

ASP NEWS



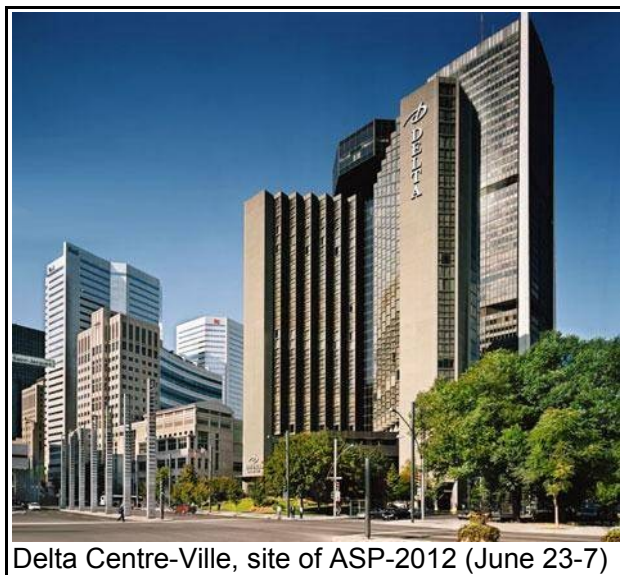
Spring 2012

vol. 41(2)

Letter from the President

Greetings and Happy Spring to All!

As I near the end of my term as ASP President, I thank numerous colleagues who answered my calls for help and contributed their time and effort. Because of such cooperation, we can report a very enthusiastic response to the 36th ASP meeting in Montreal.



Delta Centre-Ville, site of ASP-2012 (June 23-7)

There has been a record of more than 300 abstract submissions for our meeting. Moreover, at 2 months before the meeting, we have met our goal of registrations required by the conference hotel. The abstracts have been reviewed, selected by the program committee and chairs, and placed in appropriate sessions. Following the success of the poster sessions at ASP-2010, we will have two poster sessions with refreshments, and anticipate a high level of interaction among the presenting scientists. There will be several poster prizes and we are seeking volunteers to assist with this selection.

As you will see in our online program, we have

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an exciting combination of new and old photobiology topics, and we are gratified at the large number of international participants. We also wish to thank you for providing the first round of input on site selection for ASP-2014. We will have more information at the Business Meeting in Montreal, where you will have an opportunity to vote on your preference. Finally, I wish to thank the many sponsors of ASP who have come forward with assistance despite the hard economic times.

ASP-2012 Scientific Program

www.photobiology.org/asp.php?id=107

I welcome the new council members, our new President-elect **Keith Cengel**, and thank you all for participating in the nomination and voting process. I leave with the plea for more membership participation in the future so we can better capture the diversity of our society. **John Streicher** (Treasurer) and **Don Forbes** (Secretary) have agreed to continue to their service, but both have offered to train any members who might be interested in serving in the

future.

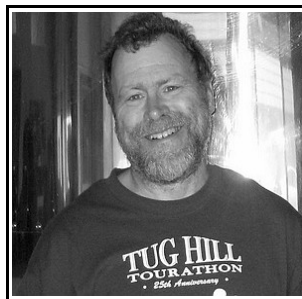
I thank all the subcommittee chairs for doing an awesome job of holding electronic and telephone meetings, with great outcomes. As a result, the Education and Mentoring Committee, chaired by **Theresa Busch**, has organized a terrific grant-writing program for ASP-2012, which is already heavily subscribed. **Georg Wondrak** and the awards committee have clarified the selection criteria, streamlined the ASP awards process, and introduced some new awards. Congratulations to all the ASP award winners for 2012! We look forward to celebrating your achievements at the Montreal meeting. The Chairs of the membership committee, **Kim Samkoe** and **Patrycja Nowak-Sliwinska**, suggested changes to the Associate membership rates that Council has approved.

Thanks to the efforts of the website committee and **Sarika Verma** (Chair), assisted by **Linda Hardwick**, our official website (www.photobiology.org), has a substantially new look and also includes fundamental structural improvements. The web site is now built on a content management system, so can be more easily managed by us directly. We invite all of you to submit scientific images for the top center image of our homepage. The images selected by the website committee will be showcased on our homepage for a fixed period of time. Almost all of you who have viewed the website have noted the improvement. We encourage you to provide suggestions for continued improvements.

I look forward to seeing you all in Montreal where you will enjoy a great scientific program, but also the sights and sounds of Montreal. This includes the Festival International de Jazz de Montreal, Biodome de Montreal, Biosphere Environment Museum, Canadian Center for Architecture, and Centre d'exposition de l'Université de Montréal. Montreal is also well known for its bars where some of the most invigorating scientific exchanges can occur! We have organized tours and negotiated discounted hotel accommodations to make it easy for you to take advantage of the great offerings of Montreal.

-Tayyaba Hasan, ASP President

Letter from the Editor



I hope that the warm spring weather has you thinking about your trip to Montreal in June! This issue of the newsletter features a letter from President **Tayyaba Hasan**, which reports that a

record of more than 300 abstracts have been submitted to ASP-2012. The Abstract Submission site is now closed, but Advance Registration is open until June 4 and Hotel Reservations are guaranteed until May 25. More details are available at www.asp2012.org.

This issue of the newsletter also features an article by **James Shinkle** on UVR8 (p. 5), a UV-B radiation-absorbing photoreceptor that triggers morphogenesis in plants. Jim reported on the discovery of UVR8 in a previous newsletter and here reports on the determination of its structure and function by use of crystallography and other methods. **John Christie**, who received the ASP New Investigator Award in 2003, is one of the leaders in this exciting new research.

Finally, this issue has some interesting tidbits on the 1989 ASP meeting in Boston (p. 3), the rise in skin cancer in young adults in Minnesota and presumably elsewhere (p. 5), and some trivia about “dog vomit slime mold”, a species that is practically begging for a cartoon (p. 3).

See you in Montreal!

ASP News

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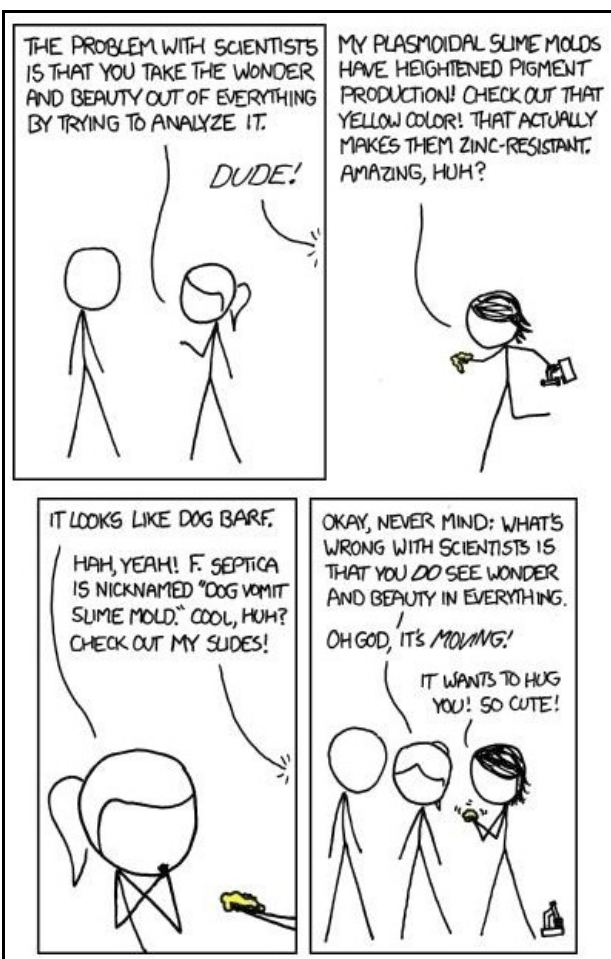
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The problem with scientists ...



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



Fuligo septica ("dog vomit slime mold") produces a yellow pigment (fuligorubin A, a tetramic acid derivative) whose concentration increases with heavy metal accumulation. In 1938, Gray reported that the yellow pigmentation was lost following exposure to light (*Am J Bot* 25: 511). Scholes confirmed this observation in 1962 (*J Gen Microbiol* 29, 137).

Tale from the Archives

The 1989 ASP meeting was held in Boston, with President **Chris Foote**, VP **Tom Coohill**, and Secretary-Treasurer **David Kessel** all in attendance. The weather was remarkably good, and members were able to explore the assorted attractions of nearby Quincy Market. This was a meat processing center beginning in about 1824, but fell into a terminal state of decay until it was rescued by a major reconstruction effort in the 1970s.



17th ASP Meeting in Boston (1989)

The images above show **Mike Rodgers**, **Giulio Jori**, **Chris Foote** and friends (top), the Boston Police explaining the meaning of 'forbidden transition' to onlookers (middle), and **Margaret Kripke** and **Tom Coohill** discussing intermediary metabolism (bottom). As expected, everyone looks about 23 years younger. The meeting abstracts were published in *Photochemistry and Photobiology*, and are available online for those who want to see what was considered topical 22

years ago. The ASP program was much more varied in Boston than in recent years, reflecting the broad national support for science in earlier days.

More recently, it has become necessary to claim that an NIH research proposal will find a cure for something. It seems that the theory of Beadle and Tatum -- *one gene, one enzyme* -- has become *one grant, one cure*. Boston is likely too expensive for another ASP meeting, unless Motel 6 comes to Beacon Hill.

-David Kessel, ASP Historian

ASP 2012

36th Meeting of the ASP, June 23-27

Our biennial meeting is fast approaching. **The deadline to ensure your reduced rate at the Delta Centre-Ville is May 25.** Please make your hotel reservations by this deadline!

The Montreal Jazz Fest begins right after our meeting. If you would like to stay over for the Jazz Fest, we have negotiated our reduced rates for three days following our meeting. The hotel will fill up for this event, so if you plan to stay for the Jazz Fest, reserve your rooms now at:

ASP-2012 Hotel Reservations
www.photobiology.org/asp.php?id=102

If you haven't been online to view how the program is shaping up, visit the ASP website at:

ASP-2012 Scientific Program
www.photobiology.org/asp.php?id=107

Finally, if you have not yet registered, now is the time! Registration in advance allows you to quickly pick up your registration packets on site so you can begin your networking and connect with your colleagues, instead of standing in line. Please register online at:

ASP-2012 Registration
www.photobiology.org/asp.php?id=108

We look forward to seeing you in Montreal. If you have any questions, please feel free to contact

me personally at lhardwick@allenpress.com.

-Linda Hardwick, ASP Executive Secretariat

ASP Election Results

We would like to thank the new ASP council members and officers who will take office at the June ASP Meeting in Montreal. Our congratulations to all!



ASP President-elect, Keith Cengel

Secretary: Don Forbes

Council: Dave Sliney

Kimberley Samkoe

Alec Greer

Edward Maytin

ASU team shines new light on photosynthesis

Photosynthesis is one of the fundamental processes of life on earth. The evolutionary transition from anoxygenic (no oxygen produced) to oxygenic (oxygen-producing) photosynthesis resulted in the critical development of atmospheric oxygen in amounts large enough to allow the evolution of organisms that use oxygen, including plants and mammals.

One of the outstanding questions of the early earth is how ancient organisms made this transition. A team of scientists from Arizona State University has moved us closer to understanding this process in a paper recently published in the *Proceedings of the National Academy of Sciences*

(2012; 109:2314-8). The paper, "Light-driven oxygen production from superoxide by Mn-binding bacterial reaction centers," is authored by **James Allen, Tien Le Olson, Paul Oyala, Wei-Jen Lee, Aaron Tufts, and JoAnn Williams**, all from the Department of Chemistry and Biochemistry of Arizona State University.

Abstract

One of the outstanding questions concerning the early Earth is how ancient phototrophs made the evolutionary transition from anoxygenic to oxygenic photosynthesis, which resulted in a substantial increase in the amount of oxygen in the atmosphere. We have previously demonstrated that reaction centers from anoxygenic photosynthetic bacteria can be modified to bind a redox-active Mn cofactor, thus gaining a key functional feature of photosystem II, which contains the site for water oxidation in cyanobacteria, algae, and plants. In this paper, the Mn-binding reaction centers are shown to have a light-driven enzymatic function; namely, the ability to convert superoxide into molecular oxygen. This activity has a relatively high efficiency with a $k(\text{cat})$ of approximately 1 s^{-1} that is significantly larger than typically observed for designed enzymes, and a $K(\text{m})$ of 35–40 μM that is comparable to the value of 50 μM for Mn-superoxide dismutase, which catalyzes a similar reaction. Unlike wild-type reaction centers, the highly oxidizing reaction centers are not stable in the light unless they have a bound Mn. The stability and enzymatic ability of this type of Mn-binding reaction centers would have provided primitive phototrophs with an environmental advantage before the evolution of organisms with a more complex Mn(4)Ca cluster needed to perform the multielectron reactions required to oxidize water.

Plants and algae, as well as cyanobacteria, use photosynthesis to produce oxygen and “fuels,” the latter being oxidizable substances like carbohydrates and hydrogen. There are two pigment-protein complexes that orchestrate the primary reactions of light in oxygenic photosynthesis: photosystem I and photosystem II.

“In photosynthesis, the oxygen is produced at a special metal site containing four manganese and one calcium atom connected together as a metal cluster,” explains professor James Allen. “This cluster is bound to the protein called photosystem II that provides a carefully controlled environment for the cluster.”

On illumination, two water molecules bound at the cluster are split into molecular oxygen and four protons. Since water molecules are very stable, this process requires that the metal cluster be capable of efficiently performing very energetic reactions.

Allen, Williams and coworkers are trying to understand how a primitive anoxygenic organism that was capable of performing only simple low energy reactions could have evolved into oxygen-producing photosynthesis.

They have been manipulating the reaction center of the purple bacterium *Rhodobacter sphaeroides* encouraging it to acquire the functions of photosystem II. In the recent publication, they describe how a mononuclear manganese bound to the reaction center has gained some of the functional features of the metal cluster of photosystem II.

Although the mononuclear manganese cannot split water, it can react with reactive oxygen species to produce molecular oxygen. These results suggest that the evolution of photosynthesis might well have proceeded through intermediates that were capable of oxygen production and served until a protein with a bound manganese-calcium cluster evolved.

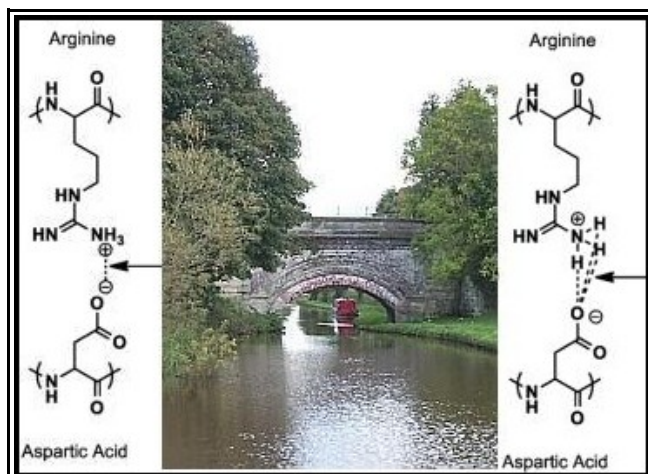
-Jenny Green, ASU Dept of Chemistry and Biochemistry

Breaking the Salt Bridge

Following close on the heels of the identification of the UV RESISTANCE LOCUS 8 (UVR8) protein as a plant photoreceptor for UV-B radiation (1), two reports published within 20 days of each other offer models for how absorption of UV-B radiation leads to the separation of UVR8 dimers into monomers (2,3). The mechanisms proposed, based on a combination of protein crystallography and spectroscopic analysis, confirm that UVR8 functions without a separate chromophore. One of the co-authors -- **John Christie** -- was a recipient of the ASP New Investigator Award in 2003.

Rizzini and co-authors (1) previously

demonstrated that UVR8 undergoes reversible conformation changes upon absorption of UV-B radiation. They also showed that these changes lead to the association of the UVR8 with COP1, a protein known as a hub for the regulation of many photomorphogenic responses in plants. Two characteristics of UVR8 are unusual. *First*, the protein does not have a separate chromophore prosthetic group; instead one or more of the tryptophans presumably act as sites of photon absorption. *Second*, the activation of UVR8 by UV-B radiation appears to involve a change of the protein from a dimer to two monomers. The results of site direct mutagenesis in last year's report implicated a small number of tryptophans as the UV-B absorbing moieties (1).



Salt bridge. A "salt bridge" stabilizes protein structure due to charge-charge interactions (left) and hydrogen bonding (right). The village of Salt (Staffordshire, UK) has a bridge that crosses the Trent and Mersey Canal (center). Images from Wikimedia Commons.

In the recently published research from *Science* and *Nature*, Christie et al. (2) and Wu et al. (3) determined the crystal structure of the dark adapted dimeric form of UVR8 and reported that the dimerization surface was highly enriched in aromatic amino acids, including three tryptophans that were coordinated into a "pyramid". Some of these tryptophans conferred sensitivity to UV-B radiation. In addition, numerous charged amino acids aligned to form multiple cross-dimer salt bridges (see figure) that surround these amino acids. Mutagenesis of these groups prevent UVR8 dimerization. The two groups extended their

studies using different in vitro spectroscopy methods. Wu et al. used time-resolved UV fluorescence of the tryptophans and found that the dark-adapted form increased in fluorescence as the dimer converted to monomers. Christie et al. used the close packing of the tryptophans to predict that the electron orbital overlaps should result in exciton coupling. In particular, they used far-UV circular dichroism to assess whether exciton coupling was present. The groups' findings led them to propose different photochemical models. Wu et al. suggested that the increased fluorescence is due to an excited state proton transfer, as seen in the Green Fluorescent Protein (4). Christie et al. propose an exciton coupling model, similar to that of the photosynthetic light harvesting complex (5).

Both teams agree that a crucial next step is elucidation of how UVR8 monomers interact with COP1 and other downstream signaling partners (6), and how photomorphogenesis signaling from UVR8 differs from that of other plant photoreceptors that use COP1. As noted in another summary of these findings (7), the regulation of protein-protein interactions by modulation of salt bridges may have wide-ranging implications for biotechnology.

References: (1) Rizzini L, Favory J-J, Cloix C, Faggionato D, O'Hara D, Kaiserli E, Baumeister R, Schäfer E, Nagy F, Jenkins GI, Ulm R (2011) Perception of UV-B by the *Arabidopsis* UVR8 protein. *Science* 332: 103-106. (2) Christie JM, Arva AS, Baxter KJ, Heilmann M, Pratt AJ, O'Hara A, Kelly SM, Hothorn M, Smith BO, Hitomi K, Jenkins GI, Getzoff ED (2012) Plant UVR8 photoreceptor senses UV-B by tryptophan-mediated disruption of cross-dimer salt bridges. *Science* 335: 1492-1496. (3) Wu D, Hu Q, Yan Z, Chen W, Yan C, Huang X, Zhang J, Yang P, Deng H, Wang J, Deng X, Shi Y (2012) Structural basis of ultraviolet-B perception by UVR8. *Nature* 484: 214-219. (4) Chattoraj M, King BA, Bublitz GU, Boxer SG (1996) Ultrafast excited state dynamics in green fluorescent protein: multiple states and proton transfer. *Proc Natl Acad Sci* 93: 8362-67. (5) Scholes GD, Fleming GR, Olaya-Castro A, van Grondelle R (2011) Lessons from nature about solar light harvesting. *Nat Chem* 3: 763-764. (6) Jenkins GI (2009) Signal transduction in responses to UV-B radiation. *Ann Rev Plant Biol* 60:407-431. (7) Gardner KH, Correa F (2012) How plants see the invisible. *Science* 335: 1451-1452.

-James Shinkle

Mayo Clinic Study Finds Dramatic Rise in Skin Cancer in Young Adults

Even as the rates of some cancers are falling, the Mayo Clinic is seeing an alarming trend: a dramatic rise of skin cancer, especially among people under 40. According to a study by Mayo Clinic researchers published in the April issue of *Mayo Clinic Proceedings* (87: 328-334), the incidence of melanoma has escalated, and young women are the hardest hit.

"We anticipated we'd find rising rates, as other studies are suggesting, but we found an even higher incidence than the National Cancer Institute had reported using the Surveillance, Epidemiology and End Result (SEER) database, and in particular, a dramatic rise in women in their 20s and 30s," says lead investigator **Jerry Brewer**, MD, a Mayo Clinic dermatologist.

Researchers conducted a population-based study using records from the Rochester Epidemiology Project, a decades-long database of all patient care in Olmsted County, Minnesota. They looked for first-time diagnoses of melanoma in patients 18 to 39 year-old from 1970 to 2009. The study found the incidence of melanoma increased 8-fold among young women and 4-fold among young men. The lifetime risk of melanoma is higher in males than females, but the opposite is true in young adults and adolescents, Dr. Brewer said.

Researchers also found mortality rates from the disease have improved over the years, likely due to early detection of skin cancer and prompt medical care.

"People are now more aware of their skin and of the need to see a doctor when they see changes," Dr. Brewer says. "As a result, many cases may be caught before the cancer advances to a deep melanoma, which is harder to treat."

The researchers speculate that the use of indoor tanning beds is a key culprit in the rising cancer rate in young women.

"A recent study reported that people who use indoor tanning beds frequently are 74% more likely to develop melanoma, and we know young

women are more likely to use them than young men," Dr. Brewer says. Despite abundant information about the dangers of tanning beds, he adds, young women continue to use them. "The results of this study emphasize the importance of active interventions to decrease risk factors for skin cancer and, in particular, to continue to alert young women that indoor tanning has carcinogenic effects that increase the risk of melanoma."

Janey Helland, of Mapleton, Minn., says she didn't think twice when tanning in high school and college.

"I used tanning beds to get ready for homecoming and prom," she says. "In college, I tanned before a trip to Barbados because I didn't want to get sunburned." At age 21, Helland noticed an abnormal spot on her leg. It was melanoma, and the diagnosis changed Helland's life. "I really didn't know what my future was going to look like, or if I'd even have one."

Two years later, she is cancer-free and dedicated to educating others. "I would advocate that it's better to be safe than sorry," she says. "My advice is to educate yourself and research the risk factors."

Childhood sunburns and UV exposure in adulthood can also contribute to melanoma development, the researchers say.

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Photobiology Events



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

Aug 19-23, 2012

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

Oct 21-26, 2012

IPMB-2012: 10th International Congress on Plant
Molecular Biology
Jeju City (Korea)
Web site: www.ipmb2012.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)

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
Cell Press: www.cell.com/conferences

All Submissions to:
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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