Photobiology News (2005)

by Peter A. Ensminger

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UV Radiation, Vitamin D, and Health

The November/December issue of *Photochemistry and Photobiology* features a "Symposium in Print" on the controversy surrounding the role of UV radiation and vitamin D status on various aspects of human health. This series has been reported in numerous trade science magazines:

- → A recent article in *Science News* [1] reports that the paper by Grant et al. [2] in this "Symposium in Print" concludes that "as many as 50,000 people may die prematurely in the United States each year from diseases related to vitamin D deficiency, at an estimated cost to society of at least $40 billion".
- → *Medical News Today* [3] reports on this "Symposium in Print" and concludes their write-up by saying that "the role of vitamin D for human health and the best way to achieve good vitamin D status is a controversial area of ongoing scientific and medical research. The current papers, by internationally acknowledged experts, show that consensus is unlikely in the near future."

1. Janet Raloff, 2005, Breathing Easier with Vitamin D. *Science News*.
2. Grant WB, Garland CF, Holick MF, 2005. Comparisons of estimated economic burdens due to insufficient solar ultraviolet irradiance and vitamin D and excess solar UV irradiance for the United States. P*hotochem Photobiol* 81: 1276-1286. [PubMed]
3. Public Health Issues Surrounding Vitamin D. *Medical News Today*. [PubMed]

Photooxidation of Pyocyanin in *Pseudomonas aeruginosa*

Pseudomonas aeruginosa is an aerobic bacterium that is an opportunistic pathogen of humans and is well known for its resistance to antibiotics. *P. aeruginosa* produces pyocyanin, a virulence factor that is involved in iron metabolism. In the November/December issue of *Photochemistry and Photobiology*, **ASP** member Krzysztof J. Reszka (University of Cincinnati) and colleagues show that illumination of pyocyanin in the presence of rose bengal or riboflavin photooxidizes pyocyanin. They characterize this photooxidation reaction with spectrophotometry and EPR spectroscopy. This photochemical study suggests that photodynamic antimicrobial chemotherapy has potential clinical applications for the inactivation of pyocyanin and detoxification of superficial wounds infected with *Pseudomonas aeruginosa*.

1. Reszka KJ, Denning G, Britigan B, 2005, Photosensitized Oxidation and Inactivation of Pyocyanin, a Virulence Factor of *Pseudomonas aeruginosa*. *Photochem Photobiol* 2005 Jul 1 [Epub ahead of print] [PubMed]

November 25, 2005
UV Radiation, Vitamin D, and Health

The November/December issue of *Photochemistry and Photobiology* features a "Symposium in Print" on the controversy surrounding the role of UV radiation and vitamin D status on various aspects of human health. This series begins with an introduction by **ASP** member Anthony Young and Susan Walker (St Johns Institute of Dermatology, London) [1]. UV radiation is well known to promote cataracts, keratoses, and skin cancers. However numerous studies also indicate that UV radiation, by promoting vitamin D synthesis, may have a beneficial effect on the susceptibility or outcome for several forms of cancer, multiple sclerosis, type-I diabetes, and rheumatoid arthritis.

1. Young AR, Walker SL, 2005, UV Radiation, Vitamin D and Human Health: An Unfolding Controversy. *Photochem Photobiol* [Epub ahead of print] [Link]

Cryptochrome Review

The November/December issue of *Photochemistry and Photobiology* also features a review article on the cryptochromes by Carrie Partch and **ASP** member Aziz Sancar (University of North Carolina) [1]. The cryptochromes are light-activated flavoproteins related to DNA photolyase that were first identified in the plant *Arabidopsis thaliana*. Subsequent studies have shown that cryptochromes regulate growth, development, and other responses in humans and other animals, plants, fungi, and bacteria. This review article covers genetics and in vivo studies, photochemistry and *in vitro* studies, and recent studies that implicate cryptochrome in the magnetoreception of birds and insects.

1. Partch C, Sancar A, 2005, Photochemistry and Photobiology of Cryptochrome Blue-Light Photopigments: The Search for a Photocycle. *Photochem Photobiol* [Epub ahead of print] [PubMed]

November 11, 2005

Phototherapy with Fullerenes

Fullerenes are large and stable carbon-cage molecules of 7-15 angstroms in diameter, with many potential applications [1]. In the recent issue of *Chemistry and Biology*, **ASP** member Michael R. Hamblin (Massachusetts General Hospital) and colleagues report their studies of the antimicrobial photodynamic effects of derivatized fullerenes [2]. Their results show that these fullerenes were highly effective photosensitizers, suggesting that they may have clinical applications in antimicrobial therapy.

1. Nakamura E, Isobe H, 2003, Functionalized fullerenes in water. The first 10 years of their chemistry, biology, and nanoscience. *Acc Chem Res* 36: 807-15. [PubMed]
2. Tegos GP, Demidova TN, Arcila-Lopez D, Lee H, Wharton T, Gali H, Hamblin MR, 2005, Cationic fullerenes are effective and selective antimicrobial photosensitizers. *Chem Biol* 2005 12: 1127-35. [PubMed]

Diet and Nonmelanoma Skin Cancer

Nonmelanoma skin cancer, while rarely fatal, is the most common form of cancer in the USA, with more than one million new cases per year. It is widely accepted that ultraviolet radiation from the sun is a major cause of these cancers. In the recent issue of *Expert Review of Anticancer Therapy*, **ASP** member Homer S. Black (Baylor College of Medicine) reviews epidemiological studies and animal studies that show a relationship between dietary fat and the occurrence of skin cancers [1]. These studies suggest that people at risk for developing nonmelanoma skin cancers may benefit from low fat diets.

1. Black HS, 2005, Can diet prevent nonmelanoma skin cancer progression? *Expert Rev Anticancer Ther* 5: 801-8. [PubMed]

October 28, 2005

Blue Light Photoreceptor in Pseudomonas putida

Pseudomonas putida is a common soil bacterium often used in bioremediation. In 2002, researchers from The Institute for Genomic Research published the complete genome sequence for the KT2440 strain of *P. putida* [1]. In a recent issue of *Physical Chemistry Chemical Physics*, **ASP** member Wolfgang Gärtner (Max Planck Institute for Radiation Chemistry, Mulheim) and

colleagues present an initial photochemical characterization of a blue-light sensing, phototropin-related protein from *P. putida* [2]. They show that this protein has photochemistry similar to YtvA, a blue light sensitive protein present in *Bacillus subtilis*, and to phototropin, a blue light sensitive protein present in plants.

1. Nelson KE, et al., 2002, Complete genome sequence and comparative analysis of the metabolically versatile Pseudomonas putida KT2440. *Environ Microbiol* 4: 799-808. [PubMed]
2. Krauss U, Losi A, Gartner W, Jaeger KE, Eggert T, 2005, Initial characterization of a blue-light sensing, phototropin-related protein from Pseudomonas putida: a paradigm for an extended LOV construct. Phys *Chem Chem Phys* 7: 2804-11. [PubMed]

Molecular Mechanism of Photolyase

Ultraviolet radiation damages DNA by causing formation of cyclobutane pyrimidine dimers (CPDs) and other products. The photolyase protein, which has a flavin co-factor, uses blue and UV-A radiation to repair CPDs, but the details of its mechanism have not been fully characterized. In a forthcoming issue of *Proceedings of the National Academy of Sciences*, **ASP** member Aziz Sancar (University of North Carolina) and colleagues characterize the catalytic processes by analysis at the picosecond time scale [1]. Their results show that photolyase repairs CPDs via a radical mechanism that is completed on subnanosecond time scale at the dynamic active site and that there is no net change in the redox state of the flavin.

1. Kao YT, Saxena C, Wang L, Sancar A, Zhong D, 2005, Direct observation of thymine dimer repair in DNA by photolyase. *Proc Natl Acad Sci* Sep 16; [Epub ahead of print] [PubMed] October 14, 2005

Phototherapy for Ulcers

The 2005 Nobel Prize in Medicine or Physiology was awarded to Barry Marshall and Robin Warren, who showed that *Heliobacter pylori* causes gastritis and peptic ulcer disease [1]. Antibiotics can eradicate this bacterium, but are not always effective due to increasing bacterial resistance. In a recent issue of *Antimicrobial Agents and Chemotherapy*, **ASP** member Michael Hamblin (Massachusetts General Hospital) and colleagues report their studies on the use of visible light for eradication of virulent and drug-resistant strains of cultured H. pylori [2]. They show that this bacterium is remarkably sensitive to violet/blue light because it accumulates abundant porphyrins. This study demonstrates the potential of phototherapy for treatment of *H. pylori* infection.

1. Press Release: The 2005 Nobel Prize in Physiology or Medicine, Oct 3, 2005.
2. Hamblin MR, Viveiros J, Yang C, Ahmadi A, Ganz RA, Tolkoff MJ, 2005, *Helicobacter pylori* accumulates photoactive porphyrins and is killed by visible light. *Antimicrob Agents Chemother* 2005 49: 2822-7. [PubMed]

Kinase Activity of Phototropin

Phototropin is a blue light photoreceptor that controls phototropism, chloroplast movement, stomatal opening, and other plant responses. At the molecular level, light causes phototropin to autophosphorylate at several distinct sites. In a recent issue of *Proceedings of the National Academy of Sciences*, Daisuke Matsuoka and **ASP** member Satoru Tokutomi (University of Osaka, Japan) present results showing that casein (a common substrate for Ser/Thr protein kinases) can act as substrate for phototropin kinase activity [1]. Further, their studies show that the LOV2 domain of phototropin acts as a light-regulated molecular switch for constitutively active kinase activity. The phototropin LOV1 domain modulates the sensitivity of the LOV2 switch.

1. Matsuoka D, Tokutomi S, 2005, Blue light-regulated molecular switch of Ser/Thr kinase in phototropin. *Proc Natl Acad Sci* 102: 13337-42. [PubMed]
September 30, 2005

Luciferase Mutants

Luciferase from the North American firefly (*Photinus pyralis*) naturally emits yellow-green (557 nm) light and is commonly used as a reporter gene to monitor gene expression. In the recent issue of *Analytical Biochemistry*, **ASP** member Bruce Branchini (Connecticut College) and colleagues report on their use of luciferase mutants that emit red (615 nm) or green (549 nm) light [1]. Their studies show the feasibility of simultaneous assay of multiple bioluminescence reactions by the use of multiple luciferase mutants.

1. Branchini BR, Southworth TL, Khattak NF, Michelini E, Roda A, 2005, Red- and green-emitting firefly luciferase mutants for bioluminescent reporter applications. *Anal Biochem* 345: 140-8. [PubMed]

Psoriasis Therapy

Dermatologists in Europe commonly treat patients who have plaque psoriasis with a combination of Dead Sea (DS) salt solution soaks and phototherapy (narrowband UV-B radiation, 311-312 nm). In the recent issue of *British Journal of Dermatology*, **ASP** member Sally Ibbotson (University of Dundee) and colleagues report their study of this combination therapy in sixty patients with chronic plaque psoriasis [1]. They compared patients given the combination therapy with patients given phototherapy alone (narrowband UV-B radiation, 311-312 nm). Their results show no clinically significant difference in clearance of psoriasis between these two groups.

1. Dawe RS, Yule S, Cameron H, Moseley H, Ibbotson SH, Ferguson J, 2005, A randomized controlled comparison of the efficacy of Dead Sea salt balneophototherapy vs. narrowband ultraviolet B monotherapy for chronic plaque psoriasis. *Br J Dermatol* 153: 613-9. [PubMed]

September 16, 2005

Sunscreens and Melanoma

Numerous case-control studies have retrospectively compared the incidence of malignant melanoma among people who used sunscreen and controls who did not. Surprisingly, meta-analyses of these studies have shown no association between sunscreen use and malignant melanoma. In the recent issue of *British Journal of Dermatology*, **ASP** member Brian Diffey (Newcastle General Hospital, United Kingdom) critically reviews these studies [1]. He concludes that the older formulations of sunscreens, in use 10-20 years ago, were ineffective or improperly applied. He argues that modern high-SPF sunscreens will effectively prevent melanoma, although these effects may not become apparent for several decades in the future.

1. Diffey BL, 2005, Sunscreens and melanoma: the future looks bright. *Br J Dermatol* 153: 378-81.[PubMed]

Cryptochrome and Cancer

Previous studies indicate that disruption of the circadian clock increases the risk of breast cancer in humans and the incidence of ionizing radiation-induced murine tumors and mortality. In the recent issue of *Cancer Research*, Michele Gauger and **ASP** member Aziz Sancar (University of North Carolina School of Medicine) report their studies of this later effect. They used mice and murine fibroblasts that lack cryptochromes (Cry1-/- Cry2-/- mutants), photoreceptive proteins that regulate the circadian clocks of diverse organisms, including mice and humans [1]. Their

results show that cryptochrome-mediated disruption of the murine clock does not increase the risk of ionizing radiation-induced tumors. This indicates that not all forms of clock disruption increase the risk of cancer.

1. Gauger MA, Sancar A, 2005, Cryptochrome, circadian cycle, cell cycle checkpoints, and cancer. *Cancer Res* 65: 6828-34.[PubMed]

August 26, 2005

Mutagenesis Studies of Bacillus subtilis Photoreceptor

YtvA is a light sensitive protein present in Bacillus subtilis that is related to phototropin, a blue light sensory receptor in plants. Both YtvA and phototropin have LOV (Light-Oxygen-Voltage) domains in which blue light drives the reversible formation of a covalent flavin-cysteine adduct. In a forthcoming issue of *Photochemistry and Photobiology*, **ASP** members Aba Losi (University of Parma), Wolfgang Gaertner (MPI Institute for Bio-Inorganic Chemistry), and colleagues report their studies of selected YtvA mutants by UV fluorescence and circular dichroism spectroscopy [1]. Their results highlight the specific regions that stabilize YtvA structure and that regulate the photocycle.

1. Losi A, Ghiraldelli Sven Jansen E, Jansen S, Gartner W, 2005, Mutational Effects on Protein Structural Changes and Interdomain Interactions in the Blue-Light sensing LOV Protein YtvA. *Photochem Photobiol* 2005 May 1; [Epub ahead of print] [PubMed]

PUVA and Narrowband UVB Phototherapy

Psoriasis and eczema may be treated by one of two general types of phototherapy. Psoralen photochemotherapy (PUVA) involves topical application of psoralen followed by exposure to broadband ultraviolet-A radiation. Narrowband (311-312 nm) ultraviolet-B radiation therapy is associated with a lower risk of photocarcinogenesis than PUVA and is increasingly replacing PUVA. In a recent issue of *Journal of Dermatology Treatment*, **ASP** member John L. Hawk (St. Thomas Hospital, London) and colleagues report their retrospective study of adherence to PUVA and narrowband UVB therapy guidelines established by the British Photodermatology Group [1]. They found that the guidelines were followed closely, with several medically justifiable exceptions.

1. Yones SS, Palmer RA, Kuno Y, Hawk JL, 2005, Audit of the use of psoralen photochemotherapy (PUVA) and narrowband UVB phototherapy in the treatment of psoriasis. *J Dermatolog Treat* 16: 108-12. [PubMed]

August 5, 2005

Role of Calcium in Photosynthesis

In the first step of oxygenic photosynthesis, Photosystem-II (PS-II) oxidizes water in four sequential reactions, producing oxygen, protons, and electrons. The electrons are eventually passed to plastoquinone. Calcium plays an important role in water oxidation. Strontium can replace calcium, but strontium-based PS-II oxidizes water at a slower rate. In the recent issue of *Biophysical Journal*, **ASP** member Bridgette Barry (Georgia Institute of Technology) and colleagues report their study of the role of calcium in water-limited PS-II [1]. They show that strontium substitution or 18OH2 exchange leads to conformational changes that interfere with two steps of the water oxidation process.

1. Barry BA, Hicks C, De Riso A, Jenson DL, 2005, Calcium ligation in Photosystem II under inhibiting conditions. *Biophys J* 89: 393-401. [PubMed]

The Future of Photodynamic Therapy

Photodynamic therapy (PDT) involves administration of a photosensitive drug and radiation of the appropriate wavelength to destroy cancerous or other harmful cells. In a recent issue of *Expert Opinion in Emerging Drugs*, **ASP** member Stuart Marcus (Dusa Pharmaceuticals) and W.R. McIntyre review recent advances in PDT [1]. In 1995, the FDA first approved PDT for treatment of esophageal cancer. Since then, the FDA has approved PDT for treatment of early and late-stage lung cancer, actinic keratoses, and age-related macular degeneration. Clinicians are currently investigating the potential of PDT for treatment of many additional conditions, such as prostate cancer, psoriasis, and acne [2].

1. Marcus SL, McIntyre WR, 2005, Photodynamic therapy systems and applications. Expert Opin Emerg Drugs 7: 321-34. [PubMed]
2. National Institutes of Health, 2005, ClinicalTrials.gov [ClinicalTrials.gov]

July 15, 2005

Resistance to Ultraviolet Radiation in Rice

Ultraviolet radiation (UV) can damage DNA by causing formation of cyclobutyl pyrimidine dimers (CPDs). Plants can repair CPDs with the enzyme CPD photolyase, a light activated enzyme. In the recent issue of *Genetics*, **ASP** member Tadahashi Kumagai (Tohoku University, Japan) and colleagues examined the molecular genetic basis of UV sensitivity in rice by comparing a UV-resistant strain (Nipponbare) and a UV-sensitive strain (Kasalath) [1]. Their results show that that a single-base substitution in the CPD photolyase gene caused the alteration of activity of CPD photolyase and associated resistance to ultraviolet radiation.

In another recent paper [2], **ASP** members Betsy Sutherland (Brookhaven National Laboratory) and Tadashi Kumagai (Tohoku University, Japan) report their comparison of UV sensitivity in rice strains Surjamkhi (a UV-sensitive indica cultivar) and Sasanishiki (a UV-resistant japonica cultivar). They show that the CPD photolyase gene of the Surjamkhi strain has alterations at two bases. In addition, they performed a linkage analysis in rice populations derived from the Surjamkhi and Sasanishiki strains. Their results show that UV sensitivity is a quantitatively inherited trait and that much of this variation can be explained by variation in the CPD photolyase gene.

Together, these studies demonstrate that it is feasible to increase rice resistance to UV by breeding or by genetic engineering of the photolyase gene.

1. Ueda T, Sato T, Hidema J, Hirouchi T, Yamamoto K, Kumagai T, Yano M, 2005, qUVR-10, a major quantitative trait locus for ultraviolet-B resistance in rice, encodes cyclobutane pyrimidine dimer photolyase. *Genetics*. Jun 18; [epub] [PubMed]
2. Hidema J, Teranishi M, Iwamatsu Y, Hirouchi T, Ueda T, Sato T, Burr B, Sutherland BM, Yamamoto K, Kumagai T, 2005, Spontaneously occurring mutations in the cyclobutane pyrimidine dimer photolyase gene cause different sensitivities to ultraviolet-B in rice. *Plant J* 43: 57-67. [PubMed]

July 1, 2005

Model for Photoinhibition of Photosynthesis

Photoinhibition is defined as the decrease in photosynthesis under excessive levels of light. This is primarily due to inactivation of photosystem-II (PS-II). In the recent issue of *Biochemistry*, **ASP** member Masakatsu Watanabe (National Institute for Basic Biology, Okazaki) and colleagues propose a two-step model for photoinhibition [1]. According to this model, blue and UV radiation first inactivates the oxygen-evolving complex. In the second step, light absorbed by

chlorophyll inactivates the PS-II reaction center. This model was supported by experiments with monochromatic light performed at the Okazaki Large Spectrograph.

1. Ohnishi N, Allakhverdiev SI, Takahashi S, Higashi S, Watanabe M, Nishiyama Y, Murata N, 2005, Two-Step Mechanism of Photodamage to Photosystem II: Step 1 Occurs at the Oxygen-Evolving Complex and Step 2 Occurs at the Photochemical Reaction Center. *Biochemistry* 44: 8494-8499. [PubMed]

Hypericin-mediated PDT and Cytokine Induction

Hypericin is a polycyclic quinone that has potential use as a photosensitizer for photodynamic therapy (PDT). PDT leads to induction of cytokines (such as interleukin-6 [IL-6]) and subsequent inflammation. In a forthcoming issue of *Cancer Letters*, **ASP** member Malini Olivo (National University of Singapore) and colleagues report on their study of IL-6 expression in nasopharyngeal cancer cells after hypericin-mediated PDT [1]. They show that hypericin-mediated PDT affects expression of IL-6 but that there are differences according to cell type, degree of histological differentiation, and basal expression.

1. Du H, Bay BH, Mahendran R, Olivo M, 2005, Hypericin-mediated photodynamic therapy elicits differential interleukin-6 response in nasopharyngeal cancer. *Cancer Lett* May 31; [Epub ahead of print] [PubMed]

June 17, 2005

11th Congress of the European Society for Photobiology

Registration for the 11th Congress of the ESP (Aix-les-Baines France, Sept 3-8, 2005) will be at the lower rate until June 30. In addition, hotel reservations will be extended until mid-August. Space may be limited in several hotels.

For registration and further information, visit the ESP Congress web site.

Light-Induced Structural Changes in Oxyblepharismin

Blepharisma japonicum is a single-celled, free-living, ciliated microorganism that exhibits numerous movement responses to light. Oxyblepharismin (OxyBP) is the hypericin-like pigment that controls the step-up photophobic response of the blue form of *Blepharisma japonicum*. In a forthcoming issue of *Photochemistry and Photobiology*, **ASP** member Francesco Lenci (CNR Istituto Biofisica, Italy) and colleagues report on their structural studies of OxyBP by circular dichroism [1]. Their results show that OxyBP induces an increase in the alpha-helix content of the protein matrix and that OxyBP has a chiral conformation with a preferential geometry when associated to its protein matrix and when isolated and dissolved in ethanol.

1. Pieroni O, Plaza P, Mahet M, Angelini N, Checcucci G, Malatesta M, Martin MM, Lenci F, 2005, Circular Dichroism of the Photoreceptor Pigment Oxyblepharismin. *Photochem Photobiol* Apr 1; [Epub ahead of print] [PubMed]

June 3, 2005

Action Spectrum for cis-Urocanic Acid Production

Ultraviolet radiation (UV) transforms trans-urocanic acid (UCA), which is naturally present in human skin, into cis-UCA. Formation of cis-UCA leads to immunosuppression in murine and human models. Cis-UCA is presumably the chromophore and mediator of UV-induced immunosuppression. In the recent issue of *Journal of Investigative Dermatology*, **ASP** member Mary Norval (University of Edinburgh) and colleagues present an action spectrum for the formation of cis-UCA in human skin [1]. The action spectrum has a broad maximum from 280-

310 nm and differs from the action spectrum for sunburn. This difference may explain why many sunscreens effectively protect against sunburn but not photo-immunosuppression.

1. McLoone P, Simics E, Barton A, Norval M, Gibbs NK, 2005, An action spectrum for the production of cis-urocanic acid in human skin in vivo. *J Invest Dermatol* 124(5):1071-4. [PubMed]

Function of LOV Domains in Adiantum Phytochrome-3

Phytochrome-3 (phy-3) is an unusual photoreceptor in the fern *Adiantum*. *Adiantum* Phy-3 has the chromophore-binding domain of phytochrome (a red/far-red photoreceptor in angiosperms) at its N-terminus and a full-length phototropin (a blue light photoreceptor in angiosperms) at its C-terminus. The phototropin domain has two regions, LOV1 and LOV2, that each bind to a flavin. In the recent issue of *Biochemistry*, **ASP** member Satoru Tokutomi (University of Osaka) and colleagues report on their studies of the LOV1 and LOV2 domains of Adiantum phy-3 [1]. Their results suggest that the LOV1 domain of Adiantum phy-3 does not function as a light sensor. Interestingly, previous studies show that the LOV1 domain of angiosperm phototropin also does not function as a light sensor.

1. Iwata T, Nozaki D, Tokutomi S, Kandori H, 2005, Comparative Investigation of the LOV1 and LOV2 Domains in *Adiantum* Phytochrome-3. *Biochemistry* 44(20):7427-34. [PubMed]

May 13, 2005

Melanoma in Children

The American Academy of Dermatology considers "excessive exposure to the ultraviolet radiation of the sun [to be] the most important preventable cause of melanoma" [1]. A recent report on CNN highlighted the increasing incidence of melanoma in children [2]. Pediatric melanoma is a rare disease but, according to the National Cancer Institute, it affected about 3 per million American children in 1982 and now affects about 7 per million. This parallels the growing incidence of melanoma in adults. The American Cancer Society estimates that in 2005, about 60,000 American adults will be diagnosed with melanoma and about 7,700 will die from it.

1. American Academy of Dermatology, 2005, [Link]
2. Doctors seeing more melanoma in kids, April 28, 2005, [Link]

Melanoma Survival Rates

Much research has been devoted to improving the survival rates from melanoma and the development of novel treatments, such as vaccine therapy and immunotherapy. A recent presentation at the American Society for Clinical Oncology (ASCO) meeting in Orlando analyzed survival rates of patients with advanced (stage III) melanoma over the past 30 years [1]. Despite the improved survival rates from early stage (I and II) melanoma, this study showed there has been no significant change in the survival rates from stage III melanoma since 1971.

1. Young SE, Giuliano AE, Morton DL, 2005, Three Decades of Evolving Treatment for Melanoma: No Improvement in Survival? ASCO.

April 29, 2005

Worldwide Doses of Ultraviolet Radiation

The ultraviolet (UV) radiation in sunlight causes sunburn, photoaging, immune suppression, and skin cancer. UV radiation also has several beneficial effects such as promotion of vitamin D synthesis and reduction in the incidence of certain internal cancers. Thus, it is important to establish the UV doses that people receive in different geographic locations. In a forthcoming

issue of *Photochemistry and Photobiology*, **ASP** member Dianne Godar (Food and Drug Administration) reviews the UV doses of people throughout the world, the weighting factors of UV doses for different biological effects, and numerous related issues [1].

1. Godar D, 2005, UV Doses Worldwide. *Photochem Photobiol* Aug 1; [Epub ahead of print] [PubMed]

Phototherapy with Narrowband UVB Radiation

Patients with certain skin diseases are treated by controlled exposure to ultraviolet radiation. One such therapy entails the use of narrowband ultraviolet-B radiation (NB-UVB; 311-312 nm), a convenient and effective treatment for psoriasis. However, there is limited data on the risk of skin cancer associated with NB-UVB therapy. In the recent issue of *British Journal of Dermatology*, **ASP** member Sally Ibbotson and colleagues show that NB-UVB is associated with a small increase in basal cell carcinoma, but has no effect on the risk of squamous cell carcinoma or malignant melanoma [1].

1. Man I, Crombie IK, Dawe RS, Ibbotson SH, Ferguson J, 2005, The photocarcinogenic risk of narrowband UVB (TL-01) phototherapy: early follow-up data. *Br J Dermatol* Apr;152(4):755-7. [PubMed]

April 15, 2005

Retinoids for Sun Damaged Skin

Topical retinoids are vitamin-A derivatives used to treat numerous skin conditions, such as acne, psoriasis, and photoaging. In the recent issue of *Cutis*, **ASP** member Sewon Kang (University of Michigan Medical Center) reviews the mechanisms of action of topical retinoids [1]. These drugs bind to retinoic acid receptors (RARs) and retinoid X receptors (RXRs), ligand-dependent transcription factors. Binding of retinoids to these receptors leads to reduction in inflammation and increases in the levels of type-I and type-III collagen.

1. Kang S, 2005, The mechanism of action of topical retinoids. *Cutis* Feb;75(2 Suppl):10-3. [PubMed]

Applications of FELs

Free-Electron Lasers (FELs) can generate radiation across a very broad spectral region and also have power, pulse, and polarization characteristics that cannot be achieved by conventional lasers. This makes them ideal for diverse research applications in photobiology and photochemistry. In a forthcoming issue of *Photochemistry and Photobiology*, **ASP** member John Simon and colleagues review the applications of FELs [1]. These applications include research in material science, biophysics, and biomedicine.

1. Edwards GS, Allen SJ, Haglund RF, Nemanich RJ, Redlich B, Simon JD, Yang WC, 2005, Applications of Free-Electron Lasers in the biological and material sciences. Photochem Photobiol Nov 1; [Epub ahead of print][PubMed]

April 1, 2005

Biologic Effects of UV Radiation

The April 1 issue of *Mutation Research* is a special issue devoted to "Biologic Effects of UV Radiation". This issue features an introduction by **ASP** members Frank R. de Gruijl and Honnavara Ananthaswamy and many review articles by other **ASP** members:

→ Jean Cadet, Evelyne Sage, and Thierry Douki review "Ultraviolet radiation-mediated damage to cellular DNA"
→ Gerd P. Pfeifer and colleagues review "Mutations induced by ultraviolet light"
→ Katsuhito Kino and Hiroshi Sugiyama review "UVR-induced G-C to C-G transversions from oxidative DNA damage"
→ Daniel B. Yarosh, David A. Brown, and colleagues review "After sun reversal of DNA damage: enhancing skin repair"
→ Frank R. de Gruijl and colleagues review "Dose-dependent effects of UVB-induced skin carcinogenesis in hairless p53 knockout mice"
→ Vladislava Melnikova and Honnavara Ananthaswamy review "Cellular and molecular events leading to the development of skin cancer"
→ Gary M. Halliday reviews "Inflammation, gene mutation and photoimmunosuppression in response to UVR-induced oxidative damage contributes to photocarcinogenesis"
→ Zalfa A. Abdel-Malek and colleagues review "MC1R and the response of melanocytes to ultraviolet radiation"
→ Farrukh Afaq, Vaqar M. Adhami and Hasan Mukhtar review "Photochemoprevention of ultraviolet B signaling and photocarcinogenesis"
→ Stephen Ullrich reviews "Mechanisms underlying UV-induced immune suppression"
→ Donat-P. Häder and Rajeshwar P. Sinha review "Solar ultraviolet radiation-induced DNA damage in aquatic organisms: potential environmental impact"
→ David Mitchell and colleagues review "Damage and repair of ancient DNA"

March 18, 2005

Photobiology for Researchers Who Use Lasers and LEDs

In the recent issue of *Photomedicine and Laser Surgery*, **ASP** member Kendric Smith urges researchers who employ lasers and LEDs to reacquaint themselves with the basics of photobiology [1]. According to Smith (founder and first President of the **ASP**), phototherapy has not been accepted into the mainstream because many studies that employ laser or LED therapy reveal a lack of basic knowledge of photobiology. He urges researchers who employ lasers and LEDs to reacquaint themselves with the basics of photobiology, to use proper methodologies, and to specify all characteristics of the light source.

1. Smith KC, 2005, Laser (and LED) Therapy is Phototherapy. *Photomed Laser Surg* 23: 78-80.

Public Knowledge of Non-Melanoma Skin Cancers

The incidence of non-melanoma skin cancers (NMSC) has increased significantly in recent years. In the recent issue of the *International Journal of Dermatology*, **ASP** member Alan C. Halpern (Memorial Sloan Kettering Cancer Center) and Laura J. Kopp report their survey of the general public from numerous countries to assess the level of understanding of NMSC and of preventative measures [1]. They found that awareness and prevention behaviors varied significantly among different countries. People from countries with a high incidence of NSMC (Australia and the United States) had significantly more awareness of NMSC and of preventative measures. They urge the development of public health campaigns that employ "population-specific documentation of skin cancer knowledge and prevention behaviors".

1. Halpern AC, Kopp LJ, 2005, Awareness, knowledge and attitudes to non-melanoma skin cancer and actinic keratosis among the general public. *Int J Dermatol* 44: 107-11.[PubMed]
March 4, 2005

Anabaena Sensory Rhodopsin

Anabaena is a widespread freshwater filamentous cyanobacterium that performs photosynthesis and can fix atmospheric nitrogen. *Anabaena* also has a light-absorbing sensory rhodopsin [1], whose structure has been determined [2]. In a recent issue of *Journal of Biological Chemistry*, **ASP** member John Spudich (University of Texas Medical School) and colleagues preesent their characterization of the isomeric states of the retinylidine chromophore of this rhopdopsin during photochemical reactions and light-dark adaptation [3]. They show that this rhodopsin has many unique characteristics and suggest that it may function in chromatic adaptation of photosynthesis or other color-sensitive physiological responses.

1. New Green Light Photoreceptor, 2003, "Photobiology News", American Society for Photobiology.
2. Vogeley L, Sineshchekov OA, Trivedi VD, Sasaki J, Spudich JL, Luecke H, 2004, Anabaena sensory rhodopsin: a photochromic color sensor at 2.0 A. *Science* 306: 1390-3. [PubMed]
3. Sineshchekov OA, Trivedi VD, Sasaki J, Spudich JL, 2005, Photochromicity of anabaena sensory rhodopsin, an atypical microbial receptor with a cis-retinal light-adapted form. *J Biol Chem* 2005 Feb 14 [PubMed]

Phototherapy for Hyperbilirubinemia

Bilirubin is the final product of heme degradation. Hyperbilirubinemia, the presence of excess bilirubin, is a common neonatal problem that can lead to neurotoxicity and other serious problems if untreated. In a recent issue of *Seminars in Perinatology*, **ASP** member Hendrik J Vreman (Stanford University School of Medicine) and colleagues review blue light therapy of hyperbilirubinemia, the most common treatment for this disorder [1]. Phototherapy converts bilirubin into water-soluble isomers that are less toxic and readily excreted. The review article discusses the determinants of phototherapy efficacy and describes the methodologies used for blue light therapy.

1. Vreman HJ, Wong RJ, Stevenson DK, 2004, Phototherapy: current methods and future directions. *Semin Perinatol* 28: 326-33. [PubMed]

February 18, 2005

New Resolution on Free-Electron Lasers

At the recent **ASP** winter council meeting (Feb 13, 2005) the Council adopted the following resolution:

> *The Council of the **ASP** recognizes the potential impact of high performance Free-Electron Lasers (FELs) in fields of interest to our members, particularly photomedicine and environmental photobiology. Achieving these opportunities will require appropriate support facilities. The **ASP** Council therefore strongly encourages the development of facilities to support biological and medical research at existing and/or new FELs.*

Frederick Urbach Memorial Travel Award

The **ASP** is pleased to announce the establishment of the "Frederick Urbach Memorial Travel Award" to help defray the costs of travel of **ASP** Associate Members to the 11th Congress of the European Society for Photobiology (September 3-8, 2005, Aix-les-Bains, France). In order to be considered for this competitive award, Associate Members must:

1. Submit an abstract to the ESP, www.esp-photobiology.it, between March 1 and June 15, 2005.

2. Submit a copy of your abstract and a letter from you justifying how travel to this meeting will further your career goals.
3. Submit a letter from your mentor supporting your application.

Application materials must be received by Stephen Ullrich (Chair of the **ASP** Mentoring Committee) on or before June 15, 2005.

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February 4, 2005
Sunlight and Risk of Cancer

Sunlight is a well-known risk factor for skin cancers (basal cell carcinoma, squamous cell carcinoma, and melanoma). However, two recent epidemiological studies published in the *Journal of the National Cancer Institute* indicate that sunlight may also protect against certain cancers.

One study, by **ASP** members Marianne Berwick (University of New Mexico), Bruce Armstrong (University of Sydney), and colleagues examined the association between measures of skin screening and death from melanoma of the skin [1]. The results of their study show that sunburn, high intermittent sun exposure, skin awareness histories, and sunlight-mediated degeneration of elastic tissues were inversely associated with death from melanoma. They conclude that exposure to sunlight is associated with survival from skin melanoma.

A second study, by researchers at the Karolinska Institute of Sweden, examined the relationship between malignant lymphomas (non-Hodgkin lymphoma, chronic lymphocytic leukemia, and Hodgkin lymphoma) and exposure to ultraviolet radiation [2]. The results of this study show a negative association between exposure to ultraviolet radiation and risk of non-Hodgkin lymphoma. Their results also show similar (although weaker) associations for Hodgkin lymphoma.

1. Marianne Berwick, Bruce K. Armstrong, Leah Ben-Porat, Judith Fine, Anne Kricker, Carey Eberle, Raymond Barnhill, 2005, Sun Exposure and Mortality From Melanoma. *J Natl Cancer Inst* 97: 195-199. [PubMed]
2. Smedby KE, Hjalgrim H, Melbye M, Torrang A, Rostgaard K, Munksgaard L, Adami J, Hansen M, Porwit-MacDonald A, Jensen BA, Roos G, Pedersen BB, Sundstrom C, Glimelius B, Adami HO, 2005,Ultraviolet radiation exposure and risk of malignant lymphomas. *J Natl Cancer Inst* 97: 199-209. [PubMed]

January 21, 2005
Melanopsin Signal Cascade

Melanopsin is a light-absorbing pigment that occurs in retinal ganglion cells and is involved in the entrainment of mammalian circadian rhythms. In a forthcoming issue of *Proceedings of the National Academy of Sciences*, **ASP** member Ignacio Provencio (Uniformed Sevices University) and colleagues report on their studies of melanopsin signaling using cultured *Xenopus* dermal

melanophores [1]. They show that light excitation of melanopsin in these mammalian cells initiates a phosphoinosotide signaling pathway that is similar to that found in the photoreceptor cells of invertebrate eyes.

1. Isoldi MC, Rollag MD, de Lauro Castrucci AM, Provencio I, 2004, Rhabdomeric phototransduction initiated by the vertebrate photopigment melanopsin. *Proc Natl Acad Sci* 10.1073/pnas.0409252102

Silymarin and Prevention of Skin Cancers

Exposure to ultraviolet radiation is a well-known risk factor for basal cell carcinoma, squamous cell carcinoma, and melanoma. In the recent issue of *International Journal of Oncology*, **ASP** member Santosh Katiyar (University of Alabama) reviews the potential role of silymarin, a flavonoid isolated from milk thistle (Silybum marianum), in reducing the risk of developing these skin cancers [1]. Based on animal studies, Katiyar concludes that silymarin is a safe and promising natural agent that may provide protection against skin cancers in humans.

1. Katiyar, S, 2005, Silymarin and skin cancer prevention: anti-inflammatory, antioxidant and immunomodulatory effects (Review). *Int J Oncol* 26: 169-76. [PubMed]

January 7, 2005

PhotochemCAD Software

PhotochemCAD is a freely available software package developed by **ASP** member Jonathan Lindsey (North Carolina State University) and colleagues for the research and teaching of photochemistry and photobiology [1]. In a forthcoming issue of *Photochemistry and Photobiology*, and Lindsey and colleagues announce their extensive revisions to PhotochemCAD since it was first developed in 1998 [2]. The new software contains a large database of absorption and emission spectra of diverse compounds, a database of solar spectra from diverse geographical regions, can perform numerous calculations, and provides extensive help sections and references.

1. Photochem CAD, 2004.
2. Dixon JM, Taniguchi M, Lindsey JS, 2004, PhotochemCAD 2. A Refined Program with Accompanying Spectral Database for Photochemical Calculations. *Photochem Photobiol* [Epub ahead of print] [PubMed]

Pigments for Murine Nonvisual Photoresponses

Mice exhibit numerous nonvisual responses to light, such as entrainment of circadian rhythms. In the recent issue of *Journal of Biological Rhythms*, **ASP** member Aziz Sancar (University Of North Carolina) and colleagues report on their studies of the roles of opsins and cryptochromes in regulating these responses [1]. Based on their studies of mice deficient in retinal binding protein and/or cryptochrome, they conclude that cryptochromes and opsins both regulate the nonvisual responses to light.

1. Thompson CL, Selby CP, Van Gelder RN, Blaner WS, Lee J, Quadro L, Lai K, Gottesman ME, Sancar A, 2004, Effect of vitamin A depletion on nonvisual phototransduction pathways in cryptochromeless mice. *J Biol Rhythms* 19: 504-17. [PubMed]