

# ASP NEWS



Autumn 2009

vol. 38(4)

## Message from the President



The ASP is doing well. Despite a worrisome drop in membership and a frightening drop in the economy, the ASP has maintained its composure and plowed forward. The transition to 2-year meetings initially met some unexpected consequences, particularly with regard to membership, but in retrospect it appears to have

been a good decision. It just needed (and still needs) a little tweaking. The experiment showed a direct correlation between meetings and memberships ... who knew?

Council and its leadership responded to this with several ideas to increase membership, some that worked and some that did not. The most productive in my opinion, was the “brain child” of our past-president **David Sliney**, who developed the concept of off-year topical meetings. David was instrumental in launching “Human Circadian Photobiology” and “Low-Level-Laser/Light Therapy”. “Illumination of Internal Tissues” is scheduled for October 16 in Rockville, MD (see last page of this newsletter). Attendance has been small (~100), but many enthusiastic newcomers have been brought to the doors of the ASP. The attendees liked the format very much and encouraged ASP to continue with these meetings. Many attendees joined the ASP. As Martha Stewart would say, “It was a good thing.” More to the point, we need to keep it going.

If you would like to organize a small meeting in 2011 around a topic you know and love, the ASP can help get it organized and off the ground. It’s a good way to advertise our diversity and bring new faces into our society. Please thank Dave and **Linda Hardwick** for their efforts and successes. I am sure that Dave and **Linda Jones** will bring the same expertise to our regular meeting at Brown University next summer.

## IN THIS ISSUE

Message from President.....	1
Atmospheric Optics.....	2
Letter from the Editor.....	2
Financial Update.....	3
Award for Winslow Briggs.....	4
Higher Education in the U.S.....	4
In the Dark.....	6
ICP-2009.....	7
Henry Lim in the News.....	7
LLLT Topical Symposium.....	7
ASP Homepage Usage Stats.....	7
Upcoming Photobiology Events.....	8
Upcoming Topical Symposium.....	9

Please plan to come and bring your students. There will be affordable housing and activities to encourage and engage the next generation of photobiologists.

**Photobiological Sciences Online** (PSO, [www.photobiology.info](http://www.photobiology.info)) recently won the “Highest Rating for a Website on Biology” from Genetic Engineering & Biotechnology News. **Kendric Smith** has been the prime mover in this project for several years and deserves full credit for its success and rank as a premier internet educational tool. The rewards from PSO will be felt for many years to come, as it is used in educational settings and increases its visibility. Kendric welcomes your suggestions and contributions ([kendric@stanford.edu](mailto:kendric@stanford.edu)). We encourage you to use these materials in your own teaching and to tell your colleagues about this resource. It is really a very valuable teaching resource and is appropriate for advanced high school students, undergraduates, and graduate students. This is another very good thing.

We have strengthened our ties with our European

associates over the past year or so. **Jean Cadet**, the new editor of *Photochemistry and Photobiology* and long-time active member and officer of the European Society for Photobiology and ASP, has made an excellent start. The journal's transition to new offices in France was smooth and the journal is thriving.

**Evelyn Sage** was recently elected president of the ESP and had to leave her position as ASP Councilor. She was replaced on Council by **George Wondrak**. Many ASP'ers have known Evelyn for many years. As Presidents, Evelyn and I hope to further expand and solidify the relationship between our two societies. This will also be a good thing.

- **David Mitchell**, ASP President

## Atmospheric Optics

### Sunset Mirage



**Sunset Mirages**, two or more images of the sun, appear when the sun's low slanting rays are refracted between air layers with different temperatures.

Atmospheric air temperature usually declines gradually with increasing altitude, and a slightly flattened sun appears. A sunset mirage occurs due to extreme variations in atmospheric temperature. One class of mirages, **M-Mir sunsets**, occur when there is a temperature inversion – warm air overlaying cooler layers.

The sunset above was produced by a temperature inversion. The cooler air trapped below the inversion appears as the darker layer. Sometimes there are several inversion layers and the sun looks like a “stack of pancakes”.

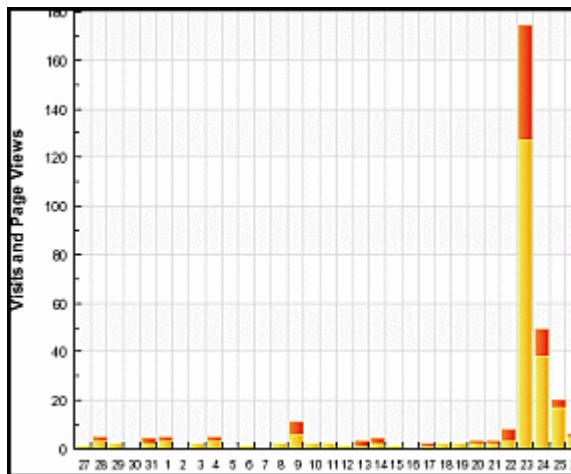
A sunset mirage often presages another atmospheric phenomenon, the elusive **Green Flash** (see: [www.atoptics.co.uk/atoptics/gf1.htm](http://www.atoptics.co.uk/atoptics/gf1.htm)).

- **Les Cowley** ([www.atoptics.co.uk](http://www.atoptics.co.uk))

## Letter from the Editor

### Who's reading the newsletter?

It's always nice to know that people are listening to you, whether at a scientific meeting or in a journal. Contributors to the *ASP Newsletter* can be assured that our members are indeed listening.



*Downloads of ASP Newsletter in May and June of 2009. The summer-2009 issue was announced by e-mail on June 22.*

As seen in the figure above, following the e-mail announcement of the summer-2009 issue of the *ASP Newsletter* (June 22), there was a dramatic increase in visitors to the web page where the newsletter is downloaded.

This should be particularly reassuring to our past-President (**David Sliney**), current President (**David Mitchell**), and President-elect (**Tayyaba Hasan**), who will be making contributions to the first page of our forthcoming newsletters.

Additional contributions are also welcome!

## ASP News

*Published quarterly by the American Society for  
Photobiology*  
[www.photobiology.org](http://www.photobiology.org)

### Editor

Peter A. Ensminger  
256 Greenwood Place  
Syracuse, NY 13210  
Tel: 315-478-6024

E-mail: [ensmingr@twcnv.rr.com](mailto:ensmingr@twcnv.rr.com)

# Financial Update

The decline in value of ASP's endowments over the last two years has been significant, but hardly devastating. Most of the net two year decline occurred in fiscal 2008 (September 2007 to August 2008). Fiscal 2009, which included the near-collapse of the world's financial system in September/October of 2008, and the ultimate market bottom in March 2009, ended with a strong and sustained stock rally.

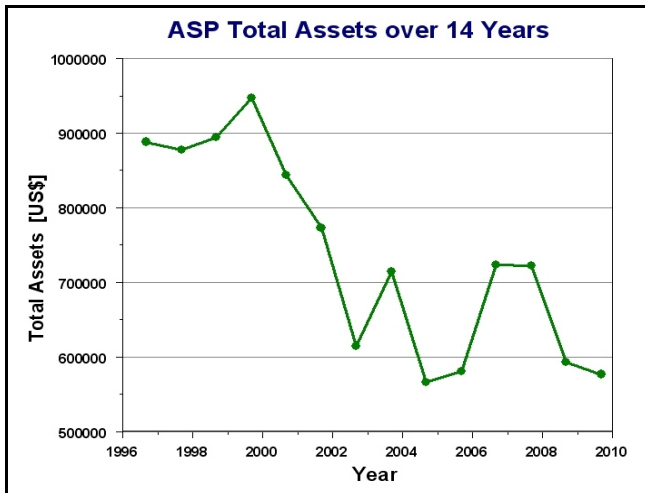


Figure 1.

Consequently, ASP's investments during fiscal 2009 experienced only a small net decline in value. Figure 1 shows the value of ASP's total assets (endowment plus operations money) over a 14 year period. As of August 31, 2009, all three of ASP's endowments had positive total returns (defined as capital change plus dividend distribution), when calculated from their inception dates in fiscal 2004 and 2005.

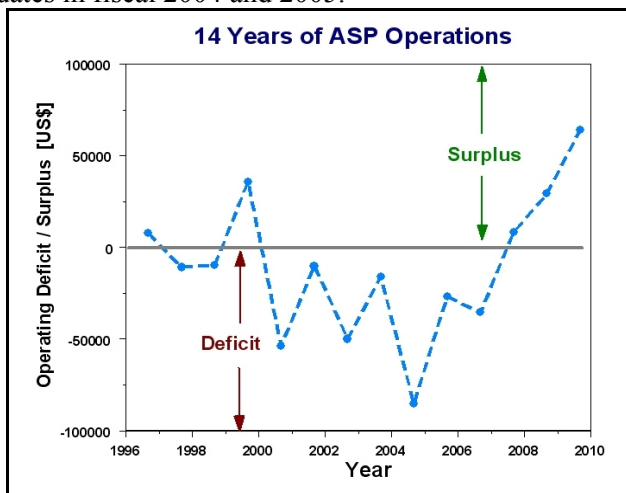


Figure 2.

A better indicator of ASP's recent financial progress is shown in Figure 2. The ASP has now operated in the black for three successive years, with the most recent operating surplus (\$63,881) being the largest in the 14 years for which such records exist. The fiscal discipline with which council now plans and executes operations reflects a constant awareness that financial health is a prerequisite to the Society's survival.

Several decisions in recent years have had a positive impact on ASP's financial strength today. First, our revenue sharing agreement with Wiley-Blackwell has greatly improved the profitability of journal operations. Since implementation of this agreement, ASP has received year-over-year increases in payments from our new publisher. Second, scheduling our congresses biennially has improved their profitability because it allows for exhaustive planning by two past presidents and our secretariat. The "off year" activity lull is being addressed this year by several topical symposia. A New York/Philadelphia regional meeting is in the planning stage. Third, the establishment of three endowments has provided a new and significant revenue stream that is independent of journal income, membership dues, or profits from biennial congresses. The cumulative distribution from the endowments since their respective inceptions has been \$117,503. This is paid into operating funds to support their designated objectives (see Figure 3).

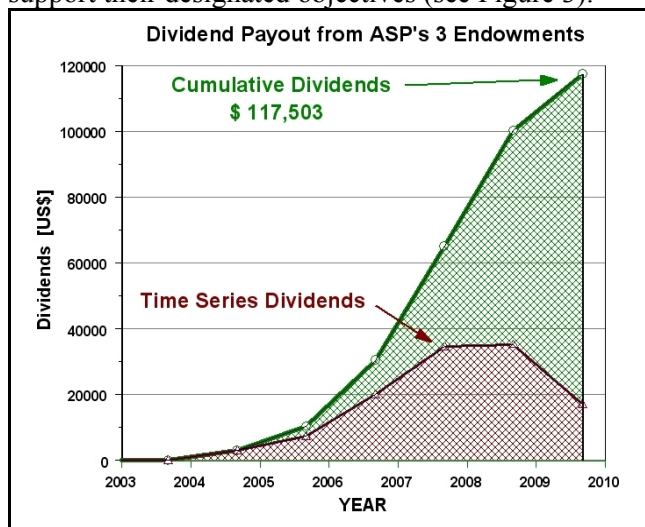


Figure 3.

There will always be the exogenous events that impact membership levels, attendance at meetings, and the value of our endowments. The "Great Recession" that began officially in December of 2007, has undoubtedly contributed to the decline in membership that is being experienced by nearly all organizations such as ours.



But make no mistake, our financial position today is *more than adequate* to support all existing operations, and to promote initiatives that foster growth and add value to membership. The necessity of collaboration and the value of networking will eventually succeed in recruiting new members as the economy improves. For its part, council has maintained membership dues at a very competitive \$120 per year (\$45 per year for associate members). Planning is well underway for the 2010 meeting in Providence, RI. As in the past, a number of financial travel grants will be awarded on a competitive basis to our associate members.

- **John Streicher**, ASP Treasurer

## Award for Winslow Briggs



**Winslow Briggs**, long-time ASP member and Director Emeritus of Carnegie's Department of Plant Biology will be awarded the prestigious "International Prize for Biology" from the Japan Society for the Promotion of Science at a ceremony in Tokyo

on November 30, 2009 held in the presence of **His Majesty the Emperor of Japan**. Briggs is being honored for his work on light sensing by plants.

The prize was formed in 1985 by the Committee on the International Prize for Biology of the Japan Society for the Promotion of Science "to commemorate the 68-year reign of **Emperor Showa** and his longtime devotion to biological research." It is awarded every year to a researcher who "has made an outstanding contribution to the advancement of basic research in the field of biology."

Briggs is an international leader in molecular biological research on how plants respond to light for growth and development and for understanding blue-light photoreceptor systems. Briggs was director of Carnegie's Department of Plant Biology from 1973 to 1993 and is now director emeritus actively running his lab. Before Carnegie, he was a professor at the Department of Biology at Harvard University, where he also received his AB, MA, and PhD,

Director of the Carnegie department, **Wolf Frommer**

commented: "The work of Dr. Briggs on blue-light receptors in plants and microbes has been a major milestone for our understanding of how organisms detect light, which allows them to respond to environmental changes. The award recognizes the pioneering work of Dr. Briggs in this field."

"Carnegie congratulates Winslow on this well-deserved award," stated Carnegie president **Richard Meserve**. "His scientific accomplishments, dedication, and the mentoring of the next generation are a model for us all."

Among his many professional affiliations, Briggs was elected to the National Academy of Sciences in 1974 and the American Academy of Arts and Sciences in 1975. He is a member of the Botanical Society of America, the American Society of Plant Physiologists, the American Society for Photobiology, and the American Association for the Advancement of Sciences. He has served on numerous committees including as co-chair of the Gordon Conference on Photoreceptor in Plants, Animals, and Microorganisms; the chair of the Gordon Conference on Plant Molecular Biology; and chair of the Botany Section of the National Academy of Sciences. His awards include the 2007 Adolph E. Gude, Jr., Award from the American Society of Plant Biologists.

Briggs will receive a cash award, medal, and an Imperial gift from His Majesty the Emperor. For more about the award, see: [www.jsps.go.jp/english/e-biol/index.html](http://www.jsps.go.jp/english/e-biol/index.html).

- **Tina McDowell**

## Higher Education in the U.S. Should it be called "Higher?"

I have been teaching for 32 years at Rutgers University. In the past decade or two, my fall teaching assignment has been to teach several sections of a 1-credit biochemistry lab class to non-biochem majors. In the spring, I teach Biochemical Separations to majors and graduate students and also teach the capstone course in the major, Problem Solving in Biochemistry. I enjoy teaching, I work hard at presenting quality courses, and I think I perform fairly well at this job. In all of these small classes, I use Socratic teaching methods – I answer the students' questions with more questions of my own. I require so much writing and I do so much grading of written material that a couple of years ago my wife gave me a huge pack of red Bic pens for Valentine's Day. They were all used up in less than a year. This fall, for the first time in about 20 years, I am teaching a large,

introductory Biochemistry lecture class to non-biochemistry majors – 150 students.

A bit apprehensive about facing a large class after so many years, last spring, I attended what was billed as an "effective teaching mini-symposium." Here, I was told that students now expect all their professors' class notes to be on line (perhaps so that they don't have to go to class) and that, if they do go to class, they have a much reduced attention span. Apparently Power Point presentations are the norm and many professors conduct their classes like network pre-election opinion polls – with clickers. I guess the idea is to repeat factual information so many times in huge lectures that students cannot help absorbing this information – perhaps without the need to personally organize, synthesize, categorize, and systematize a study routine outside of class. I cannot teach this way. I am using chalk. We shall see how this works.

For years, my concern has been that many of my students come into my advanced classes with insufficient backgrounds in the pre-requisite courses (general chemistry, organic chemistry, biology, physics, arithmetic, and English composition – factual recall as well as reasoning skills). I feel that many don't know how to study, how to think, and how to retain essential factual information. Furthermore, many seem to have limited life skills of the sort I practiced almost daily as I was growing up.

I was born an obsessive, compulsive, workaholic with a passion for manual projects. As a young kid I was never without Tinker Toys, Erector sets, model railroads, and balsa planes. I wanted nothing pre-made, pre-assembled, or pre-painted. I made everything from scratch. My father even taught me how to make a working record player from Tinker Toys — no joke! Rather than master translation in high school Latin II, I built, from scratch, using scraps of material around the house, detailed, miniature, working models of all the Roman weapons pictured in the Latin book – hundreds of hours of work. Every one of these models worked perfectly. In college, I created masterful biology drawings – always the best in the class. I volunteered to draw the Acropolis for my Humanities professor's quiz (there were no Xerox machines in those days). So focused was I upon the artistic rendering of the buildings, statues, and frescos (in 3-D perspective), that I neglected to learn the names of the structures I drew. I got 2 of the 10 questions wrong on the quiz that I prepared myself!. Making "things" on my own, from scratch, has been with me throughout my life. This is still the driving force for my passion as an experimental biochemist.

My most fervent goal as a youngster was to be a great baseball player. Mickey Mantle was my idol. I played center field, and I even tried to become a switch hitter like Mickey. Even though I had 14-flat speed in the 100 yard dash (at my prime), even though I couldn't hit a fast ball, let alone a curve, and even though my reaction time is terrible, I kept trying. The more I failed the harder I tried. Finally, I discovered slow pitch softball, where brawn is more important than rapid reflexes. At slow pitch, I was brawny enough to succeed. I stuck with this for 35 years, sometimes playing on 4 teams at the same time. Perhaps my zeal to succeed is the exception rather than the rule. I don't know. But, as a teacher, I find relatively few students with what I consider to be the required passion to succeed.

Describing my students' lack of incoming skills to the college dean is invariably an exercise in futility. It is always turned around – "You must be doing something wrong. It is not the students. We get the best students in the state." No use going in this direction.

I mentioned my ongoing concerns to a colleague who then suggested that I should administer a little "Biochemistry readiness quiz" to my junior and senior level Biochem majors on the first day of classes. I liked this idea, so I wrote a 10-question quiz to test my students' factual recall and reasoning ability. I gave them as much time as they needed, told them that the quiz results would not affect their grades, and offered to clarify any question if asked. The class average was 16 percent. Just one student of the 31 was able to identify the acid for which the "A" in DNA stands. Not one linked the word "aroma" to a definition of "aromatic" as used in chemistry or in food science. Very few could define pH. A few could name a single amino acid, but none could draw the structure of that named amino acid.

For many years we taught experimental biochemistry in a lab equipped with faucet aspirators. The first day we used these aspirators to draw a vacuum, I would ask the class to tell me the principle behind an aspirator's function. In 10 or 15 years, not a single student was able to tell me something as simple as "Oh, yes, I remember from physics class something about a fluid moving rapidly across a small opening at 90 degrees." My prompting the class by saying "It's the same principle behind the perfume atomizer," or "It is the principle that creates lift in an airplane," never stimulated a response. Even asking the students to study the faucet aspirator up close while it was working failed to "turn on a light in the attic."

Current rankings of college students' skills in math and science place the United States near the bottom of the list for industrialized nations. This is very troubling and I don't know how to turn things around. Surely one source of the problem is that college professors, certainly those in major research institutions, are provided, by the administration, with zero incentive to focus any attention on teaching. In the administration's view, our teaching job is to show up behind a podium once in a while and say something or other – whatever. As teaching counts for nothing and to make things really easy for ourselves, most of us rely upon multiple choice tests that fail to exercise reasoning skills and foster only short term memory, at best.

When our whole department was called into the Dean's office a few years back to be criticized for relative lack of research productivity and grant income (the only two administration-accepted measures of a professor's productivity), our chairman correctly pointed out that we have a greater than normal teaching load. The Dean then blew us away by saying, "Oh, just let the students hang for a few years." With college administrators like this dean, is it any surprise that other developed nations are racing ahead of us? But, hey, we play intercollegiate football real good! Go RU!

- **Bill Ward**, ASP Councilor

Bill Ward is the author of *Hey, Doc! Does Spelling Count?*, available from amazon.com, barnesandnoble.com, and elsewhere.

## In the Dark

### Olive oil, Milk, Butter, Beer



**Harold McGee**  
(photo © **Karl Petzke**)

In a previous post from news.curiouscook.com, I mentioned that olive oil is best stored in the dark. The same is true for milk, butter, and beer. It turns out that all these foods are sensitive to light for similar reasons.

When milk is exposed to light, especially sunlight or the fluorescent lights in a market, it develops an

unpleasant, sulfurous "sunlight" or "lightstruck" flavor. It has been known for a long time that riboflavin (vitamin B-2) is involved in this reaction, and a recent report by **David Min** and colleagues at Ohio State

(Bradley et al. *J Agric Food Chem* 2006, 54, 6016-20) summarizes the current understanding of what happens. It turns out that the off-flavor signals significant nutritional losses. When riboflavin absorbs light, it catalyzes the conversion of ground-state oxygen to singlet oxygen. Singlet oxygen attacks the milk fat, producing fragments with grassy aromas, and also attacks the amino acid methionine, producing dimethyl disulfide, a compound with the aroma of overcooked vegetables. Singlet oxygen also attacks riboflavin itself and vitamin D, a vitamin added to milk that allows us to absorb its calcium more efficiently.

Exposure to light also damages the flavor of beer, which accumulates a characteristic "skunky" sulfur compound known as MBT (3-methyl-2-butene-1-thiol). Earlier studies had shown that MBT is produced when flavor compounds from hops (alpha acids) react with sulfur-containing compounds. But the alpha acids themselves do not absorb the visible light that causes skunkiness. It appears that the energy for the reaction is supplied indirectly, probably by riboflavin, the same molecule that damages milk! A recent publication by **Richard Pozdrik** and colleagues in Melbourne, Australia (Pozdrik et al. *J Agric Food Chem* 2006, 54, 6123-29) has strengthened the case against riboflavin by showing that light absorption by riboflavin in beer correlates with the development of skunkiness.

According to a new study of butter performed in Norway and Denmark, riboflavin is not the only "photosensitizer" in dairy products (Wold et al. *J Agric Food Chem* 2006, 54, 10197-10204). **J.P. Wold** and colleagues found that traces of chlorophyll and related substances in butter also absorb light energy and transfer it to other butter components, thus causing oxidation reactions and unpleasant flavor changes. This makes sense, because absorbing and transferring light energy is exactly what chlorophyll is designed to do in the leaf of a living plant. And it is the lovely green chlorophyll and related molecules that are the major photosensitizers in olive oil.

So it's a good idea to buy and keep all these foods in opaque or at least dark containers. If they are in clear glass or plastic, or (in the case of butter) wrapped in light wax paper, then keep them in the dark as much as possible.

- **Harold McGee**

Harold McGee writes about the chemistry of food and cooking. His magnum opus is *On Food & Cooking: The Science & Lore of the Kitchen*.

## ICP-2009

### International Congress on Photobiology

The 15th International Congress on Photobiology of the International Union of Photobiology (IUPB) was held from June 18-23, 2009 in Düsseldorf, Germany. More than 500 attendees from all parts of the world experienced a scientific program of the highest quality that covered all important areas of photobiology in 42 scientific sessions and 13 plenary lectures. The congress was organized by **Jean Krutmann** and his institute, the IUF, one of the leading research institutes in the world that deals with the effects of UV radiation on the skin. During the Congress, 5 scientists who had worked for many years in the field of photobiology were given awards.

#### ICP-2009 Award Winners

**Finsen Award:** John M. Christie (Glasgow, UK) and Pill-Soon Song (Jeju, Korea)

**Finsen Medal:** Margaret Kripke (Houston, USA) and Kimiyuki Satoh (Okayama, Japan)

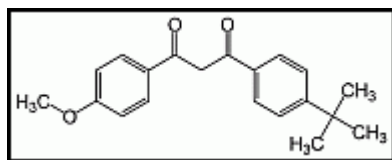
**Edna Roe Award:** Evelyne Sage (Orsay, France)

In addition, the new IUPB Executive Board was elected: **Henry Lim** (USA) is the new IUPB President, **Herbert Hönigsmann** (Austria) is the treasurer, and **Jean Krutmann** was nominated as liaison-officer for the 16th International Congress on Photobiology. The next IUPB congress will be in 2014 in Buenos Aires and will be organized by **Silvia Braslavsky**.

- Jean Krutmann

## Henry Lim in the News

The June 21 issue of the *Wall Street Journal* featured an article entitled "Don't pay up to avoid rays".



Avobenzone

In this article, ASP member and former president **Henry Lim** (Henry Ford Hospital, Detroit MI) urges

consumers to also watch out for UV-A radiation, since SPF only applies to UV-B radiation. Products containing avobenzone, titanium dioxide, or zinc oxide provide protection from UV-A.

When asked if a sunscreen of SPF 100 is needed, Henry Lim responded "SPF 50 is probably sufficient. Beyond 30, the increase in the filtering is small."

- PAE

## The Science Behind LLLT

### Rochester NY (Aug 7-8, 2009)

"The Science Behind Low Level Light Therapy", a topical symposium organized by **David Sliney**, was recently held at the University of Rochester.

The importance of action spectra and the relevance of radiation coherence were among the many actively discussed topics.



## ASP Homepage Usage Stats

**Dates:** June 20-Sept 21, 2009 (93 days)

**Total page views:** 5302

**Average page views per day:** 45

(Total views/days ≠ average views per day because of multiple views per visit)



# Photobiology Events

**Map/Timeline/Table:**  
[www.pol-us.net/meetings.html](http://www.pol-us.net/meetings.html)

## Sept 21-22, 2009

JEP 2009: Putting light to work in the environment: Materials and methods for air and water purification  
Bordeaux (France)  
Web site: [jep2009site.teamresa.biz](http://jep2009site.teamresa.biz)

## Oct 16, 2009

**ASP Topical Symposium:** Light and Internal Tissues. Applications, Basic Science, and Future Directions  
Crown Plaza Hotel  
Rockville, MD (USA)  
Web site: [www.pol-us.net/ASP\\_Home/asp\\_meet.html](http://www.pol-us.net/ASP_Home/asp_meet.html)

## Dec 1-4, 2009

Scientific Meeting of the Mutagenesis and Experimental Pathology Society of Australasia (MEPSA)  
Sydney NSW (Australia)  
Web site: [www.pathology.usyd.edu.au/sfra2009.htm](http://www.pathology.usyd.edu.au/sfra2009.htm)

## Nov 6-7, 2009

Laser Florence 2009  
Florence (Italy)  
Web site: [www.laserflorence.org/](http://www.laserflorence.org/)

## Dec 7-10, 2009

FISPHOTON: 2nd France-Italy Symposium on Photosciences  
Marseille (France)  
Web site: [www.fisphoton.com](http://www.fisphoton.com)

## Jan 23-28, 2010

Mechanisms for Low-Light Therapy V  
SPIE: Photonics West  
The Moscone Center  
San Francisco, CA (USA)  
Web site: [spie.org/x1375.xml](http://spie.org/x1375.xml)

## June 12-16, 2010

**ASP-2010:** 35th Meeting of the American Society for Photobiology  
Brown University  
Providence, RI (USA)

## Jun 13-16, 2010

6th European meeting on Solar Chemistry and Photocatalysis: Environmental Applications (SPEA6)  
Prague (Czech Republic)  
Web site: [www.spea6.com](http://www.spea6.com)

## Jul 30-Aug 5, 2010

Plant Biology 2010: American Society of Plant Biologists Montreal QC (Canada)  
Web site: [aspb.org/meetings/pb-2010](http://aspb.org/meetings/pb-2010)

## Aug 15-20, 2010

7th International Conference on Photo-Excited Processes and Applications (ICPEPA7)  
Copenhagen (Denmark)  
Web site: [icpepa7.com](http://icpepa7.com)

## Sept 24-26, 2010

Fifth Latin-American Congress on Photobiology and Photomedicine  
Santa Cruz (Bolivia)  
Web site: [www.allenpress.com/pdf/AnnouncementLatin-AmericanCongress1.pdf](http://www.allenpress.com/pdf/AnnouncementLatin-AmericanCongress1.pdf)

## Other Event Calendars:

**SPIE Events:** [spie.org/x1375.xml](http://spie.org/x1375.xml)

**Plant Biology Events:** [aspb.org/calendar](http://aspb.org/calendar)

**Chemistry Events:** [www.chemistry.org](http://www.chemistry.org)

**Gordon Research Conferences:** [www.grc.com](http://www.grc.com)

**Cell:** [www.cell.com/conferences](http://www.cell.com/conferences)





The **American Society for Photobiology** and the **Food and Drug Administration** are proud to present a topical symposium:

## **Light and Internal Tissues: Applications, Basic Science and Future Directions**



Friday, October 16, 2009  
Crowne Plaza Hotel  
Room: Remington III  
3 Research Court  
Rockville, MD



### **Symposium Topics:**

- Internal light applications in therapeutic and diagnostic medicine
- Medical devices as optical sources
- FDA concerns – risk assessment
- What do we know from dermatological studies?
- Fetal exposures
- Neonatal/Pediatric exposures
- Tissue optics and Biological Effects
- Optical properties of tissues (epidermis vs internal epithelial tissues)
- Action spectra: Wavelength vs chemical/biological endpoints from UVC to IR
- Thermal effects
- Skin: The most studied tissue with respect to light exposure
- Respiratory epithelium
- Hamster pouch
- Engineered human tissue models
- Experimental biology: applications (RPT, laser therapy, etc.)
- Risk assessment
- Photosensitizers

**Details will be online as they become available at:**

[www.pol-us.net/ASP\\_Home/asp\\_meet.html](http://www.pol-us.net/ASP_Home/asp_meet.html)