ASP NEWS

Summer 2010 vol. 39(3)

ASP 2010

35th Meeting of the ASP

The recent ASP meeting in Providence, RI was as enjoyable as ever, with attendance by professionals, students, and post-docs from throughout the world. This diversity is also reflected in our Council (see page 8), which includes members from England, Germany, Italy, Japan, and Poland, as well as the USA.

ASP Presidents' Lunch in Providence, RI

Our lively poster sessions were made so much better by the delicious food and drinks that were served by the Brown University Staff.

Finally,the ASP Council announced that our next meeting will be in Montreal. Stay tuned for announcements about the dates and venue.

ASP-2012

Location: Montreal, Canada

Date: Summer of 2012 (dates not yet set)

More info soon: www.asp2012.org

IN THIS ISSUE

Photochem Photobiol

New Web Site by Wiley-Blackwell

Wiley-Blackwell is pleased to announce that Wiley Online Library will launch on July 24, 2010. Wiley Online Library will be the new home for *Photochemistry and Photobiology*.

This new service is built on the latest technology and designed with extensive input of scholars from throughout the world and from the many subjects in which we publish. Featuring a clean and simple interface, this new online service will combine intuitive navigation, enhanced discoverability, expanded functionality, and a range of personalization options.

Almost all journal back content has been successfully transferred to the Wiley Online Library, and new content is now being uploaded to Wiley InterScience and the new platform.

Users will receive ongoing information and support up to, during, and following the July 24 launch. Wiley Online Library will completely replace the Wiley InterScience website and all content and licenses will be transferred to the new site to enable seamless access for users. Journal home pages for all titles on Wiley Online Library will be improved and feature an option of customizable areas to share news, information, and events.

We will be contacting subscribers directly about these changes, and will work with the ASP to ensure seamless access for members to content on the Wiley Online Library.

Following the initial release, there will be an ongoing program of development which will include many additional features and new opportunities for users to interact with the content.

More information is available now at: www.wileyonlinelibrary.com/inf, including a list of features, regularly updated FAQs, screenshots, online demos, and more. You can also sign up for alerts from this new website to get updates on developments.

Selene Carey, scarey@wiley.com
Editor, Life Sciences Journals
Wiley-Blackwell

New Bioluminescent Fungi

The genus *Mycena* is a large group of widely distributed small mushrooms. **Dennis Desjardin** et al. (*Mycologia* 2010, 102: 459-477) recently reported seven new bioluminescent species of this genus, including *Mycena silvaelucens* (above).The left photo was taken in daylight and the right photo in darkness. Images courtesy of Dennis Desjardin.

Letter from the Editor

I hope that everyone who attended our recent meeting in Providence had an enjoyable experience. The turnout was a bit lighter than we hoped, but there was nonetheless a great diversity of scientists, in terms of age and nationality. I have included several photos from our meeting in this newsletter, and there are more photos on the web. Just go to the ASP meetings page (www.pol-us.net/ASP_Home/asp_meet.html), then click on the "Photos" link for the 2010 meeting.

Also in this issue of the newsletter, **Selene Carey** of Wiley-Blackwell (publishers of *Photochemistry and Photobiology*), announces that there will be a new web site design for our journal in late July. We hope that this enhanced web site will provide a better experience for ASP members, who have on-line access to *Photochem Photobiol*, and will make *Photochem Photobiol* a more attractive place for researchers to publish.

Optogenetics, which uses genetically engineered light-activated channels and enzymes to control neural activity, is one of the most exciting recent developments in photobiology. Accordingly, this issue of the newsletter also features an article on optogenetics that is reprinted from the *Howard Hughes Medical Institute Bulletin*.

On the lighter side, **David Kessel**, Councilor and ASP Historian, describes a memorable experience at the 1994 ASP meeting in Scottsdale AZ. David tells me that he has many more tales from our archive, so keep an eye out in future newsletters!

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

Double Dactyl Contest

As the outgoing web site and newsletter Chair, I challenge our members to a "Double Dactyl" poetry contest. Basically, the poem starts with a nonsense verse of the rhyme "tamdada-tamdada" and continues with three more dactylic lines. The second stanza starts with a single double dactylic nonense word, such as "superpunctilious".

Here is an example I composed to razz the Deputy Director of the Arizona Department of Enviromental Quality, where I worked until last year (he hated it, and me):

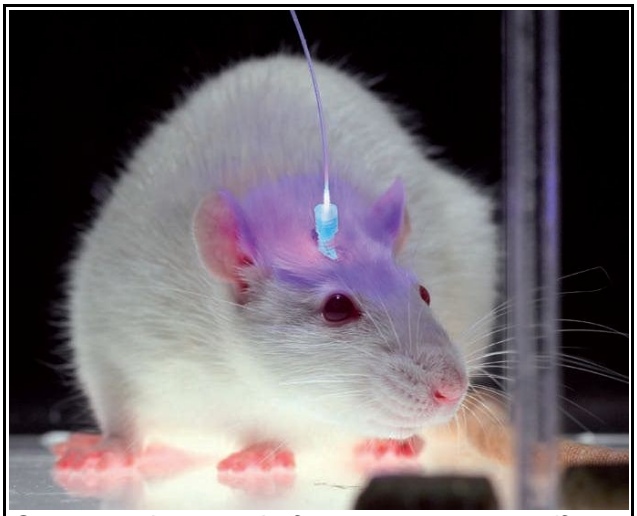
> Higgledy-Piggledy,
> Here comes Pat Cunningham
> Ever the manager
> Down to details.
>
> Oopsalapoopsala,
> Never mind common sense,
> Justice or Loyalty
> Patrick prevails!

Do me one better!

Bodo Diehn, bodo.diehn@cybertrails.com

Light Moves: Optogenetics

Light is becoming the tool of choice for researchers who want to precisely manipulate neurons and other cells.



Optogenetic control of mouse movement (from www.stanford.edu/group/dlab/)

There's a reason neuroscientist and bioengineer **Karl Deisseroth** shows the same video at most of his talks. The movements of the gray mouse with the long tail offer a striking illustration of the power of light to manipulate specific cells.

Karl Deisseroth lecture on optogenetics:
http://www.youtube.com/watch?v=C8bPbHuOZXg

Barely visible in the overhead view of the mouse is a hair-thin optical fiber that feeds through the animal's skull into the right motor cortex of its brain. As the mouse casually sniffs around and explores its white basin, a cool blue glow appears at the fiber's point of entry. At that instant, the mouse starts circling leftward around the basin, swiftly and deliberately, as though it just received marching orders. A few moments later in the video, the blue glow disappears. The mouse suddenly stops marching and reverts to its lazy meandering, eventually sitting on its haunches.

Deisseroth, an HHMI early career scientist at Stanford University, is part of a growing community of researchers, including several HHMI investigators, who draw upon genomics, genetic engineering, biochemistry, molecular biology, microbiology, biophysics, bioengineering, and optics to tease out the complexities of brain circuitry and to manipulate researcher-specified cells (such as the motor cortex cells of the marching mouse) among thickets of diverse cell types.

Patients with optical fibers inserted into their brains are not on the agenda, says Deisseroth, a psychiatrist who sees patients one day a week. But the laboratory approaches he and others have been developing could reveal telling details about healthy and dysfunctional brains that point the way to improved treatments for people. Today's therapies—drugs, electroshock, surgery—sometimes work. But “they are crude and have side effects,” he says, because they are not very selective about the cells and tissues they affect. “My patients have motivated me to find elegant tools that speak the language of the brain.”

Edward Boyden, a former postdoctoral fellow of Deisseroth who now runs the Synthetic

Neurobiology Group at the Massachusetts Institute of Technology, has taken early steps in the direction of human applications. In April 2009, he and colleagues published a paper in *Neuron* reporting that the same kind of protocol underlying the marching mouse can work, apparently safely, in macaque monkeys. And in 2008, he and two colleagues launched the start-up Eos Neuroscience in San Francisco, whose mission, according to its website, is to "develop treatments for chronic neurological disorders."

L to R: Karl Deisseroth (© Darcy Padilla) Wendell Lim (George Nikitin/AP, © HHMI) Massimo Scanziani (Denis Poroy/AP, © HHMI)

Fixing brains is quite an ambition for a field that commandeered its core technology from single-celled organisms.

Borrowing from Nature

Bacteria, fungi, plants, and other organisms use a repertoire of molecular switches that respond to light. Spanning the membranes of many of these microbial species are light-activated gates and pumps that control the passage of positively charged sodium, potassium, calcium, and hydrogen ions or negatively charged chloride ions.

Those ancient, light-activated membrane gates and pumps can be transferred into other cells of the living kingdom, including mammalian brain and muscle cells, with genetic engineering techniques. Once transferred, those mobile modules become controllable with light. "If you can do that," says synthetic biologist and HHMI investigator **Wendell Lim** at the University of California, San Francisco (UCSF), "you have an extraordinarily powerful tool. You can use light to perturb systems and modify them. We can get a kind of systematic control that we have not had before."

The handiest light-activated molecule so far is channelrhodopsin-2 (ChR2), which was originally found in the light-sensitive "eye spot" of *Chlamydomonas reinhardtii*, a type of green algae. In *Chlamydomonas*, upon exposure to blue light, ChR2 opens and allows positively charged ions into the cell. That triggers a sequence of changes that influence the cell's cilia-based propulsion and, thereby, its motion and feeding behavior. When transferred into neurons, ChR2 becomes a light-activated trigger that makes the modified neurons fire more easily. Deisseroth's group used motor neurons that they genetically modified to bear ChR2 receptors to make the mouse march in response to light.

If ChR2 is a blue activator, halorhodopsin (NpHR) is a yellow silencer. It was discovered in *Natronobacterium pharaonis*, a bacterium isolated from a high-alkaline, high-salt lake in Egypt. In the bacterium, the light-driven NpHR channels pump chloride ions into the cell, a flow that ultimately helps drive the synthesis of ATP, the cell's biochemical fuel. Transferred into neurons, however, these channels respond to yellow light by hyperpolarizing the cells, effectively silencing them.

ChR2 and NpHR make for a powerful duo. They enable researchers to rig neurons and other cell types, including muscle cells and perhaps even insulin-making pancreas cells and immune system cells, with light-controlled on and off switches. From a third light-activated gate, VChR1, Deisseroth's group developed a tool that responds to light on the red side of the spectrum. VChR1, a channelrhodopsin in *Volvox* algae, is a cell excitor like ChR2.

For neuroscientists like HHMI investigator **Massimo Scanziani** of the University of California, San Diego, the real experimental power of these switches becomes clear when they are inserted into specific types of neurons.

To achieve this, Scanziani appends the gene for, say, ChR2 or NpHR, to stretches of DNA known as "cell selective promoters," each of which becomes operative in only one neuron type. So,

even though the gene-insertion step might occur in all neuron types, only one of those types will actually express the ChR2 or NpHR switches.

"This gives you immense sensitivity," says Scanziani, who uses the technique to probe the function of specific cells in the cortex of animal brains, the region associated with sensation and thought. In mice and rats, for example, Scanziani studies how sensory inputs, such as the contrast between different elements of a visual scene, are processed by neuronal circuitry in the visual cortex. "You now can manipulate a circuit and understand what the heck it does in the brain," Scanziani says.

The repertoire of light-switchable modules available for optogenetics studies is growing. "There's a Home Depot of different kinds of switches out there," says **Michael Ehlers**, an HHMI investigator at Duke University Medical Center, where he studies the structure and dynamics of the synapses through which neurons communicate with one another. Deisseroth's group, for one, continues to stock the shelves with more and more optogenetic switches.

Their newest category of switches, the optoXRs, enable researchers to modify cells to respond to light as though they were being stimulated by neurotransmitters, such as adrenaline and dopamine. These switches combine a light-sensing rhodopsin component with the internal parts of a G protein-coupled receptor. That's a large family of receptors that trigger internal cellular responses to sensory, hormonal, neurochemical, and other stimuli arriving at the outside of the cell. For neuroscientists, optoXRs open entirely new research approaches for studying Parkinson's disease, schizophrenia, addiction, and other severe neurological problems, Deisseroth says.

Boyden and his colleagues are trolling the ever-enlarging library of genomic databases to diversify the optogenetic tool set. That's how he and his coworkers found Arch and Mac, two light-driven proton pumps (the first from a bacterium, the second from a fungus) that silence cells into which the researchers insert them when the switches are exposed to yellow and blue light, respectively. The scientists reported their initial work with them in a *Nature* paper on January 7, 2010.

Cell Sculpting

Lim, at UCSF, is applying optogenetic methods to illuminate the localized, protein-protein interactions that underlie everything from turning genes on and off, to making cells more or less sensitive to stimuli, to cytoskeletal remodeling that alters a cell's shape or influences its movements.

Phytochrome B is a light-sensitive receptor in the mustard plant *Arabidopsis thaliana* that Lim is developing as a versatile molecular tool. In its normal role, the phytochrome enables the plants to respond to shade. When bathed in red light, for example, the phytochrome undergoes a shape change that leads to the alteration of gene expression in ways that cause the plant to grow toward sunnier patches of space.

In one audacious show of experimental control, Lim and his colleagues combine the phytochrome with an enzymatic component into modules so they can use light to trigger the polymerization of actin protein molecules in a cell. This results in localized changes in the cell's cytoskeletal framework, which determines the cell's shape. Using precision optics, the researchers can induce localized shape changes with enough finesse that Lim refers to the process as cell sculpting.

Lim can imagine using light to orchestrate new organizations of cells, perhaps even for making neuron-based logic components for biological computers or to help reconstruct damaged nerve tissue.

To demonstrate the utility of the approach in fine cell sculpting, Lim's group used a digital micromirror array device to project a minuscule "game of life" movie onto mammalian cells containing the phytochrome module. Each movie frame displays a pattern of dark and light boxes. The pattern evolves in a systematic way from frame to frame—dark boxes become light and vice versa, according to simple mathematical rules. By projecting these changing patterns of light and dark boxes (pixels) onto a cell, the

researchers induced the cell surface to embody the same morphing patterns.

In a paper in the September 13, 2009, issue of *Nature*, Lim and several UCSF colleagues at the Cell Propulsion Lab say they should be able to link the phytochrome light switch to many other cell signaling pathways that involve the recruitment of protein players. Lim refers to the system as a "universal remote control" for experimentally dictating when and where in a cell to activate a pathway of interest. He can also imagine expanding the toolkit.

"We are learning how to dissect biological systems the way electronics engineers dissect circuits," Lim says. Elegant, precise interventions in neural circuitry, the kind that optogenetics researchers are exploring, stand a chance of eventually taking the place of blunt instruments like surgery, electrodes, and the present generation of pharmaceuticals.

Ivan Amato (reprinted with permission from the *HHMI Bulletin*)

Tales from the Archive

The 1994 ASP meeting was at the Camelback Resort in Scottsdale AZ, where the daytime temperature was 120ºF and at night, because of radiation from the surroundings, it seemed to get hotter. Large chunks of ice were added to the swimming pool but it didn't help. At the far end, the chefs were boiling lobsters.

Some participants were put up in small villas. President **Mike Rodgers** had a particularly lavish villa with a private swimming pool. The photograph shows Pres. Rodgers (far right), being handled by **Tom Coohill**, who is about to attempt something foolish. Several other past-Presidents and major figures in photobiology are also visible. Coohill's plan involved an effort to push Mike into the pool, presumably with the aid of the accompanying group. The next scene involved a great deal of water being thrown about, and then a thoroughly drenched Coohill emerged and was kindly provided with a large bathrobe by a totally dry Mike Rodgers. At the last moment, other members of the poolside group thought better of the plan, but Tom was not to be put off.

The 1994 meeting was later enlivened by an outdoor steak roast on huge beds of hot coals, raising the ambient temperature to levels usually associated with smelting operations. All things considered, it was a memorable week.

David Kessel (ASP Historian)

ASP Homepage Usage Stats

Visitation Summary

Dates: March 22-July 3, 2010 (100 days)
Total page views: 4499
Average page views per day: 45

Geographic Location of Users

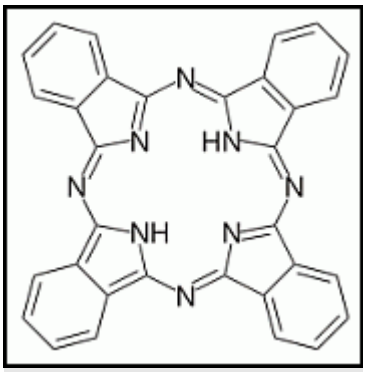
North America: 57%
Europe: 22%
Asia: 11%
Oceania/Australia: 3%
South America: 1%
Africa: 1%
Unknown: 5%

Update Your Browser

About 6% of our visitors are still using Internet Explorer version 6 (IE6), which is now almost 10 years old. Microsoft itself has said that continued use of IE6 is making the web less secure and is an impediment to web developers. It's time to update!

Research by ASP Members

Photodynamic therapy (PDT) is a treatment in which a photosensitive pro-drug is introduced to cancerous or diseased tissue, and is then activated by light. Upon light activation, photosensitive drugs produce reactive oxygen species that destroy the diseased tissue. Topical PDT is currently an approved treatment for nonmelanoma skin cancers and several other skin diseases.



Chemical structure of phthalocyanine.

In the May/June issue of *Photochem Photobiol*, **Myriam E. Rodriguez** and colleagues (Universidad de Buenos Aires) describe the properties of four zinc (II) phthalocyanines that were encapsulated into polymers or gels, which have potential as PDT drugs [1]. They found that these compounds were good photosensitizers and that as the gel lipophilicity increased, the fluorescence yield and singlet oxygen yield also increased. In addition, their gel permeation studies indicated no apparent risk of photosensitivity outside the region where the gel was applied.

[1] Rodriguez ME, Diz VE, Awruch J, Dicelio LE. (2010) Photophysics of Zinc (II) Phthalocyanine Polymer and Gel Formulation. *Photochem Photobiol* 86: 513-519.

ASP-2010 Sponsors

The ASP would like to thank the following companies and organizations for their generous financial support of our recent meeting in Providence, RI.

Boston Electronics	www.boslec.com
Brighter Ideas	www.brighterideasinc.com
Chroma Technology	www.chroma.com
DUSA Pharmaceuticals	www.dusapharma.com
ISS	www.iss.com
Lutron	www.lutron.com
MicroVideo Instruments	www.mvi-inc.com
Ocean Optics	www.oceanoptics.com
Proctor & Gamble	www.pg.com
Quantum BioMedical	www.warp-heals.com
Royal Society of Chemistry	www.rsc.org
Simphotek	www.simphotek.com
Therakos	www.therakos.com
University of Rochester	www.rochester.edu
Wiley-Blackwell	www.wiley.com

ASP-2010

Travel Award Winners

ASP would like to congratulate the 14 students and post-docs who won travel awards, so that they could give presentations at our recent meeting in Providence, RI. Travel awards are supported by the Frederick Urbach Memorial Travel Fund.

Adnan Abu-Yousif: Real-Time In Vivo Monitoring of Tumor Selective Photosensitizer Delivery using Hyperspectral and Endoscopic Imaging Technologies in an Ovarian Cancer Model

Corona M. Cassidy: Photodynamic Antimicrobial Chemotherapy (PACT) of *Burkholderia cepacia* Complex Infection

Craig Grossman: Glottic Laryngeal Mucosal Photodynamic Therapy with a Balloon Diffusing Light Source: Evidence of Targeted Light Delivery and Activity

Jennifer Hunter: Progress on New Thresholds for Photochemical Damage from Ophthalmic Exposures

Dominika Nowis: Improvement of PDT-Induced Antitumor Immune Response

Rasul Sadykov: Applications of Laser in Treating Hemangiomas; Efficacy of Photodynamic Therapy Against Antibiotic Resistant Strains of *Klebsiella*

Bryan Spring: Nanocell-Based Combination Therapy of Pancreatic Cancer: Quantitative Fluorescence Imaging of Bevacizumab Delivery and Antiangiogenic Response

Jonathan Celli: Quantitative Imaging of Photodynamic Therapy Treatment Response in 3D In Vitro Tumor Models

Zofia Drzagza: Fluorescence Spectroscopy to Reveal the Effect of Zidovudine Maternal Administration on Bone Development in Newborn Rats

Gesine Heuck: Endogenous Protoporphyrin IX: A Photodynamic Inactivator for *E.coli*

Patrycja Nowak-Sliwinska: Post-Photodynamic Therapy Regrowth of the Vascular Network in the Chicken's Chorioallantoic Membrane (CAM)

Prokash Rai: Multifunctional Nanotechnology for Combined Photodynamic and Anti-VEGF Therapy Enhances Pancreatic Cancer Treatment Outcome

Ulysses Sallum: Targeting Bacterial Resistance Enzymes for PDT: Predicting Treatment Response and Improving Outcomes

Lei Zak Zheng: An Integrative Therapy that Enhances Pancreatic Cancer Treatment Outcome - Simultaneous Photodynamic Therapy and Receptor Tyrosine Kinase Inhibition using Nanotechnology (SPARKIN)

ASP Officers

President: Tayyaba Hasan (2010-11)
thasan@partners.org

Past-Pres: David Mitchell (2009-10)
dmitchel@mdanderson.org

Pres-Elect: Beth Gaillard (2011-12)
gaillard@niu.edu

Secretary: Don Forbes (2008-11)
forbes@toxarus.com

Treasurer: John Streicher (2009-12)
Streicher.John@epamail.epa.gov

ASP Councilors

2010-2013

Wolfgang Gaertner
gaertner@mpi-muelheim.mpg.de

Francesco Lenci
francesco.lenci@pi.ibf.cnr.it

Micheline Matthews-Roth
mmmathroth@rics.bwh.harvard.edu

Tom Vogelmann
thomas.vogelmann@uvm.edu

Georg Wondrak
wondrak@pharmacy.arizona.edu

2009-12

Chikako Nishigori
chikako@med.kobe-u.ac.jp

David Kessel
dhkessel@med.wayne.edu

Tad Sarna
TSARNA@MOL.MOL.UJ.EDU.PL

Antony Young
antony.r.young@kcl.ac.uk

2008-11

Theresa Busch
buschtm@mail.med.upenn.edu

Bruce Branchini
brbra@conncoll.edu

Robert Sayre
RPTL@aol.com

2010-12

Ulysses Sallum (Associate Councilor)
usallum@partners.org

ASP Secretariat (Business Office)

Linda Hardwick
Lhardwick@allenpress.com

Photobiology Events

Interactive Map/Table:
www.pol-us.net/meetings.html
(All submissions to: ensmingr@twcny.rr.com)

July 11-15, 2010
Light-Activated Tissue Regeneration and Therapy
Burlington, VT (USA)
Web site: http://www.engconfintl.org/10at.html

July 11-16, 2010
23rd IUPAC Symposium on Photochemistry
Ferrara (Italy)
Web site: web.unife.it/convegni/iupac-photochem-2010/

July 13-16, 2010
Challenges in Physical Chemistry and Nanoscience (ISACS2)
Budapest (Hungary)
Web site: www.rsc.org/isacs2

July 16-18, 2010
SolarFest
Tinmouth, VT (USA)
Web site: www.solarfest.org

Jul 30-Aug 5, 2010
Plant Biology 2010: American Society of Plant Biologists Montreal QC (Canada)
Web site: aspb.org/meetings/pb-2010

Aug 8-13, 2010
Electron Donor-Acceptor Interactions
Gordon Research Conference
Newport, RI (USA)
Website: www.grc.org

Aug 15-19, 2010
FASEB - Mechanisms in Plant Development
Saxtons River, Vermont (USA)
Web site: www.faseb.org/meetings

Aug 15-20, 2010
7th International Conference on Photo-Excited Processes and Applications (ICPEPA7)
Copenhagen (Denmark)
Web site: 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

Oct 6-9, 2010
Photodynamic Therapy and Photodiagnosis in Clinical Practice
Brixen/Bressanone (Italy)
Web site: www.bio.unipd.it/2010-PDT/

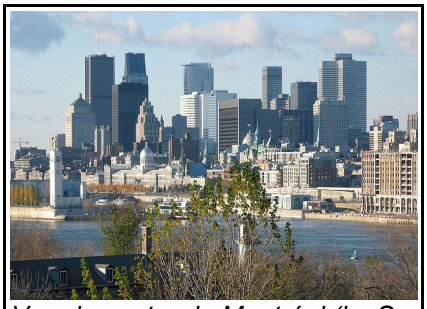
Nov 14-18, 2010
Sixth Asian Photochemistry Conference
Wellington (New Zealand)
Web site: www.confer.co.nz/apcnz2010/

Dec 15-20, 2010
PacifiChem 2010: The International Chemical Congress of Pacific Basin Societies
Honolulu, HI (USA)
Web site: www.pacifichem.org/

May 15-20, 2011
Spin Chemistry Meeting 2011
Noordwijk (Netherlands)
Web site: scm2011.leidenuniv.nl/

Aug 28-Sep 1, 2011
14th International Congress of Radiation Research
Warsaw (Poland)
Web site: www.icrr2011.org/main/article/ptbr

Summer 2012
36th ASP Meeting
Montreal (Canada)
www.asp2012.org



Vue du centre de Montréal (by S. Lacasse)

Other Event Calendars:

SPIE Events:	spie.org/x1375.xml
Plant Biology Events:	aspb.org/calendar
Chemistry Events:	www.chemistry.org
Gordon Res Confs:	www.grc.org
Cell:	www.cell.com/conferences