 2010, **Amy Chyao** won the top prize for her efforts in developing photosensitizers for photodynamic therapy. Working with Associate Members and the ASP leadership, I hope to identify ways to get promising young photobiologists like Amy involved with the ASP.

**Learn more about Amy Chyao:**
nanotech.utdallas.edu/nanoexplorers/AmyChyao.html

We will also continue the great efforts made by **Ulysses Sallum**, the outgoing Associate Councilor, to initiate online discussion groups and forums on social networking websites such as Facebook and LinkedIn. If you haven't already done so, please join and participate in these groups to communicate with fellow scientists about photobiology topics that interest you. You can find us on Facebook under the American Society for Photobiology Group (**www.facebook.com/groups/159951190875**), and on LinkedIn under the Photon Forum Discussion Group (**www.linkedin.com/groups/Photon-Forum-4001510?trk=myg_ugrp_ovr)**. Please also take a few minutes to visit the Associate members page on the ASP website (**www.photobiology.org/asp.php?id=6**) where you can find useful information about the benefits of becoming an ASP Associate Member.

I also encourage all Associate Members to reach out to me (IRIZVI@PARTNERS.ORG) with any specific ideas, concerns or suggestions that should be presented to the ASP leadership. In the past few months, a few members have already contacted me and have initiated very constructive conversations. (My thanks in particular to **Tyler St. Denis** for his helpful discussions about ways to engage young photobiologists).

I look forward to interacting with more of you in the coming months. One suggestion that will be made at the upcoming Council meeting in January 2013 will be to have two Associate Councilors to help achieve a critical mass of representatives and make the position more productive. It would be great to receive your thoughts on these and any other ideas.

I want to close by thanking the Associate Members for giving me the opportunity to serve as their Councilor. I look forward to representing you on the ASP Council over the next two years.

**-Imran Rizvi, ASP Associate Councilor**

# Spinach Power

### Spinach power has just gotten a big boost

An interdisciplinary team of researchers at Vanderbilt University have developed a way to combine the photosynthetic protein that converts light into electrochemical energy in spinach with silicon, the material used in solar cells, in a fashion that produces substantially more electrical current than has been reported by previous

"biohybrid" solar cells.

The research was reported online on September 4 in the journal *Advanced Materials* and Vanderbilt has applied for a patent on the combination. "This combination produces current levels almost 1,000 times higher than we were able to achieve by depositing the protein on various types of metals. It also produces a modest increase in voltage," said **David Cliffel**, associate professor of chemistry, who collaborated on the project with **Kane Jennings**, professor of chemical and biomolecular engineering. "If we can continue on our current trajectory of increasing voltage and current levels, we could reach the range of mature solar conversion technologies in three years."


Kane Jennings, biochemical engineer at Vanderbilt University

The researchers' next step is to build a functioning PS1-silicon solar cell using this new design. Jennings has an Environmental Protection Agency award that will allow a group of undergraduate engineering students to build the prototype. The students won the award at the *National Sustainable Design Expo* in April based on a solar panel that they had created using a two-year old design. With the new design, Jennings estimates that a two-foot panel could put out at least 100 milliamps at one volt – enough to power a number of different types of small electrical devices.

### Harnessing the power of spinach

More than 40 years ago, scientists discovered that one of the proteins involved in photosynthesis, called Photosystem 1 (PS1), continued to function when it was extracted from plants like spinach. Then they determined PS1 converts sunlight into electrical energy with nearly 100 percent efficiency, compared to conversion efficiencies of less than 40 percent achieved by manmade devices. This prompted various research groups around the world to begin trying to use PS1 to create more efficient solar cells. Most plants use the same photosynthetic proteins as spinach. In fact, in another research project Jennings is working on a method for extracting PS1 from kudzu.

Since the initial discovery, progress has been slow but steady. Researchers have developed ways to extract PS1 efficiently from leaves. They have demonstrated that it can be made into cells that produce electrical current when exposed to sunlight. However, the amount of power that these biohybrid cells can produce per square inch has been substantially below that of commercial photovoltaic cells.

LeBlanc G, Chen G, Gizzie EA, Jennings GK, Cliffel DE. Enhanced Photocurrents of Photosystem I Films on p-Doped Silicon. *Advanced Materials* DOI: 10.1002/adma.201202794

Another problem has been longevity. The performance of some early test cells deteriorated after only a few weeks. In 2010, however, the Vanderbilt team kept a PS1 cell working for nine months with no deterioration in performance. "Nature knows how to do this extremely well. In evergreen trees, for example, PS1 lasts for years," said Cliffel. "We just have to figure out how to do it ourselves."

### Secret is "doping" silicon

The Vanderbilt researchers report that their PS1/silicon combination produces nearly a milliamp (850 microamps) of current per square centimeter at 0.3 volts. That is nearly two and a half times more current than the best level reported previously from a biohybrid cell. The reason this combo works so well is because the electrical properties of the silicon substrate have been tailored to fit those of the PS1 molecule. This is done by implanting electrically charge atoms in the silicon to alter its electrical properties, a process called "doping." In this case,

the protein worked extremely well when doped with positively charged silicon, but poorly when doped with negatively charged silicon.

To make the device, the researchers extracted PS1 from spinach into an aqueous solution and poured the mixture on the surface of a p-doped silicon wafer. Then they put the wafer in a vacuum chamber in order to evaporate the water away leaving a film of protein. They found that the optimum thickness was about one micron, about the thickness of 100 PS1 molecules.

### Protein alignment

When a PS1 protein is exposed to light, the energy is used to free electrons and transport them to one side of the protein. That creates regions of positive charge, called holes, which move to the opposite side of the protein. In a leaf, all the PS1 proteins are aligned. But in the protein layer on the device, individual proteins are oriented randomly. Previous modeling work indicated that this was a major problem. When the proteins are deposited on a metallic substrate, those that are oriented in one direction provide electrons that the metal collects while those that are oriented in the opposite direction pull electrons out of the metal in order to fill the holes that they produce. As a result, they produce both positive and negative currents that cancel each other out to leave a very small net current flow.

The p-doped silicon eliminates this problem because it allows electrons to flow into PS1 but will not accept them from protein. In this manner, electrons flow through the circuit in a common direction.“This isn’t as good as protein alignment, but it is much better than what we had before,” said Jennings.

Graduate students **Gabriel LeBlanc**, **Gongping Chen**, and **Evan Gizzie** contributed to the study.

**-David Salisbury** (reprinted with permission from from *Research News at Vanderbilt*)

## Deep-Sea Crabs Grab Grub in UV

### Some crabs on the sea floor can see UV and use this to select healthy food

Crabs living half-a-mile down in the ocean, beyond the reach of sunlight, have a sort of color vision combining sensitivity to blue and ultraviolet light. Their detection of shorter wavelengths may give the crabs a way to ensure they grab healthy grub, not poison.

"Call it color-coding your food," said Duke biologist **Sönke Johnsen**. He explained that the animals might be using their ultraviolet and blue-light sensitivity to "sort out the likely toxic corals they're sitting on, which glow, or bioluminesce, blue-green and green, from the plankton they eat, which glow blue."

The discovery explains what some deep-sea animals use their eyes for and how their sensitivity to light shapes their interactions with their environment. "Sometimes these discoveries can also lead to novel and useful innovations years later," like the X-ray telescope based on lobster eyes, said **Tamara Frank**, a biologist at Nova Southeastern University.

She and her collaborators report the findings online Sept. 6 in the *Journal of Experimental Biology*.


Johnsen S, Frank TM, Haddock SH, Widder EA, Messing CG. Light and vision in the deep-sea benthos I: Vision in Deep-sea Crustaceans. *J Exp Biology* 2012;215(Pt 19):3335-43.

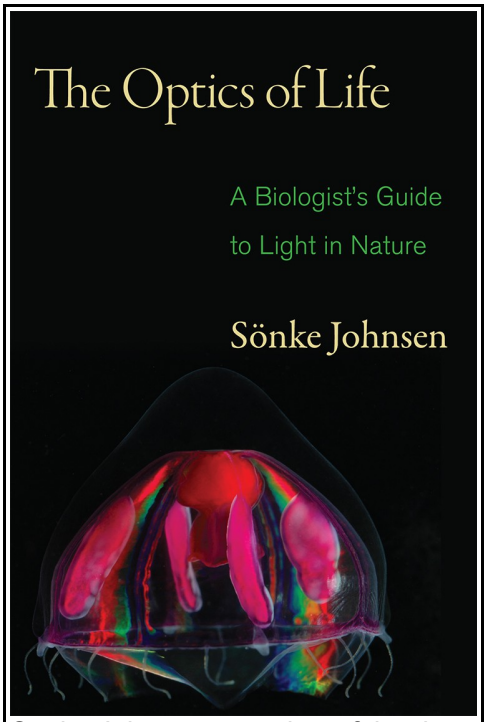
Frank TM, Johnsen S, Cronin TW. Light and vision in the deep-sea benthos II: Bioluminescence at 500-1000 m depth in the Bahamian Islands. *J Exp Biol* 2012; 215(Pt 19):3344-53.


Frank, who led the study, has previously shown that certain deep-sea creatures can see ultraviolet wavelengths, despite living at lightless depths. Experiments to test deep-sea creatures' sensitivity to light have only been done on animals that live in the water column at these depths. The new study is one of the first to test how bottom-

dwelling animals respond to light.

The scientists studied three ocean-bottom sites near the Bahamas. They took video and images of the regions, recording how crustaceans ate and the wavelengths of light at which neighboring animals glowed by bioluminescence. The scientists also captured and examined the eyes of eight crustaceans found at the sites and several other sites on earlier cruises.

To capture the crustaceans, the team used the Johnson-Sea-Link submersible. During the dive, crustaceans were gently suctioned into light-tight, temperature-insulated containers. They were brought to the surface, where Frank placed them in holders in her shipboard lab and attached a microelectrode to each of their eyes.



Sönke Johnsen, coauthor of the deep sea crab study, recently wrote an optics book for biologists: *The Optics of Life: A Biologists Guide to Light in Nature.*

She then flashed different colors and intensities of light at the crustaceans and recorded their eye response with the electrode. From the tests, she discovered that all of the species were extremely sensitive to blue light and two of them were extremely sensitive to both blue and ultraviolet light. The two species sensitive to blue and ultraviolet light also used two separate light-sensing channels to make the distinction between the different colors. “It's the separate channels that would allow the animals to have a form of color vision,” Johnsen said.

During a sub dive, he used a small, digital camera to capture one of the first true-color images of the bioluminescence of the coral and plankton at the sites. In this "remarkable" image, the coral glows greenish, and the plankton, which is blurred because it's drifting by as it hits the coral, glows blue, Frank said.

That "one-in-a-million shot" from the sub "looks a little funky," Johnsen noted. But it, along with video of the crabs placidly sitting on a sea pen, and periodically picking something off it and putting it in their mouths and the data showing the crabs' sensitivity to blue and ultraviolet light, suggests that they have a basic color code for their food. The idea is "still very much in the hypothesis stage, but it's a good idea," Johnsen said.

To further test the hypothesis, the scientists need to collect more crabs and test the animals' sensitivity to even shorter wavelengths of light. That might be possible, but the team will have to use a different sub, since the Johnson-Sea-Link is no longer available.

Another challenge is to know whether the way the crabs are acting in the video is natural. "Our subs, nets and ROVs greatly disturb the animals, and we're likely mostly getting video footage of stark terror," Johnsen said. "So we're stuck with what I call forensic biology. We collect information about the animals and the environment and then try to piece together the most likely story of what happened."

“Here, the story looks like the crabs are color-coding their food,” he said.

**-Ashley Yeager** (reprinted with permission from *Duke Today*)

## UV Emission from CFL Bulbs

A recent study, soon to published in *Photochemistry and Photobiology*, indicated that commercially available compact fluorescent bulbs (CFLs) emit significant amounts of UVC and UVA radiation at wavelengths corresponding to mercury emission lines. This radiation is presumably due to cracks in the phosphor coating.

The researchers also showed that exposure of cultured fibroblasts and keratinocytes to CFLs had decreased cell proliferation, increased production of reactive oxygen species, and a decreased ability to contract collagen. The researchers conclude that the UV radiation from CFL bulbs is a potential harm to human skin.

**Miriam Rafailovich** directed this study. She is Professor of Materials Science and Engineering and the Director of the Garcia Center for Polymers at Engineered Interfaces at SUNY Stony Brook.

**-PAE**

Mironava T, Hadjiargyrou M, Simon M, Rafailovich MH. The effects of UV emission from compact fluorescent light exposure on human dermal fibroblasts and keratinocytes i*n vitro. Photochem Photobiol* 2012;DOI:10.1111/j.1751-1097.2012.01192.x

**Abstract**

Compact fluorescent light (CFL) bulbs can provide the same amount of lumens as incandescent light bulbs, using one quarter of the energy. Recently, CFL exposure was found to exacerbate existing skin conditions; however, the effects of CFL exposure on healthy skin tissue have not been thoroughly investigated. In this study, we studied the effects of exposure to CFL illumination on healthy human skin tissue cells (fibroblasts and keratinocytes). Cells exposed to CFLs exhibited a decrease in the proliferation rate, a significant increase in the production of reactive oxygen species, and a decrease in their ability to contract collagen. Measurements of UV emissions from these bulbs found significant levels of UVC and UVA (mercury [Hg] emission lines), which appeared to originate from cracks in the phosphor coatings, present in all bulbs studied. The response of the cells to the CFLs was consistent with damage from UV radiation, which was further enhanced when low dosages of TiO nanoparticles (NPs), normally used for UV absorption, were added prior to exposure. No effect on cells, with or without TiO NPs, was observed when they were exposed to incandescent light of the same intensity.

John Streicher (ASP Treasurer) with his wife Aimee (R), Beth Gaillard (L), Linda Hardwick (top L), and Jo Turner (top R) at the 2012 ASP meeting in Montreal.

Some of the luminaries who attended the banquet at the 2012 ASP meeting in Montreal. Photo is from Jo Turner.

Chateau Frontenac (Quebec City), site of ASP-2002.

# Photobiology Events

**Oct 11-12, 2012**
Optogenetics and Pharmacogenetics in Neuronal Function and Dysfunction
New Orleans, LA (USA)
Web site: www.brainresearchconference.com

**Oct 21-26, 2012**
IPMB-2012: 10th International Congress on Plant Molecular Biology
Jeju City (Korea)
Web site: www.ipmb2012.org

**November 5-7, 2012**
Photonics Asia
Beijing (China)
Web site: www.spie.org/x6445.xml

**Dec 15-19, 2012**
American Society for Cell Biology Annual Meeting
San Francisco, CA (USA)
Web site: www.ascb.org

**Jan 2-5, 2013**
Inter-American Photochemical Society Conference
Lido Beach Resort, FL (USA)
Web site: www.i-aps.org

**Jan 6-11, 2013**
Gordon Research Conference: Carotenoids
Ventura, CA (USA)
Web site: www.grc.org

**Feb 2-7, 2013**
Photonics West
The Moscone Center
San Francisco, CA (USA)
Web site: www.spie.org/x2584.xml

**Mar 7-10, 2013**
International Symposium on Ocular Pharmacology and Therapeutics (ISOPT)
Paris (France)
Web site: www.isopt.net/isopt2013

**Jul 14-19, 2013**
Gordon Research Conference: Photochemistry
Easton, MA (USA)
Web site: www.grc.org

**Jul 20-24, 2013**
Plant Biology 2013
Providence, RI (USA)
Web site: aspb.org/calendar

**Aug 11-16, 2013**
16th International Congress on Photosynthesis Research
St. Louis, MO (USA)
Web site: www.ps16stlouis.wustl.edu

**Aug 31-Sep 4, 2013**
ESP 2013
Liège (Belgium)
Web site: www.esp-photobiology.it

**Nov 10-13, 2013**
6th Asia and Oceania Conference on Photobiology
Sydney (Australia)
Web site:www.aocp2013.org.au

**June 14-18, 2014**
ASP Biennial Meeting
Hard Rock Hotel, San Diego CA

**Aug 10-14, 2014**
22nd IUPAC International Conference on Physical Organic Chemistry
Ottawa (Canada)
Web site:
events.science.uottawa.ca/icpoc22/welcome.html

**Other Event Calendars**

SPIE Events: spie.org/x1375.xml
Plant Biology Events: aspb.org/calendar
Chemistry Events: www.chemistry.org
Gordon Research Conferences: www.grc.org

**All Submissions to:**
**ensmingr@twcny.rr.com**

# Life on a Sun-Drenched Planet

**The 6th Asia & Oceania Conference on Photobiology**

**10-13 November 2013**

**Sydney, Australia**

www.aocp2013.org.au

Photomedicine
Photodermatology
DNA Damage and Repair
Photodynamic Therapy
Photoreceptors
Photosynthesis
Photocarcinogenesis
Photoaging
And much more…

**Organised by Congress Presidents:**

**Dr Scott Byrne and A/Prof Min Chen from The University of Sydney**

for The Asia and Oceania Society for Photobiology (AOSP), Molecular and Experimental Pathology Society of Australasia and The Australian Society of Plant Scientists

# ESP meeting 2013 in Liège Belgium

## August 31 to September 4

www.esp-photobiology.it

# American Society for Photobiology

*Lux et Vita* since 1972

The American Society for Photobiology promotes research in photobiology, integration of different photobiology disciplines, dissemination of photobiology knowledge, and provides information on photobiological aspects of national and international issues.

Thank you for your interest in joining the **American Society for Photobiology**. Please print this page, fill out the form, and send it with payment to:

**American Society for Photobiology**
**PO Box 1897**
**Lawrence KS 66044-8897**
**Fax: (785) 843-1274**

First Name: _____ Last Name: _____
Organization: _____
Address: _____
_____
_____
City: _____ State: ___
Zip/Postal Code: _____
Country: _____
Phone: _____
Fax: _____
E-mail: _____

**Membership type:**
__ $45/yr Associate Member (student/post-doc; online access to *Photochem Photobiol*)
__ $120/yr Member (online access to *Photochem Photobiol*)
__ $228/2-yrs Member (online access to *Photochem Photobiol*)
__ $160/yr Member (printed version and online access to *Photochem Photobiol*)
__ $308/2-yrs Member (printed version and online access to *Photochem Photobiol*)
__ $40/yr Emeritus (printed version and online access to *Photochem Photobiol*)
__ $0/yr Emeritus (online access to *Photochem Photobiol*)

**Payment Type:**
__ Check
__ Master Card Credit Card Number _____
__ Visa Credit Card Expiration Date _____
__ AMEX Signature _____

# Photobiology

## Photosensory biology
- Bioluminescence
- Light and behavior
- Circadian rhythmicity
- Photomorphogenesis
- Phototropism/ photomovement
- Non-visual photoreception
- Vision

## Photochemistry/ photophysics
- Photochemistry
- Photophysics
- Action spectra
- Photometrics/ measurement/ modeling
- Chemiluminescence
- Photostability
- Bioluminescence

## Public health
- Screening
- Vitamin D metabolism
- Photoprotection
- Artificial UVR
- Regulatory
- Education
- Safety
- Management

## Environmental
- Terrestrial ecosystems
- Climate change
- Monitoring
- Light and Energy
- Plants
- Phototopography
- Aquatic ecosystems

## Phototechnology
- Spectroscopy
- Nanotechnology
- UV/infrared astronomy
- Sterilization/ industrial
- Bioimaging
- Light and Energy
- Photography

## Photomedicine
- Photocarcinogenesis
- Phototoxicology
- Low level light therapy
- Photodermatology
- Bioimaging
- Photoimmunology
- Photodynamic therapy (PDT)

## Molecular and cellular
- DNA damage
- Photoprotection/ pigmentation
- DNA repair
- Signal transduction pathways
- UV effects
- Photosynthesis
- Mutagenesis