Photobiology News (2006)

by Peter A. Ensminger

Dec 15
Low Level Light Therapy

Low Level Light Therapy (LLLT) is the application of very low power red or near infrared light for wound healing and other therapeutic purposes. The topic of LLLT is very controversial. Some researchers claim to have achieved positive clinical and pre-clinical results while other scientists remain skeptical. Linda Jones (**ASP** President-elect) recently began an informational web site on LLLT [1]. The aim of the web site is to provide information on the interaction of light with biological tissues and to discuss the evidence and potential mechanisms of LLLT.

1. Jones L, 2006, Low Level Light Therapy. [www.pol-us.net/lllt]

Vitamin D and Sunlight

People are often urged to apply high-SPF sunscreen as protection against skin cancer and other ultraviolet-mediated damage to the skin. However, the ultraviolet component of sunlight also promotes the formation of previtamin D3, which spontaneously isomerizes to vitamin D3. Vitamin D3 is important for maintenance of normal physiological function and its deficiency leads to several diseases, including Rickets, osteoporosis, and osteomalacia. In a forthcoming issue of ***Photochemistry and Photobiology***, Robert Sayre and John Dowdy (Rapid Precision Testing Laboratories, Cordova, TN) show that normal application of SPF-15 sunscreen greatly inhibits synthesis of previtamin D3 [1].

1. Sayre RM, Dowdy JC, 2006, Darkness at Noon: Sunscreen and Vitamin D3. *Photochem Photobiol* [Epub ahead of print]

Nov 10
Nuclear Factor-κB and Photodynamic Therapy

Nuclear factor-κB (NF-κB) is a nuclear transcription factor that plays an important role in cellular response to free radicals, ultraviolet irradiation, and other stressors. The current issue of ***Photochemistry and Photobiology*** features an invited review article about the role of NF-κB in photodynamic therapy (PDT), a therapy that involves administration of a photosensitizing drug and subsequent exposure to light [1]. The authors show that NF-κB has an apparent duality in anti-tumor therapy. It is important in the induction of immune responses against a tumor but also appears to promote tumor cell survival. Future PDT therapeutic regimes will address the dual role of NF-κB.

1. Matroule J-Y, Volanti C, Piette J, 2006, NF-κB in Photodynamic Therapy: Discrepancies of a Master Regulator. *Photochem Photobiol* 82: 1241-46.

Effect of Ultraviolet-B on Interleukin-20 Expression

The interleukins (IL's) are a large family of cytokines (signaling molecules) that are secreted by many different cell types as a form of intercellular communication. The current issue of ***Photochemistry and Photobiology*** features an article on IL-20 expression in cultured normal human epithelial cells [1]. The authors show that treatment of these cells with ultraviolet-B radiation (280-315 nm) induces secretion of IL-20 above the level seen in dark controls. These results suggest that IL-20 expression may play a role in the physiological response of skin to ultraviolet radiation.

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1. Hunt DWC, Boivin WA, Fairley LA, Jovanovic MM, King DE, Salmon RA, Utting OB, 2006, Ultraviolet B Light Stimulates Interleukin-20 Expression by Human Epithelial Keratinocytes. *Photochem Photobiol* 82: 1292-1300.

Oct 27

Singlet Oxygen Symposium-in-Print

The current issue of ***Photochemistry and Photobiology*** features a symposium-in-print on singlet oxygen. Singlet oxygen is simply the term given to two meta-stable states, O2(a1Δg) and O2(b1Σg+), of molecular oxygen that have slightly more energy than the triplet (ground) state, O2(X3Σg-). Christopher Foote, former president of the **ASP**, performed many of the seminal studies on singlet oxygen in the 1960's and 1970's. **ASP** member Peter R. Ogilby (University of Aarhus, Denmark) wrote the introduction to the diverse articles for this symposium-in-print [1]. These articles cover light-induced generation of singlet oxygen, the significance and detection of singlet oxygen in plants, the use of "Singlet Oxygen Luminescence Dosimetry" for photodynamic therapy, and other fields.

1. Ogilby, PR, 2006, Singlet Oxygen: Introduction. *Photochem Photobiol* 82:1133-1135.
2. Redmond RW, Kochevar IE, 2006, Spatially Resolved Cellular Responses to Singlet Oxygen. *Photochem Photobiol* 82: 1178-1186.

Phototoxic Effect of St. John's Wort

St. John's wort (*Hypericum perforatum*) is an herb whose extract has been advocated as a treatment for mild to moderate depression [1,2]. However, this herb contains hypericin, a compound that is phototoxic to the skin and to cells in the lens of the eye. In a forthcoming issue of ***Photochemistry and Photobiology***, **ASP** members Albert Wielgus, Colin Chignell, Joan Roberts, and colleagues report on their studies of the phototoxicity of hypericin to cells in the human retina [3]. They show that retinal pigment epithelial cells readily take up hypericin and that subsequent exposure to visible light causes cell death. Controls (given hypericin alone or light alone) were unaffected. The authors conclude that St. John's wort is potentially phototoxic to the human retina and may contribute to ocular pathologies.

1. Linde K, Ramirez G, Mulrow CD, Pauls A, Weidenhammer W, Melchart D, 1996, St John's wort for depression - an overview and meta-analysis of randomised clinical trials. *Br Med J* 313: 253-258.
2. Linde K, Mulrow CD, 2003, St John's wort for depression (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2004. Chichester, UK: John Wiley & Sons, Ltd.
3. Wielgus, AR, Chignell CF, Miller DS, Van Houten B, Meyer J, Hu D-N, Roberts JE, 2006, Phototoxicity in Human Retinal Pigment Epithelial Cells Promoted by Hypericin, a Component of St. John's Wort. *Photochem Photobiol* [E-pub ahead of print]

Oct 6

New 5-Aminolevulinc Acid Derivatives for Photomedicine

Photodynamic therapy (PDT) is a medical treatment that involves administration of a drug, such as 5-aminolevulinic acid (5-ALA), and subsequent exposure to light that activates the drug or its metabolite. In the current issue of ***Photochemistry and Photobiology***, researchers from the University of Geneva (Switzerland) review the use of two new lipophilic 5-ALA derivatives for PDT and fluorescence detection [1]. These two drugs (methylaminolevulinate and hexylaminolevulinate) have been approved in Europe and Australia. The authors review the basic chemistry of 5-ALA derivatives, discuss preclinical experiments, and review recent clinical studies.

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1. Fotinos N, Campo MA, Popowycz F, Gurny R, Lange N, 2006, 5-Aminolevulinic Acid Derivatives in Photomedicine: Characteristics, Application and Perspectives. Photochem Photobiol 82: 994-1015.

Two Pools of Phytochrome-A in Rice

Phytochrome is a pigment that controls growth and development of plants and occurs in two interconvertible isoforms, Pr (which strongly absorbs red light) and Pfr (which strongly absorbs far-red light). Many species have multiple phytochrome genes, termed phyA, phyB, phyC, etc. In the current issue of ***Photochemistry and Photobiology***, researchers from Moscow State University and the National Institute of Agrobiological Sciences in Japan report on their fluorescence spectroscopy studies of phyA in selected rice mutants [1]. The recent isolation of rice phy mutants has allowed these researchers to demonstrate that rice phyA exists in two distinct populations, phyA' and phyA".

1. Sineshchekov V, Loskovich A, Inagaki N, Takano M, 2006, Two Native Pools of Phytochrome A in Monocots: Evidence from Fluorescence Investigations of Phytochrome Mutants of Rice. *Photochem Photobiol* 82: 1116-1122.

Sept 22

Short-wavelength-sensitive Visual Pigment in Vertebrates

Vertebrates have four classes of visual pigments in their cone cells that provide color vision. The short-wavelength-sensitive-1 (SWS1) pigment has the greatest variability in its absorption spectrum, with peak sensitivity ranging from less than 360 nm (ultraviolet) to 435 nm (violet) among different species. In a forthcoming issue of ***Photochemistry and Photobiology***, David Hunt and colleagues review the molecular mechanisms for variability of the SWS1 pigment [1]. They conclude that the ancestral SWS1 pigment was most sensitive in the UV region and that wavelength "tuning" depends on the protonation state of the Schiff base that is crucial for attachment of the retinal chromophore.

1. Hunt DM, dos Santos Carvalho L, Cowing JA, Parry JWL, Wilkie SE, Davies WL, Bowmaker JK, 2006, Spectral tuning of shortwave-sensitive visual pigments in vertebrates. *Photochem Photobiol* [Epub ahead of print]

Ultraviolet-A Radiation and DNA Damage

Ultraviolet-B radiation (UVB, 290-320 nm) is well known to cause lesions in DNA, with cyclobutane pyrimidine dimers (CPDs) being the most common form. There has been controversy regarding the types of DNA damage caused by UVA (320-400 nm). In the recent issue of *Proceedings of the National Academy of Sciences*, **ASP** members Jean Cadet and Thierry Douki (CEA Grenoble) and colleagues present results of their study of the types and yields of DNA damage caused by UV-A in whole human skin [1]. They found that CPDs were also the most common form of UVA-induced DNA damage. However, the mechanism of CPD formation differs for UV-B and UV-A irradiated tissue. These findings may have important implications for the formulation of sunscreens and other UV-protection strategies.

1. Mouret S, Baudouin C, Charveron M, Favier A, Cadet J, Douki T, 2006, Cyclobutane pyrimidine dimers are predominant DNA lesions in whole human skin exposed to UVA radiation. *Proc Natl Acad Sci* 103: 13765-13770.

Sept 1

Symposium-in-Print ... in the Current Issue of *Photochem Photobiol*

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The current issue of ***Photochemistry and Photobiology*** features a special symposium-in-print entitled "UV Effects on Aquatic and Coastal Ecosystems". Maria Vernet (Scripps Institution of Oceanography) wrote the "Introduction" for the sixteen articles in this series [1]. This series is especially significant because of its multidisciplinary nature and the geographic diversity of the ecosystems that are covered. These ecosystems include lakes in Patagonia, tropical to sub-Antarctic South America, and phytoplankton communities in Rimouski Canada.

1. Vernet M, 2006, Introduction to the Symposium-in-Print: Enhanced Ultraviolet-B Radiation in Natural Ecosystems as an Added Perturbation Due to Ozone Depletion. *Photochem Photobiol* 82:831-833.

Sea Squirt Vision ... in a Forthcoming Issue of *Photochem Photobiol*

Sea squirts (Ascidians) are the closest living chordate relatives of vertebrates. These organisms have an eye spot (ocellus) that controls swimming behavior in response to light. In a forthcoming paper in ***Photochemistry and Photobiology***, Takehiro Kusakabe and Motoyuki Tsuda (University of Hyogo, Japan) present their study of the photoreceptive systems of sea squirts [1]. They suggest that the ocellus of sea squirts is homologous to the photosensitive pineal glands of vertebrates and that the most recent common ancestor of sea squirts and vertebrates may have had molecular precursors of the paired eyes of vertebrates.

1. Kusakabe T, Tsuda M, 2006, Photoreceptive Systems in Ascidians. *Photochem Photobiol* [Epub ahead of print]

August 18

Role of Calcium in Phototropin Signal Transduction

Phototropin is a blue light photoreceptor that regulates growth and development of plants. In a forthcoming issue of ***Photochemistry and Photobiology***, Akiko Harada and ASP member Ken-ichiro Shimazaki review the role of calcium in phototropin-based signal transduction [1]. Physiological studies with Arabidopsis suggest that Ca+2 is involved in signal transduction, but the molecular details are largely unknown. Ca+2 is a well known intracellular messenger in plants and, in addition to light, regulates many extracellular signals to specific responses.

1. Harada A, Shimizaki K, 2006, Phototropins and Blue Light-dependent Calcium Signaling in Higher Plants. *Photochem Photobiol* [Epub ahead of print]

Ethics in Science: What has Happened to it?

(by Kendric C. Smith, **ASP** Founding President)

A rash of reports have appeared about falsifying data in scientific articles, however, there is a more subtle and important danger to science, i.e., warping the discussion in a paper to prove a false theory by ignoring all of the data in the literature that are contrary to the false theory, and by misinterpreting (deliberately?) one's own experimental data, and by incorrectly re-interpreting the data of others, and by incorrectly reporting the results of others.

False data will soon be found out, however, the more subtle form of falsification, about which I speak, is usually believed (it came from a "good" laboratory, and was published in "good" journals), and it will remain in the scientific literature forever as "fact", and it will waste the time and money of unsuspecting students and scientists.

To counter some of these subtle falsehoods, I wrote a short review on recombinational DNA repair in *BioEssays* [1] and a letter to *ASBM Today* [2].

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1. Smith KC, 2004, Recombinational DNA repair: the ignored repair systems. *BioEssays* 26: 1322-26. [PDF]
2. Smith KC, 2006, Ethics in Science: What has happened to it. *ASBM Today*. May, p3

July 7

Phototropin Signal Transduction

Phototropins are ultraviolet-A/blue light photoreceptors that mediate phototropism and other responses in higher plants. In a forthcoming issue of ***Photochemistry and Photobiology***, **ASP** member Satoru Tokutomi (Osaka Prefecture University) and colleagues review the primary processes of phototropin signal transduction [1]. Phototropin has two flavin-based light-absorbing LOV (Light-Oxygen-Voltage) domains at its N-terminus and these regulate the kinase activity of a serine/threonine kinase at its C-terminus. Future research will attempt to elucidate the details of how light-induced changes in the LOV domains regulate kinase activity and the possible substrate(s) for this kinase that are involved in signal transduction.

1. Matsuoka D, Iwata T, Zikihara K, Kandori H, Tokutomi S, 2006, Primary processes during the light-signal transduction of phototropin. *Photochem Photobiol* [Epub ahead of print]

Quantum Dots and Photodynamic Therapy

A quantum dot is a quasi-zero dimensional semiconductor nanocrystal that consists of about 10 to 50 atoms. Quantum dots have a sharper density of states than high dimensional structures and unique transport and optical properties that make them suitable for a variety of applications. The current issue of ***Photochemistry and Photobiology*** features a review article by researchers at Case Western Reserve University (Cleveland, OH) on the potential uses of quantum dots and quantum dot conjugates as photosensitizers for photodynamic therapy [1]. Compared to other photosensitizers, quantum dots have the advantage of having tunable optical properties and favorable surface chemistries.

1. Samia ACS, Dayal S, Burda C, 2006, Quantum dot-based energy transfer: perspectives and potential for applications in photodynamic therapy. *Photochem Photobiol* 82: 617-625.

June 9

Review of Photomovement Responses in Cryptogams

In a forthcoming issue of ***Photochemistry and Photobiology***, Noriyuki Suetsugu and **ASP** member Masamitsu Wada (National Institute for Basic Biology, Okazaki, Japan) review the regulation of photomovement responses in cryptogams (spore-producing plants) [1]. These photomovement responses include phototropism, chloroplast movement, and stomatal opening. The sensory pigments of cryptogams detect red and blue light, presumably allowing more efficient capture of light for photosynthesis. The recently discovered neochrome (a chimeric phytochrome/phototropin photoreceptor) has arisen independently in ferns and green algae.

1. Suetsugu N, Wada M, 2006, Phytochrome-dependent photomovement responses mediated by phototropin family proteins in cryptogam plants. *Photochem Photobiol* [Epub ahead of print]

Proton Transfer in Bacteriorhodopsin

Bacteriorhodopsin is a retinal-based archaeal photosynthetic pigment that absorbs light and uses its energy to move protons out of the cell. The cell then converts the pH gradient into chemical energy. In a forthcoming issue of ***Photochemistry and Photobiology***, **ASP** member Thomas Ebrey (University of Washington, Seattle, WA) and colleagues report their study of the role of water as a cofactor in the light-mediated proton transfer [1]. They propose that water molecules

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form organized structures in the transient intermediates during the bacteriorhodopsin photocycle and that water is critical in determining the chemistry of these intermediates.

1. Maeda A, Morgan JE, Gennis RB, Ebrey TG, 2006, Water as a cofactor in the unidirectional light-driven proton transfer steps in Bacteriorhodopsin. *Photochem Photobiol* [Epub ahead of print]

May 19

UV Radiation and Marine Environments

The current issue of ***Photochemistry and Photobiology*** features a review article by Marc Tedetti and Richard Sempéré on the penetration of UV radiation in marine environments [1]. They begin with a discussion of UV radiation measurement by dosimeters and radiometers. Then, they review data on the depth of UV penetration at numerous sites in the open ocean, Antarctic region, and coastal regions. They found clear differences in the UV penetration of these different regions. These differences are presumably associated with differences in the photobiological and photochemical processes at these sites.

1. Tedetti M, Sempéré R, 2006, Penetration of ultraviolet radiation in the marine environment. A review. *Photochem Photobiol* 82: 389-397.

Dissipation of Excess Energy in Photosynthesis

Excess illumination can damage the photosynthetic apparatus of plants, but a process known as "non-photochemical quenching" can harmlessly dissipate this excess energy. In a recent issue of *Proceedings of the National Academy of Sciences*, **ASP** members Devens Gust, Ana Moore, Tom Moore (Arizona State University) and colleagues report their investigation of the mechanism of non-photochemical quenching in photosynthesis [1]. In their model system, a carotenoid can accept and harmlessly dissipate excess excitation energy. Interestingly, the addition of a single double bond to a carotenoid transforms it from a non-quencher into an effective quencher. A similar mechanism may occur in plants, where zeaxanthin (a carotenoid that accumulates under high light levels) may quench excess photochemical energy.

1. Berera R, Herrero C, van Stokkum IH, Vengris M, Kodis G, Palacios RE, van Amerongen H, van Grondelle R, Gust D, Moore TA, Moore AL, Kennis JT, 2006, A simple artificial light-harvesting dyad as a model for excess energy dissipation in oxygenic photosynthesis. *Proc Natl Acad Sci* 103: 5343-8.

April 28

GFP Symposium-in-Print

The current issue of *Photochemistry and Photobiology*, features a symposium-in-print on the family of GFP (Green Fluorescent Protein)-like fluorescent proteins. GFP-like proteins are widely used as marker proteins for research in molecular and cellular biology. Proteins from this large homologous family generate bright light, the color of which varies depending on the specific protein. The symposium features an introduction by **ASP** member Rebekka Wachter (Arizona State University) and six additional articles that focus on photophysical aspects of fluorescence, protein structure, and biological function [1].

1. Wachter RM, 2006, The Family of GFP-Like Proteins: Structure, Function, Photophysics and Biosensor Applications. Introduction and Perspective. *Photochem Photobiol* 82: 339-44. [PubMed]

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GFP-like Proteins in Coral Reefs

Photos of brightly colored coral reefs from the Great Barrier Reef appear on the cover of the current issue of *Photochemistry and Photobiology*. Coral reefs appear colorful to people partly due to the presence of GFP-like proteins in reef-building Anthozoan species. Do coral reefs also appear colorful to the fish that inhabit them? This question is addressed in the first article in the symposium-in-print series [1]. The researchers conclude that the fishes which inhabit coral reefs can perceive the GFP-determined colors of corals and that these colors may be an important factor in the visual ecology of reef-inhabiting fishes.

1. 1. Matz MV, Marshall NJ, Vorobyev M, 2006, Are Corals Colorful? *Photochem Photobiol* 82: 345-50. [PubMed]

April 7

(in revision)

March 31

(in revision)

March 10

Special Issue of Photochem Photobiol Honors Tito Scaiano

The current issue of *Photochemistry and Photobiology* is dedicated to Professor Tito Scaiano (University of Ottawa) on the occasion of his 60th birthday [1]. Tito is an active member of the **ASP** and is the previous editor of *Photochem Photobiol*. He has published nearly 600 scientific papers in diverse fields of chemistry and has received many awards for his work, including the NSERC Gerhard Herzberg Gold Medal, Canada's premier research award. This issue also features an article by Tito on the effect of zeolite encapsulation on TiO2-photosensitized generation of reactive oxygen species [2].

1. Bohne C, Johnston LJ, Leigh WJ, 2006, Introduction to the Special Issue in Honor of J. C. (Tito) Scaiano. *Photochem Photobiol* 82: 1-4. [PubMed]
2. Shen B, Scaiano JC, English AM, 2006, Zeolite Encapsulation Decreases TiO2-Photosensitized ROS Generation in Cultured Human Skin Fibroblasts. *Photochem Photobiol* 82: 5-12. [PubMed]

High-Intensity Light Induction of Lhl4

In a forthcoming issue of *Plant and Cell Physiology*, **ASP** member Masakatsu Watanabe (National Institute for Basic Biology, Okazaki) and colleagues report the action spectrum for induction of the Lhl4 (a gene distantly related to the light-harvesting chlorophyll-a/b binding protein) in the unicellular alga, *Chlamydomonas reinhardtii* [1]. This gene is induced by high intensity light. The action spectrum, determined at the Okazaki Large Spectrograph, shows a maximum in the blue (450 nm), a shoulder in the UV-A (375 nm), and a steep rise down to 325 nm. There are also small peaks at 575 nm and 675 nm. They suggest that a flavin-based photoreceptor and a novel UV photoreceptor are responsible for the observed effects.

1. Teramoto H, Ishii A, Kimura Y, Hasegawa K, Nakazawa S, Nakamura T, Higashi SI, Watanabe M, Ono TA, 2006, Action Spectrum for Expression of the High Intensity Light-Inducible Lhc-like Gene Lhl4 in the Green Alga *Chlamydomonas reinhardtii*. *Plant Cell Physiol* [Epub ahead of print] [PubMed]

February 10, 2006

UV Radiation, Vitamin D, and Cancer

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Exposure to UV radiation is associated with increased risk for various types of skin cancers, but also promotes the formation of vitamin D-3, which may protect against other cancers. The current issue of *Photochemistry and Photobiology* features an open-access Symposium-in-Print entitled "UV Radiation Exposure, Vitamin D, and Human Health". One of the seven articles in this series, authored by **ASP** member Marianne Berwick (University of New Mexico) and Denece Kesler, reviews the relationship between exposure to UV radiation, vitamin D, and cancer [1]. While noting uncertainties with regard to the role of vitamin D in cancer protection, they conclude that current data supports a recommendation for exposure of the face and arms to sunlight for ~5-10 min per day, three times per week.

1. Berwick M, Kesler D, 2005, Ultraviolet Radiation Exposure, Vitamin D, and Cancer. *Photochem Photobiol* 81: 1261-1266. [PubMed]

Treatment of Non-Melanoma Skin Cancers

Photodynamic therapy involves the topical or systemic administration of a photosensitizing drug and subsequent exposure to light of the appropriate wavelength range. In the recent issue of *Acta Dermato-Venereologica*, **ASP** member Rolf-Markus Szeimies (University of Regensburg, Germany) and colleagues discuss the use of photodynamic therapy for treatment of non-melanoma skin cancers [1]. Recent research has focused on the development of topical photosensitizers (5-aminolevulinic acid or its methyl ester), so as to avoid the complication of generalized skin photosensitization associated with systemic photosensitizers. Topical methyl aminolevulinate-photodynamic therapy is currently approved in Europe, Australia, and New Zealand for treatment of actinic keratosis and basal cell carcinoma. It is also approved for treatment of actinic keratosis in the United States.

1. Szeimies RM, Morton CA, Sidoroff A, Braathen LR, 2005, Photodynamic therapy for non-melanoma skin cancer. *Acta Derm Venereol* 85: 483-90. [PubMed]

January 20, 2006

Sensitivity to UV Radiation in Freshwater Fishes

Organisms use two main mechanisms to repair DNA that is damaged by UV radiation: nucleotide excision repair and photoenzymatic repair. Little is known about which of these is used by freshwater fishes. In a forthcoming issue of *Photochemistry and Photobiology*, Mark Olson and **ASP** member David L Mitchell (M.D. Anderson Cancer Center, University of Texas) present laboratory experiments that compare the UV repair mechanisms of five freshwater fish species that are from four taxonomic families and three taxonomic orders [1]. Their results show that all species used nucleotide excision repair but only two species used photoenzymatic repair.

1. Olson MH, Mitchell DL, 2006, Interspecific variation in UV defense mechanisms among temperate freshwater fishes. *Photochem Photobiol* [Epub ahead of print] [PubMed]

Improving Antimicrobial Photodynamic Therapy

Antimicrobial photodynamic therapy (PDT) entails use of a photosensitzing dye and light to kill microbial cells. Phenothiazinium compounds are the only dyes currently used for clinical antimicrobial PDT. In the recent issue of *Antimicrobial Agents and Chemotherapy*, George Tegos and **ASP** member Michael Hamblin (Wellman Center for Photomedicine, Massachusetts General Hospital) present experiments showing that bacterial mutants which are deficient in the multidrug resistance (MDR) pump are 100 to 10,000-fold more sensitive to phenothiazinium-mediated PDT [1]. They suggest that specific MDR pump inhibitors may be effective in enhancing the effectiveness of clinical antimicrobial PDT.

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1. Tegos GP, Hamblin MR, 2006, Phenothiazinium antimicrobial photosensitizers are substrates of bacterial multidrug resistance pumps. *Antimicrob Agents Chemother* 50: 196-203. [PubMed]

January 6, 2006

Modulation of Bioluminescence Color in Vibrio fischeri

Vibrio fischeri is a bioluminescent bacterium that is a well-known symbiont of the light-emitting organs of sepiolid squids and monocentrid fishes [1]. *V. fischeri* bioluminescence is unusual among marine bacteria because it is yellow (λmax 535 nm), due to the presence of a secondary emitter, Yellow Fluorescent Protein (YFP). Furthermore, the bioluminescence color of V. fischeri can be reversibly and rapidly altered between blue and yellow, a phenomenon known as "bioluminescence modulation". In a forthcoming issue of *Photochemistry and Photobiology*, **ASP** member Hajime Karatani (Kyoto Institute of Technology) and colleagues report their study of V. fischeri using bioluminescence spectroscopy, fluorescence spectroscopy, and 2-D protein gel electrophoresis [2]. They show that bioluminescence modulation occurs near the cell membrane and that the level of YFP is a critical factor in determining the level of yellow bioluminescence.

1. Vibrio fischeri Genome Project, 2002.
2. Karatani H, Matsumoto S, Miyata K, Yoshizawa S, Suhama Y, Hirayama S, 2005, Bioluminescence color modulation of Vibrio fischeri strain Y1 coupled with alterable level of endogenous yellow fluorescent protein and its fluorescence imaging. *Photochem Photobiol* [Epub ahead of print] [PubMed]

Photosensitized Killing of Retinal Pigment Epithelial Cells

Retinal Pigment Epithelial (RPE) cells form the outer blood-retinal barrier of the eye and support the function of retinal photoreceptor cells. RPE cells are vulnerable to photo-oxidative stress by visible and ultraviolet radiation. In a forthcoming issue of *Experimental Eye Research*, **ASP** member Jeffrey R Kanofsky (Hines VA Hospital, Elmhurst, IL) and Paul Sima report their study of the prevention of photosensitized killing of RPE cells by lutein and five synthetic carotenoid derivatives [1]. Three of the synthetic carotenoids provided effective protection but lutein and GRP-retinal were ineffective. The ineffectiveness of GRP-retinal may be due to its low singlet-oxygen quenching constant. The ineffectiveness of lutein (which has a high singlet oxygen quenching constant) may be due to its unique subcellular distribution.

1. Kanofsky JR, Sima PD, 2005, Synthetic carotenoid derivatives prevent photosensitised killing of retinal pigment epithelial cells more effectively than lutein. *Exp Eye Res* Nov 27; [Epub ahead of print] [PubMed]

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