ASP NEWS

Winter 2011/12 vol. 41(1)

Letter from the President

Hello and Best Wishes for 2012!

Hope you had an enjoyable and restful holiday season, although to some of us it already seems like a distant memory! I wanted to update you on the goings-on at the ASP since the last newsletter in September.

The Biosphere, in Montreal's Parc Jean-Drapeau (from Wikimedia Commons)

First, I have an urgent request to the membership. **Please take a few minutes to nominate your colleagues for ASP awards.** A request has already gone out via e-mail. Relevant information can be found on our web site.

ASP Awards
www.photobiology.org/asp.php?id=94

We have excellent scientists in the society who deserve recognition, and we serve our field of photobiology well by providing appropriate nominations. **Georg Wondrak** and the committee have spent an enormous amount of time in working out guidelines for these awards and will be grateful for your cooperation. There have been a few new awards added this year.

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The ASP Winter council meeting was held on Saturday, January 7, 2012 in Sarasota, Florida with the Executive Committee attending in person and council members dialing in telephone. The major concern remains the declining membership. Your participation in recruiting new and lapsed members back is needed and much appreciated. Our journal, *Photochemistry & Photobiology* is doing well with an increase in the impact factor to 2.679. Wiley has streamlined the submission of articles, making it much easier. Your input for improving our journal is always appreciated and you can do so by writing directly to our Editor, **Jean Cadet** or to me. There were some changes discussed to the by-laws, which will be put forward for vote by the general membership at the business meeting in Montreal during the biennial conference.

Elections for ASP council membership and President-elect are open. It just takes a moment to vote.

As you might expect, we are getting to the last stretch in the planning the scientific program for

the upcoming 2012 biennial meeting at the Delta Center-Ville, Montreal, Canada from June 23-27. The full program and a preliminary schedule is now available online **photobiology.org/asp.php?id=91**.

The early registration and abstract submission sites are now open and I hope that you will take advantage of our early rates. For more information on registration, abstracts, travel, Montreal attractions, and accommodation, please visit **www.asp2012.org**. I very sincerely thank the program committee and the session chairs for working hard on organizing a superb set of sessions in a timely fashion. There will be several topics, important to the future of the ASP that will be discussed at our Business Meeting, including the location for the 2014 biennial meeting. I would very much like your participation in these decisions and hope to see you at the business meeting. I am also grateful to those of you who participated in the survey to give us a sense of your preference. We hope to return with more information in June and will use the broadest possible input to inform the final decision for site selection.

I look forward to seeing you in Montreal in a few months!

-Tayyaba Hasan, ASP President

Old Montreal (from Wikimedia Commons)

Letter from the Editor

The new web sites for ASP and ASP-2012 are now up and running at **www.photobiology.org** and **www.asp2012.org**. The meeting web site provides complete information on all of the important deadlines, and links to hotel reservations, registration, and cultural events in Montreal. I am personally looking forward to the Montreal Jazz Fest (June 28-July 7), which begins just as our meeting ends. **Stanley Clarke**, **Wayne Shorter**, **BB King**, and **Al Di Meola** are among the performing artists.

This newsletter includes our second article on optogenetics, a really hot topic. The summer 2010 newsletter had an article on optogenetics research at the HHMI. You can learn even more about optogenetics at the **Kendric C. Smith** Symposium on Emerging Light Technologies on the morning of June 24th at ASP-2012.

Finally, this newsletter also has an article about recent research at the Scripps Institution which measured the global rate of photosynthesis (**Welp LR** *et al.* 2011 *Nature* 477:579-82). The researchers concluded that recent estimates of the global gross primary production of 120 petagrams of carbon per year was too low. Based on their measurements of $^{18}O/^{16}O$ ratios, they suggest an annual rate of 150 to 175 petagrams (150-175 trillion kilograms) per year. An interesting footnote: one of the co-authors is the son of **Charles David Keeling**, who began measuring global CO_2 in 1958 at the Mauna Loa Observatory in Hawaii.

ASP News

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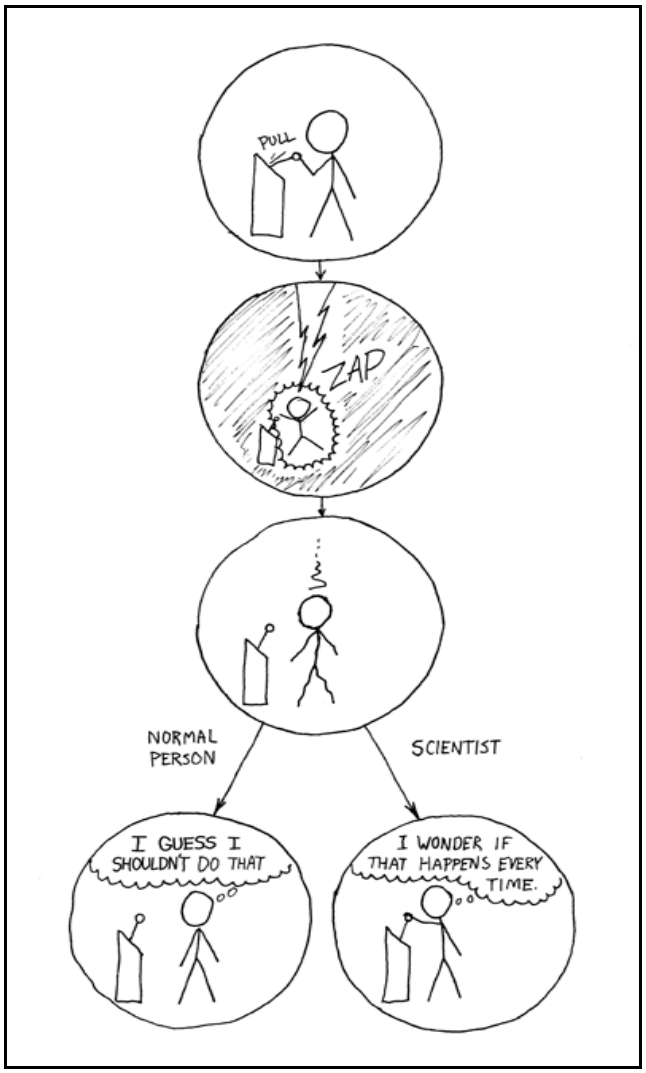
The Difference ...



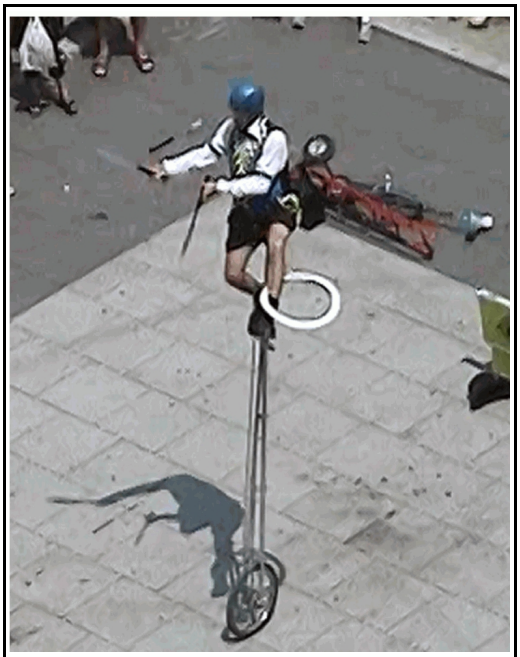
-Randall Munroe

(See www.xkcd.com for more of Randall's unusual humor)

Tale from the Archives

A memorable ASP meeting was held in Quebec (2002). The site was the *Chateau Frontenac*, a hotel I had viewed with awe during prior visits to Quebec beginning in about 1960. I often stayed at the spartan Park View Hotel, near the *Frontenac*, but miles away in terms of decor. When the edict abolishing English signage was invoked, that hotel changed its name to the *Fleur de Lys*. There was a transition period in which signs could be in both languages, but only if the English was smaller. The author **Mordecai Richler** observed that it would soon be permitted to speak English *ONLY* if the speaker would then speak French in a louder voice. I did venture near the *Frontenac* in those days, but never ventured past the doorman whom, I was certain, had orders to allow no post-docs to get past the entrance.

The 2002 ASP meeting took place during the *Festival d'été*, a time when assorted artists, actors and musicians gather to show off what they can do. I especially remember a fellow who I think was a post-doc attending our meeting. He got up on a ten-foot high unicycle and rode, keeping up a steady dialog in French while juggling three sharp knives and twirling a hoop.



Quebec City in the summer of 2002.

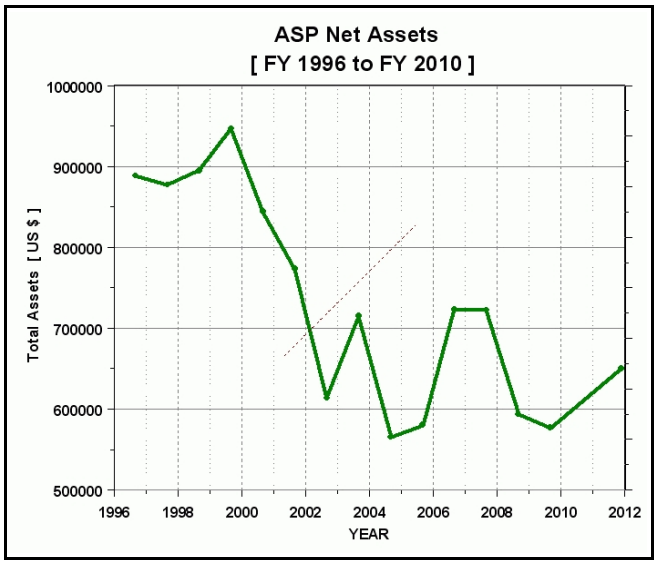
Paul Strudler from the NIH spoke on how best to interact with the National Cancer Institute, showing an image from the dark ages when grants were printed out and filled a huge room. His most memorable advice to applicants were: ***(i)*** do not to request that he find a previously submitted proposal and replace a few pages and ***(ii)*** do not use the phrase “then a miracle happens” in the Specific Aims section.

-David Kessel, ASP Historian

ASP Financial Update

The stock market continued to disappoint during 2011. By several measures, US equities were cheaper than at any time since World War II. The reasons for such low valuations include lack of investor confidence in the economy, lack of trust in the financial markets themselves, and a loss of confidence in our political representatives to lead in budget and long term debt management. More fundamentally, the US economy is entering its fifth year of sub-par growth. Recovery from the implosion of the great real estate bubble is impeded by massive debt loads carried by households as well as the federal government.

Depressed stock prices have had a modestly negative impact on ASP's overall financial position. The figure below shows ASP's total asset value over time. During periods of protracted equity market downturns, careful money management, *i.e.* balanced operating budgets, is key to survival.



There are reasons for optimism, however. Interest rates are at historic lows with no increase on the horizon. Corporate profits have shown steady improvement, as borrowing costs are minimal. US bank balance sheets are strong, making loan initiation attractive. A rebound in equity prices will likely precede a recovery in the overall economy. ASP's assets are positioned to benefit from such a rebound. Defensive positions in bonds were liquidated during 2011, and exposure to U.S. stocks was increased.

The year ahead will see at least one major stimulus to the North American economy – our biennial meeting in Montreal! This meeting will celebrate the 40th anniversary of the ASP. We've leveraged the weak economy to secure very attractive lodging rates at the Delta Centre-Ville in the heart of Montreal. All essential information is available at **www.asp2012.org**

-John Streicher, ASP Treasurer

ASP 2012

36th Meeting of the ASP
Celebrating 40 years: 1972-2012

Greetings! We would like to announce that the 2012 meeting site is now open. Just go to the ASP homepage **www.photobiology.org** and select "Meetings" and then "2012" in the left column. Or your can go there directly **www.asp2012.org**

Registration, Abstract Submission, and Hotel Reservations are all open. ASP associate members can apply for student travel awards. The tentative program and information on Montreal is also available.

Important Deadlines for ASP 2012

March 1, 2012: Abstract submission

March 31, 2012: Travel award applications (applicants must submit an Abstract by March 1)

May 25, 2012: Hotel reservations to ensure the negotiated ASP meeting rate of $159.00

If you are interested or know someone interested in being a sponsor for this meeting, direct them to the meeting website and then click on the "Sponsorship" link in the right column.

We hope to see you all in Montreal!

If you need further assistance or information, please feel free to contact me at: **lhardwick@allenpress.com**

-Linda Hardwick, ASP Executive Secretariat

Photobiological Sciences Online

Photobiological Sciences Online (PSO) tries to cover all areas of photobiology: bioluminescence, environmental photobiology, non-visual photoreception, photochemistry, photomedicine, photomorphogenesis, photomovement, photophysics, photosensitization, photosynthesis, spectroscopy, UV radiation photobiology, and vision. There are also sections entitled “Historical Vignettes”, “Experiments”, “Suggested Readings”, “History of PSO”, “Animations for Science”, and “User Statistics”.

According to the user statistics from the web host , there are currently more than 10,000 unique visitors to PSO each month, and this number doubles every 12-13 months. In October 2011, we had 17,017 unique visitors.

I get e-mails from all over the world thanking me for PSO. The latest one was from Iran. Recently, we received a link to a translation of one of the modules into Estonian. Obviously, PSO is read all over the world.

For comparison, there are 502 members of ASP for 2011, 154 members take the print version of *Photochemistry and Photobiology* and 348 members take the online version. As of the end of October 2011, there are 280 paid institutional subscribers to *Photochemistry and Photobiology*. We don't know how many different people read the institutional copies.

Since PSO is an online publication, it is easy to update older modules (if I can get the authors to do it), and to add new modules (if I can get authors to do it).

I would like to hear from readers about what new modules are needed, and who might be the best authors. You can even volunteer yourself! Please e-mail me your suggestions and comments: **kendric@stanford.edu**

-Kendric C. Smith, PSO Editor and Webmaster

Pacing Heart Cells with Light

Optogenetics study at Stanford

Oscar Abilez and a multidisciplinary team developed the first human heart cells that can pulse in response to specific wavelengths of light.

Oscar Abilez and a multidisciplinary team developed the first human heart cells that can pulse in response to specific types of light.

In a compact lab space at Stanford University, Oscar Abilez, MD, trains a microscope on a small collection of cells in a Petri dish. A video recorder projects what the microscope sees on a nearby monitor. The cells in the dish pulse rhythmically, about once a second. The cells are cardiomyocytes, which drive the force-producing and pacemaker functions of the human heart. They are programmed to pulse. They will beat this way until they die.

Abilez holds up a finger as if to say, “Wait,” and reaches for a small lever hidden behind the microscope. With the same finger, he flips the lever up. A pale, blue light floods the petri dish. Abilez flicks the light off and then on; first fast and then slow. Each time his finger goes up, the heart cells contract in concert with the light.

In a paper published September 21 in the *Biophysical Journal*, lead author Abilez, a postdoctoral scholar and PhD candidate in bioengineering, and a multidisciplinary team from Stanford describe how they have for the first time engineered human heart cells that can be paced with light using a technology called optogenetics.

In the near term, say the researchers, the advance will provide new insight into heart function. In the

long term, however, the development could lead to an era of novel, light-based pacemakers and genetically matched tissue patches that replace muscle damaged by a heart attack.

To create the light-responsive heart cells, the researchers first inserted DNA encoding a light-sensitive protein called channel-rhodopsin-2, or ChR2, into human embryonic stem cells. ChR2 controls the flow of electrically charged ions into the cell. For heart cells, the primary ion is sodium, which initiates an electrochemical cascade that causes the cell to contract. They then transformed the optogenetically engineered stem cells into cardiomyocytes unlike any others — those that respond to light.

Like the new heart cells, optogenetics is a product of Stanford. Bioengineer and psychiatrist **Karl Deisseroth**, MD, PhD, a co-author of the new study, has played a key role in the technology's development. It is an increasingly common research technique that allows researchers to fashion all manner of mammalian tissues that are responsive to light.

While Deisseroth has focused his research primarily on neurons in order to study neurological illnesses ranging from depression to schizophrenia, Abilez is the first to create optogenetic human heart cells.

The all-important protein for the experiment is ChR2, which is sensitive to a very specific wavelength of blue light and regulates tiny channels in the cell surface. When ChR2 is illuminated by the right wavelength of blue light, the channels open to allow an influx of electrically charged sodium into the cell, producing a contraction.

After creating the cells in a laboratory dish, Abilez next turned to **Ellen Kuhl**, PhD, the study's senior author and an associate professor of mechanical engineering, whose specialty is sophisticated computer modeling of the human body.

Using her algorithms, they tested their new cells in a computer simulation of the human heart, injecting the light-sensitive cells in various locations in the heart and shining a virtual blue light on them to observe how the injections affected contraction as it moved across the heart.

"In a real heart, the pacemaking cells are on the top of the heart and the contraction radiates down and around the heart," Kuhl explained. "With these models we can demonstrate not only that pacing cells with light will work, but also where to best inject cells to produce the optimal contraction pattern."

The long-term goal is a new class of pacemakers. Today, surgically implanted electrical pacemakers and defibrillators are commonplace, regulating the pulses of millions of faulty hearts around the globe.

"But neither is without problems," said Abilez. "Pacemakers fail mechanically. The electrodes can cause tissue damage."

"Defibrillators, on the other hand," Kuhl said, "can produce tissue damage due to the large electrical impulses that are sometimes needed to restore the heart's normal rhythm."

The researchers foresee a day when bioengineers will use induced pluripotent stem cells fashioned from the recipient's own body, or similar cell types that can give rise to genetically matched replacement heart cells paced with light, circumventing the drawbacks of electrical pacemakers.

"We might, for instance, create a pacemaker that isn't in physical contact with the heart," said co-author **Christopher Zarins**, MD, professor emeritus of surgery and director of the lab where Abilez performed the experiments. "Instead of surgically implanting a device that has electrodes poking into the heart, we would inject these engineered light-sensitive cells into the faulty heart and pace them remotely with light, possibly even from outside of the heart."

The leads for such a light-based pacemaker might be placed outside the heart, but inside the pericardium — the protective sack surrounding the heart. Or, someday, the researchers say, there might be a pacemaker placed inside the heart chambers, as with traditional pacemakers, whose

light can travel through the intervening blood to pace light-sensitive heart cells implanted inside.

"And, because the new heart cells are created from the host's own stem cells, they would be a perfect genetic match," Abilez added. "In principle, tissue rejection wouldn't be an issue."

"Much work and many technical hurdles remain before this research might lead to real-world application," said Zarins. "But, it may one day lead to more reliable, less invasive devices."

In the near term, however, the advance is promising on other fronts, said Abilez.

"Optogenetics will make it easier to study the heart. Not only can researchers turn cells on with light, but off as well," Abilez said.

Scientists might use these tools to induce disease-like abnormalities and arrhythmias in sample tissues in order to better understand how to fix them. There are likewise advantages inherent in pacing with light versus electricity.

"Heart researchers are often seeking to measure electric response in the heart," said Abilez, "but it takes quite a lot of electricity to stimulate the heart and the resulting electrical signal is relatively weak. This makes it hard to distinguish stimulus from response. It's like trying to hear a whisper in a crowded room." Pacing with light would eliminate that challenge.

Optogenetics could lead to advances beyond the heart, as well, the authors concluded in their study. It might lead to new insights for various neuronal, musculoskeletal, pancreatic and cardiac disorders, including depression, schizophrenia, cerebral palsy, paralysis, diabetes, pain syndromes and cardiac arrhythmias.

Other Stanford co-authors were Jonathan Wong, a mechanical engineering PhD student in the Kuhl Lab; and Rohit Prakash, a neuroscience MD/PhD student in the Deisseroth lab.

This work was supported by a Stanford ARTS Fellowship, a Stanford Graduate Fellowship, the National Science Foundation, the National Institutes of Health and the California Institute for Regenerative Medicine.

The Department of Bioengineering, which also supported this work, is operated jointly by the schools of Engineering and of Medicine. For more information about the department, please visit **bioengineering.stanford.edu**.

-Andrew Myers, Associate Director of Communications

This article is reprinted with permission from the Stanford School of Engineering.

Measuring Global Photosynthesis

New Research from Scripps Institution

A Scripps Institution of Oceanography at UC San Diego-led research team followed the path of oxygen atoms on carbon dioxide molecules during photosynthesis to create a new way of measuring the efficiency of the world's plant life.

Lead authors Ralph Keeling and Lisa Welp

A team led by postdoctoral researcher **Lisa Welp** considered the oxygen atoms contained in the carbon dioxide taken up by plants during photosynthesis. The ratio of two oxygen isotopes in carbon dioxide told researchers how long the CO2 had been in the atmosphere and how fast it had passed through plants. From this, they estimated that the global rate of photosynthesis is about 25 percent faster than thought.

"It's really hard to measure rates of photosynthesis for forests, let alone the entire globe. For a single leaf it's not so hard, you just put it in an instrument chamber and measure the CO2 decreasing in the chamber air," said Welp. "But you can't do that for an entire forest. What we have done is to use a naturally occurring marker in atmospheric CO2 that let us track how often it ended up inside a plant leaf, and from that we estimated the mean global rate of

photosynthesis over the last few decades."

The authors said the new estimate of the rate of global photosynthesis enabled by their method will in turn help guide other estimates of plant activity such as the capacity of forests and crops to grow. Understanding such variables is becoming increasingly important to scientists and policymakers attempting to understand the potential changes to ecosystems that can be expected from global warming.

"It speaks to the question, how alive is the earth? We answer that it is a little more alive than previously believed," said study co-author and director of the Scripps CO_2 Research Group, **Ralph Keeling**.

The key to this new approach was establishing a means of linking the changes in oxygen isotopes to El Niño, the global climate phenomenon that is associated with a variety of unusual weather patterns including low amounts rainfall in tropical regions of Asia and South America. The naturally occurring forms of oxygen known as ^{18}O and ^{16}O are present in different proportions to each other in water inside leaves during dry periods in the tropics. This signal in leaf waters is passed along to CO_2 when CO_2 mingles with the water inside leaves. This exchange of oxygen between CO2 and plant water also occurs in regions outside of the tropics that aren't as affected by *El Niño* and eventually returns this $^{18}O/^{16}O$ ratio to its norm. Welp's team used the time it took for this return to normal to infer the speed at which photosynthesis is taking place. They discovered that the ratio returned to normal faster than previously expected.

Readings of oxygen isotope ratios of CO_2 in samples of air collected around the world show fluctuations over the course of several *El Niño* cycles.

From this, the team revised the rate of global photosynthesis upward. The rate is expressed in terms of how much carbon is processed by plants in a year. From the previous estimate of 120 petagrams of carbon a year, the team set the annual rate between 150 and 175 petagrams. One petagram equals one trillion kilograms.

Keeling added that part of the value of the study is its validation of the importance of long-term measurement series and of making multiple independent measurements of the same phenomena. The researchers conducted isotope analyses of air that has been collected by the Scripps CO_2 group at several locations around the world since 1977. It was only after decades of measurements that the researchers saw that the several bumps in the isotope record matched the timing of El Niño events. They compared their data to samples collected by Australia's Commonwealth Science and Industrial Research Organization (CSIRO). The redundancy was needed to make sure the data from Scripps' own samples weren't the result of measurement errors, said Keeling, whose research group maintains the famous record of atmospheric carbon dioxide concentration known as the Keeling Curve. Keeling's father, **Charles David Keeling**, established the CO_2 measurements in 1958.

"Supporting long-term measurements is not easy through the normal funding mechanisms, which expect to see results on time scales of typically four years or less," said Keeling. "Few science agencies are happy to commit to measuring variables over longer periods but the value of tracking changes in the atmosphere doesn't stop after four years. Decades of measurements were required to unravel the features highlighted in this paper."

Other co-authors of the report were **Harro A.J. Meijer** from the University of Groningen in the Netherlands; **Roger Francey** and **Colin Allison** from CSIRO; and **Alane Bollenbacher**, **Stephen Piper**, and **Martin Wahlen** from Scripps and **Kei Yoshimura** of University of Tokyo. The National Science Foundation and the federal Department of Energy have provided long-term support for collection of the data used in the study.

-Robert Monroe, Communications Officer

This article is reprinted with permission from the Scripps Institution of Oceanography.

Photobiology Events

Mar 25-29, 2012
American Chemical Society (Spring 2012)
Chemistry of Life
San Diego, CA (USA)
Web site: www.chemistry.org

Apr 16-20, 2012
SPIE Photonics Europe
Brussels (Belgium)
Web site: spie.org/x12290.xml

Jun 3-8, 2012
Gordon Research Conference
Multiphoton Processes
June 3-8, 2012
South Hadley, MA (USA)
Web site: www.grc.org

Jun 23-27, 2012
Gordon Research Conference
Photosensory Receptors and Signal Transduction
Galveston, TX (USA)
Web site: www.grc.org

June 23-27, 2012
ASP-2012: 36th ASP Meeting
Delta Center-VilleMontreal (Canada)
Web site: www.asp2012.org

Jul 7-13, 2012
Gordon Research Conference
Photosynthesis
Davidson, NC (USA)
Web site: www.grc.org

Jul 20-24, 2012
Plant Biology 2012
Austin TX (USA)
Web site: www.austin2012.aspb.org/

Jul 29-Aug 3, 2012
Plant Biology Congress 2012
Freiburg (Germany)
Web site: www.plant-biology-congress2012.de/home.html

Aug 19-23, 2012
American Chemical Society: Fall 2012
Materials for Health & Medicine
Philadelphia, PA (USA)
Web site: www.chemistry.org

Jan 6-11, 2013
Gordon Research Conference
Carotenoids
Ventura, CA
Web site: www.chemistry.org

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
July 14-19, 2013
Easton, MA
Web site: www.grc.org

Jul 20-24, 2013
Plant Biology 2013
Providence, RI (USA)

All Submissions to:
ensmingr@twcny.rr.com

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36th Meeting of The American Society for Photobiology (ASP 2012)

http://www.pol-us.net/ASP_Home/index.html

June 23-27, 2012 **Delta Center-Ville, Montréal, Canada**

Chairs:

Tayyaba Hasan
Massachusetts General Hospital
Harvard Medical School

David Mitchell
University of Texas MD Anderson Cancer Center

Topics include

- Emerging Technologies in Photobiology
- Photobiology in Extreme Environments
- Artificial Tanning: Risks and Benefits
- Oxygen Effects and Optical Probes
- UVA, Sunscreens and Melanoma
- Magnetomotive optical imaging
- Photochemical Internalization
- DNA Damage and Repair
- Photodynamic Therapy
- Nanotechnology
- Optogenetics

Networking Events

- Mentoring Lunch
- ASP-ESP Symposium
- Posters, Prizes, Reception
- NIH Grant Writing Workshop
- Associate Member Travel Awards
- Banquet, Entertainment and Awards

Enjoy Montreal Attractions and Jazz Festival

Festival International de Jazz de Montréal - June 28 - July 7, 2012