ASP NEWS

Spring/Summer 2018 **vol. 47 (2)**

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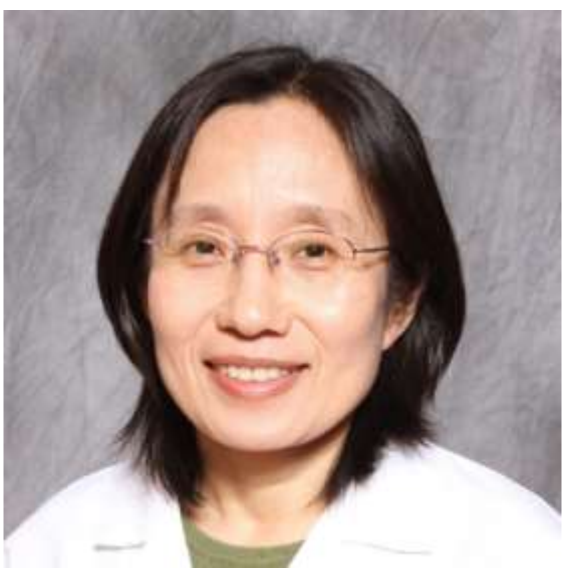
President's Note



Dear ASP members and colleagues,

As the president, I look forward to working with all of you in the next two years for ASP. Here I would like to share with you a few important updates about our society.

1. I would like to thank the following ASP officers and councilors for their outstanding service to the ASP: the former president and now the past president Georg Wondrak, and the councilors Bernhard Ortel and Charles Simone.

2. I would like to congratulate and welcome the newly elected/continuing officers and councilors: the President-Elect Alec Greer, the Secretary Doug Learn, the Treasurer Theresa Busch, the councilors Martin Schnermann and Shiyong Wu, and the Associate Councilors Regina Discipio and Paul O'Mahoney.

3. We just had a successful 2018 meeting in Tampa. We would like to hear your feedback. We are working on putting together an online survey.

4. Save the date. The 2019 ASP Presidential Evening Symposia will be in Chicago, May 9 and 10, 2019. More information will be available online soon.

5. The EC together with the Secretariat is actively working on deciding the venue for ASP 2020.

Enjoy your spring and summer!

Yu-Ying

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Snapshots from ASP 2018

Master chef preparing 'cardiac special' for nourishment of the ASP membership

A view of Tampa after dark.

Past President Tayyaba Hasan and close associates (Imran, Bernard and Ed) in a happy moment

Collection of ASP members sandwiched in between current and past presidents.

-David Kessel, PhD

ASP Awards

Congratulations to everyone who was recognized at the 2018 ASP Meeting for their significant contributions to photobiology, photochemistry and photomedicine! We were also fortunate to support several young scientists with the Frederick Urbach Memorial Student Travel Award, an important investment in the future of the Society!

Thank you to all the members of the ASP Awards Committee who contributed their time and provided a broad range of expertise!

ASP Lifetime Achievement Award

Tayyaba Hasan, Ph.D.

Professor
Department of Dermatology
Harvard Medical School

Professor
Health Sciences and Technology
Harvard-Massachusetts Institute of Technology

Biochemist
Wellman Center for Photomedicine
Massachusetts General Hospital

ASP Research Award

Thierry Douki, Ph.D.

Chercheur, Adjoint du chef de Service
Directeur de Recherche du CEA
Laboratoire Systèmes Moléculaires et nanoMatériaux pour l'Energie et la Santé (SyMMES) UMR CNRS/UGA/CEA
Équipe Chimie en Interfac avec la Biologie en Environnement, Santé et Toxicologie (CIBEST)

ASP New Investigator Award

Shobhan Gaddameedhi, Ph.D.
Assistant Professor
Pharmaceutical Sciences
College of Pharmacy
Washington State University

Editor's Student Research Award

Marvin Pollum, Ph.D.
From the Laboratory of Carlos Crespo, Ph.D
Department of Chemistry
Case Western Reserve University

Currently: PPG Industries
Pittsburgh, PA

Photocite-A Award

So Yeong Lee and **Sang-Woo Joo**

Photocite-B Award

Douglas Brash, Ph.D.
Senior Research Scientist
Therapeutic Radiology and Dermatology

Clinical Professor
Therapeutic Radiology
Yale School of Medicine

Frederick Urbach Memorial Student Travel Award

Sepalika Bandara, University of Illinois at Chicago

Gwendolyn Cramer, Ph.D. U Penn Health System

Richard Davis IV, Ph.D. U Penn Health System

Marie Dorr, M.Sc., Laval University

David Jean du Preez, M.Sc., University of Pretoria

Anne-Sophie Gary, M.Sc., Laval University

Ryan Lang, Northeastern University

Richard Lincoln, McGill University

Arvind Mohan, Northeastern University

Kaitlin Moore, Northeastern University

Kylie Morgan, University of London

Yi Hong Ong, Ph.D., U Penn Health System

Luis Ortiz-Rodriguez, Case Western Reserve University

Michael Pigula, Massachusetts General Hospital

Palak Shah, University of Chicago

Ajeet Srivastav, Indian Institute of Toxicology Research

Yunxian (Giselle) Tian, University of British Columbia

Kai Zhang, Northeastern University

ASP Awards Committee: Imran Rizvi (Chair), Georg Wondrak (ASP Past President), Yu-Ying He (ASP President), David Kessel, Thierry Douki, Sherri McFarland, Tadeusz Sarna, Lisa Kelly, Huang-Chiao (Joe) Huang, Bryan Spring, Jonathan Lovell, Giuliano Scarcelli

-Imran Rizvi, PhD

We need YOU!

Please submit content (science highlights, suggested links, personal stories, etc) to ASP News. Email: jflovell@buffalo.edu or Huang.Huang-Chiao@mgh.harvard.edu

Photo-vaccines

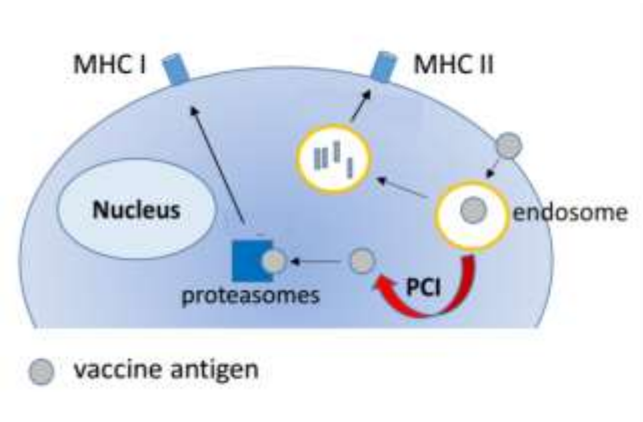
PCI technology as a novel strategy for therapeutic cancer peptide vaccination

CD8+ cytotoxic T lymphocytes (CTLs) are the most efficient and specific immune cells to kill cancer cells. Unfortunately, induction of cancer-specific CTLs is difficult to achieve with today's vaccination strategies. A major obstacle is that vaccine antigens endocytosed by antigen-presenting cells (APCs) do not translocate efficiently from endosomes into the cytosol. From the cytosol, antigen can feed into the MHC class I antigen-presentation pathway which effectively induces CTL responses.

In a recent collaboration study between the Norwegian University of Science and Technology (NTNU), Oslo University Hospital and PCI Biotech AS we demonstrated that the PCI technology (PCI = Photochemical internalization) may provide a novel strategy to improve the effectivity of cancer vaccination by a light-controlled routing of endocytosed vaccine antigens to the cytosol of APCs.

We found that PCI-mediated cytosolic delivery made antigenic peptides 30- 100-fold more accessible for MHC class I antigen-presentation and subsequent CTL activation. In addition, it was found that the PCI treatment in itself had an adjuvant effect on APCs, probably due to low-grade cell damage and inflammation by the treatment. In mice, we could demonstrate that intradermal vaccination using the PCI technology was able to effectively induce specific CTL responses to two cancer antigens without the use of any additional adjuvant in the vaccine formulation.

We used in our study short antigenic peptides, which usually are poorly immunogenic. Thus our findings may be of particular interest as these short peptides have attractive features for therapeutic cancer vaccination: They are generally non-toxic, cheap, easy to synthesize and can thus readily be tailored for patient-specific vaccination therapy. We therefore believe that PCI-mediated cancer peptide vaccination may provide a promising novel approach to realize effective therapeutic cancer vaccination by raising specific CTL responses against neo-epitopes and tumor mutations found in patients. PCI Biotech currently conducts a clinical validation of the PCI vaccination technology (fimaVACC) in a Phase I/Proof of Principle study in healthy volunteers.



The journal “Frontiers in Immunology” published the paper. https://doi.org/10.3389/fimmu.2018.00650

-Markus Haug (NTNU) and Pål Kristian Selbo (Oslo University Hospital)

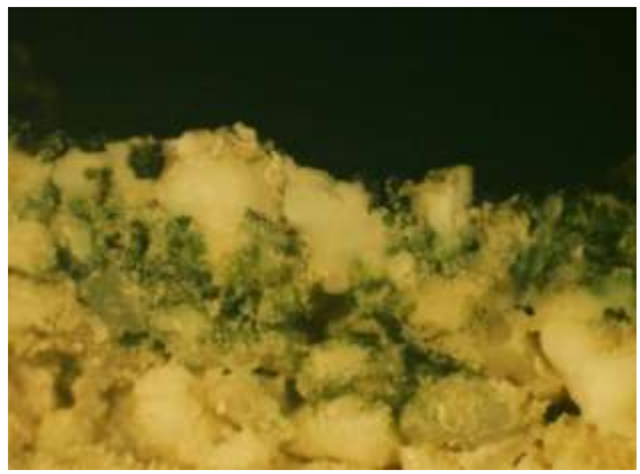
Near Infrared Photosynthesis

The vast majority of life on Earth uses visible red light in the process of photosynthesis, but the new type uses near-infrared light instead. It was detected in a wide range of cyanobacteria (blue-green algae) when they grow in near-infrared light, found in shaded conditions like bacterial mats in Yellowstone and in beach rock in Australia. As scientists have now discovered, it also occurs in a cupboard fitted with infrared LEDs in Imperial College London.

The standard, near-universal type of photosynthesis uses the green pigment, chlorophyll-a, both to collect light and use its energy to make useful biochemicals and oxygen. The way chlorophyll-a absorbs light means only the energy from red light can be used for photosynthesis.

Since chlorophyll-a is present in all plants, algae and cyanobacteria that we know of, it was considered that the energy of red light set the ‘red limit’ for photosynthesis; that is, the minimum amount of energy needed to do the demanding chemistry that produces oxygen. The red limit is used in astrobiology to judge whether complex life could have evolved on planets in other solar systems.

However, when some cyanobacteria are grown under near-infrared light, the standard chlorophyll-a-containing systems shut down and different systems containing a different kind of chlorophyll, chlorophyll-f, takes over.



Cross-section of beach rock (Heron Island, Australia) showing chlorophyll-f containing cyanobacteria (green band) growing deep into the rock, several millimetres below the surface

Until now, it was thought that chlorophyll-f just harvested the light. The new research shows that instead chlorophyll-f plays the key role in photosynthesis under shaded conditions, using lower-energy infrared light to do the complex chemistry. This is photosynthesis ‘beyond the red limit’.

Lead researcher Professor Bill Rutherford, from the Department of Life Sciences at Imperial, said: “The new form of photosynthesis made us rethink what we thought was possible. It also changes how we understand the key events at the heart of standard photosynthesis. This is textbook changing stuff.”

Another cyanobacterium, Acaryochloris, is already known to do photosynthesis beyond the red limit. However, because it occurs in just this one species, with a very specific habitat, it had been considered a 'one-off'. Acaryochloris lives underneath a green sea-squirt that shades out most of the visible light leaving just the near-infrared.

The chlorophyll-f based photosynthesis reported today represents a third type of photosynthesis that is widespread. However, it is only used in special infrared-rich shaded conditions; in normal light conditions, the standard red form of photosynthesis is used.

It was thought that light damage would be more severe beyond the red limit, but the new study shows that it is not a problem in stable, shaded environments.

Co-author Dr Andrea Fantuzzi, from the Department of Life Sciences at Imperial, said: "Finding a type of photosynthesis that works beyond the red limit changes our understanding of the energy requirements of photosynthesis. This provides insights into light energy use and into mechanisms that protect the systems against damage by light."

These insights could be useful for researchers trying to engineer crops to perform more efficient photosynthesis by using a wider range of light. How these cyanobacteria protect themselves from damage caused by variations in the brightness of light could help researchers discover what is feasible to engineer into crop plants.

More detail could be seen in the new systems than has ever been seen before in the standard chlorophyll-a systems. The chlorophylls often termed 'accessory' chlorophylls were actually performing the crucial chemical step, rather than the textbook 'special pair' of chlorophylls in the centre of the complex.

This indicates that this pattern holds for the other types of photosynthesis, which would change the textbook view of how the dominant form of photosynthesis works.

Dr Dennis Nürnberg, the first author and initiator of the study, said: "I did not expect that my interest in cyanobacteria and their diverse lifestyles would snowball into a major change in how we understand photosynthesis. It is amazing what is still out there in nature waiting to be discovered."

Peter Burlinson, lead for frontier bioscience at BBSRC – UKRI says, "This is an important discovery in photosynthesis, a process that plays a crucial role in the biology of the crops that feed the world. Discoveries like this push the boundaries of our understanding of life and Professor Bill Rutherford and the team at Imperial should be congratulated for revealing a new perspective on such a fundamental process."

'Photochemistry beyond the red-limit in chlorophyll f-containing photosystems' by Nürnberg et al., is published in *Science*.

-Imperial College London

Upcoming Photobiology Events

International Conference on Porphyrins and Phthalocyanines. July 1-6, 2018, Munich, Germany www.icpp2018.org

PDT and Photodiagnosis 2018. Sep 19-22, 2018, Munich, Germany. http://pdt2018.com

IPA World Congress. June 28-July 4, 2019, Boston, MA. https://www.ipaboston2019.org

Photosynthesis Gordon Research Conference. 2019, July 21-26, 2019, Newry, ME. http://www.grc.org/photosynthesis-conference/2019

17th International Congress on Photobiology & 18th Congress of the European Society for Photobiology, Aug 25-30, 2019: Barcelona, Spain http://www.iuphotobiology.org

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