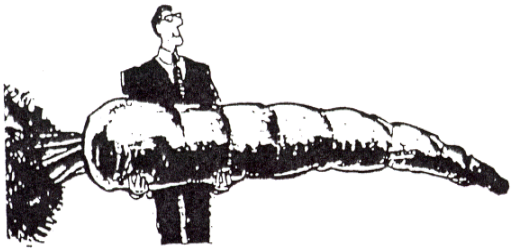

Carotenoid News

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FROM THE EDITOR

"Like light rays in the spectrum, the different components of a pigment mixture…are resolved on the calcium carbonate column. I call such a preparation a chromatogram and the corresponding method the chromatographic method".
(Mikhail Semionovich Tswett, 1906)

The year 2003 is the centennial of the invention of chromatography, and it is very fitting for carotenoid researchers to celebrate it with great fanfare. The father of chromatography, Russian scientist M.S.Tswett, was awe-struck observing a rainbow of green, yellow, orange and red color bands appearing on his improvised inulin, alumina and chalk columns after application of green leaf extracts. He coined the term "chromatography" (from Greek "color writing") to describe his new method of chlorophyll and carotenoid separation and possibly to immortalize his own name ("tswett" means "color" in Russian). He had a great knack for creating scientific names, because we owe him also "carotenoids" - the term he proposed in 1911 to include carotenes and xanthophylls, i.e. compounds similar in structure to carotene. Tswett investigated more than 100 adsorbents and their interaction with various solvent combinations, even constructed an ingenious "high pressure" column chromatography apparatus, where the pressure was applied with a rubber ball. All this work was accomplished at the University of Warsaw, where he gave his first famous lecture "On a new category of adsorption phenomena and their application to biochemical analysis" on March 8, 1903, at a meeting of the Biological Section of the Warsaw Society of Natural Sciences. The building, where he worked, is still a part of the University of Warsaw. I had the privilege of being a student there, in the same lecture halls and laboratories where he made his discoveries.

Maria S. Sapuntzakis (Chicago, IL)

News from the CARIG Steering Committee

The annual meeting of the CARIG Steering Committeewas held at EB'03 in San Diego. The committee celebrated another successful year that featured a social, carotenoid conference and bi-annual newsletter. The committee began planning for events in the coming year and agreed to conduct a conference at EB next year. The conference next year will be a change of pace from the EB'03 conference with a more informal format and topics of practical interest. Furthermore, the conference will include a memorial to James A. Olson, now to be an annual tribute. The committee also decided to request that abstracts for the student travel awards to the conference be submitted concurrently with submission of abstracts to EB (see call for abstracts below). Please watch the carotenoid society website (www.carotenoidsociety.org) in the coming months for the date, time and topics of the conference.

The committee regretfully saw the end of Boon Chew's tenure on the committee. Boon did an excellent job as treasurer during the past three years. The membership of the CARIG Steering Committee now includes:

Dale Cooper (Chair) – Procter & Gamble Co.
Neal Craft (Treasurer) – Craft Technologies, Inc.
John Landrum – Florida International University
Julie Mares – University of Wisconsin-Madison
Cheryl Rock – University of California – San Diego
Noel Solomons (fundraising) – CeSSIAM, Guatemala
Maria Stacewicz-Sapuntzakis (newsletter editor) – University of Illinois at Chicago
Sherry Tanumihardjo – University of Wisconsin-Madison
Wendy White – Iowa State University

CARIG Travel Awards

CARIG will award $500 for travel to the Experimental Biology 2004 meeting in Washington DC. The award will be based on the scientific merit of EB'04 abstracts submitted by students in graduate school who have not yet received a Ph.D. Please send a copy of your abstract (on the EB 2004 form) and a letter briefly describing the significance of the research and your role in the research to: Dale A. Cooper, Ph.D., The Procter & Gamble Company, Miami Valley laboratories, 11810 East Miami River Road, Cincinnati, OH 45252; Fax: 513-627-1940; E-mail (preferred): cooper.da@pg.com. Please submit abstracts by December 1, approximately 2 weeks after the deadline for EB'04 abstract submission.

UPCOMING EVENTS

October 1-4, 2003
9th European Nutrition Conference, Rome, Italy. Contact FASI Congress St, Viale Gorizie, 24c-00198 Rome, Italy. **tel:** +39 06 8417001/8540296, **fax:** +39 06 8414495 **website**: www.fens2003.org **E-mail**: registration@fens2003.org

October 6-24, 2003
Food Comp 2003, Wageningen, the Netherlands. 6th International Graduate Course on Production and Use of Food Composition Data in Nutrition. Contact: Ms. L.A. Duym-Brookman, Secretariat Food Comp 2003, Division of Human Nutrition, Wageningen University, P.O. Box 8129, 6700 EV Wageningen, The Netherlands, **tel:** +31-317-48-3054/48-2589, **fax:** +31-317-48-3342, **E-mail**: lous.duym@wur.nl, **website**: www.wau.nl/vlag/foodcomp.htm

November 8-12, 2003
5th International Symposium on Natural Colorants for Foods, Confectionery, Beverages, Cosmetics. San Diego, CA. Contact: Peter C. Hereld, Whitney Center, Suite 341, 200 Leeder Hill Drive, Hamden, CT 06517, **tel/fax:** 203-281-6766

November 20-24, 2003
10th Annual Meeting of the Society for Free Radical Biology and Medicine. Seattle, WA. Contact Kent Lindeman, **tel:** 925-472-5904, **E-mail**: info@sfrbm.org, **website**: www.sfrbm.org

January 4-9, 2004
The 5th Gordon Research Conference on Carotenoids, Ventura, CA. Contact GRC office **tel:** 401-783-4011, **E-mail**: app@grc.org, **website**: www.grc.org/programs/2004/carot.htm [more information below in the Announcements]

April 17-21, 2004
Experimental Biology 2004. Washington DC. Contact: EB2004, FASEB Office of Scientific Meetings & Conferences, 9650 Rockville Pike, Bethesda MD 20814-3998, **website**: www.faseb.org/meetings/eb2004

RECENT / FORTHCOMING PUBLICATIONS

Current Protocols in Food Analytical Chemistry. 2002 (Wrolstad RE, Acree TE, An H, Decker EA, Penner MH, Reid DS, Schwartz SJ, Shoemaker CF, Sporns P, eds. John Wiley & Sons, New York. A section on carotenoids includes methods of detection and measurements by the leading analysts:
Craft N E. Chromatographic techniques for carotenoid separation.

Lichtenthaler H K. & Buschmann C. Extraction of photosynthetic tissues: chlorophylls and carotenoids. Chlorophylls and carotenoids: measurement and characterization by UV-VIS spectroscopy.
Rodriguez G A. Extraction, isolation, and purification of carotenoids.
Scott K J. Detection and measurement of carotenoids by UV/VIS spectrophotometry.
van Breemen R B. Mass spectrometry of carotenoids.

SIGHT AND LIFE Newsletter 1/2003 and 2/2003, publication of the Task Force SIGHT AND LIFE, PO Box 2116, 4002 Basel, Switzerland, **tel**: 41-61-688-7494; **fax**: 41-61-688-1910, **website**: www.sightandlife.org. The second issue 2/2003 includes "Transcriptional and dietary regulation of β-carotene 15,15'-mono oxygenase" by TM Redmond, A Boulanger, S Gentleman, based on a lecture presented at CARIG Conference, EB 2003, San Diego, CA, April 12, 2003.

Alphabetical Listing of Recent Publications

This list of citations includes many missed in earlier issues. Prepared by Dr. Harold Furr, Craft Technologies, Inc.

Anonymous (2000) Opinion of the Scientific Committee on Food on the Tolerable Upper Intake Level of beta-Carotene, pp. 1-21. European Commission, Health & Consumer Protection Directorate-General, Brussels.

Anonymous (2002) Tomato-based products may lower risk of prostate cancer. *Clin.J.Oncol.Nurs.* 6: 321.

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Annibale, B., Capurso, G. & Delle Fave, G. (2002) Consequences of *Helicobacter pylori* infection on the absorption of micronutrients. *Dig.Liver Dis.* 34 Suppl 2: S72-S77.

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Bernstein, P. S., Zhao, D. Y., Wintch, S. W., Ermakov, I. V., McClane, R. W. & Gellermann, W. (2002) Resonance Raman measurement of macular carotenoids in normal subjects and in age-related macular degeneration patients. *Ophthalmology.* 109: 1780-1787.

Bhatti, R. A., Yu, S., Boulanger, A., Fariss, R. N., Guo, Y., Bernstein, S. L., Gentleman, S. & Redmond, T. M. (2003) Expression of β-carotene 15,15' monooxygenase in retina and RPE-choroid. *Invest.Ophthalmol.Vis.Sci.* 44: 44-49.

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Bohne, F. & Linden, H. (2002) Regulation of carotenoid biosynthesis genes in response to light in *Chlamydomonas reinhardtii*. *Biochim.Biophys.Acta* 1579: 26-34.

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MEETING REPORT

CARIG Conference at EB2003

The 2003 CARIG conference featured a lineup of distinguished speakers with an eclectic mix of hot topics in the field of carotenoids. About 100 people attended the individual presentations. The wife and elder son of Dr. James Olson, Giovanna Olson and Daniel Olson, were present at the meeting. Wendy White, Cheryl Rock and Dale Cooper co-chaired this event.

T. Michael Redmond of the National Eye Institute presented the James A. Olson Memorial Perspectives on Carotenoids Lecture entitled: Dietary and transcriptional regulation of β-carotene 15,15'-monooxygenase (BCM). This was an appropriate topic for the Olson lecture because James Olson was co-discoverer of this enzyme. Dr. Redmond is studying the transcriptional regulation of the BCM gene by examination of its promoter sequence. He hypothesized that transcriptional regulation may explain the coordinated induction of chicken BCM and other enzymes involved in synthesis and storage of retinol (retinal reductase, CRBPII and LRAT). To test this, he transfected cell lines with plasmids containing various segments of the BCM promoter and a reporter gene. He also conducted *in vivo* studies in mice to determine the response of the BCM gene to diet and PPAR ligands. He found that the BCM gene promoter has an active response element that binds PPARβ and is responsible for cell specific regulation. Secondly, in various tissues, BCM was increased by a PPARβ agonist and high fat diet whereas fasting reduced BCM in the gut. This research supports the hypothesis that PPARs regulate vitamin A synthesis from β-carotene that is integrated with the metabolism of vitamin A and neutral lipids. This lecture was published in recent issue of Sight and Life (2/2003).

Sung Koo, U. of Connecticut: Marginal zinc deficiency decreases intestinal retinol and β-carotene absorption. Is the decrease attributable to a defect in luminal phosphatidyl choline hydrolysis? Zn deficiency is known to adversely affect vitamin A and E status. Dr. Koo hypothesized that defects in the assimilation and metabolism of lipids causes poor absorption of these vitamins in zinc insufficiency. He tested this by infusing lipids and vitamins into lymph duct of cannulated rats with adequate or insufficient zinc status. These studies showed that zinc deficiency lowers the absorption of fat, retinol, α-tocopherol and β-carotene. By systematic evaluation of the steps involved in fat absorption, Dr. Koo discovered the biochemical defect involved is low activity of phospholipase A_2, a Zn dependent enzyme. The low activity of this enzyme prevents pancreatic lipase from accessing the triglyceride rich core of lipid emulsions in the intestinal lumen, resulting in poor release and absorption of lipophilic vitamins and carotenoids. This research illuminates the mechanism underlying the nutrient interaction between zinc and vitamin A with significant public health implications for undernourished populations.

Mohamad Navab, UCLA School of Medicine: Lutein and atherosclerosis. Dr. Navab filled in for Dr. James Dwyer who was unable to attend. Their lab has produced several significant lines of evidence that dietary lutein may protect against the development of atherosclerosis. First, they reported a significant inverse association between progression of carotid artery intima-media thickness and plasma lutein in a cohort of 40-60 year old adults participating in the Los Angeles Atherosclerosis Study. There was a remarkable 80% lower rate of thickening in the quintile with the highest compared to the lowest plasma lutein and there was no significant association between thickening and plasma β-carotene. Second, using an elegant co-culture system, they found that pretreatment of endothelial and smooth muscle cells with nanomolar concentrations of lutein inhibited the monocyte chemotractive properties of LDL by 8-fold. Third, they demonstrated that dietary lutein reduces aortic lesion size in atherosclerosis-prone apoE-null mice by 44%. LDL from the lutein treated mice produced fewer hydroperoxides and lower monocyte chemotactic activity in the cell co-culture system. These epidemiological and laboratory findings, accompanied by a plausible mechanism of reduced inflammation and oxidative stress in the artery wall, have generated a great deal of interest in the hypothesis that dietary lutein may reduce heart disease risk in humans.

Christine Shewmaker, Calgene: Use of plant biotechnology to develop oil seeds high in provitamin A carotenoids for human nutrition. Thanks to advances in biotechnology, it is now possible to engineer oilseed crops with the ability to synthesize high levels of provitamin A carotenoids that can be used to help alleviate vitamin A deficiency in the developing world. Dr. Shewmaker described her work to develop canola with seed oil rich in α- and β-carotene by introduction of bacterial phytoene synthase and desaturase enzymes linked to a seed specific promoter. The resulting canola oil contains more vitamin A than other good food sources. She then described a collaboration between industry, academia and government to similarly modify another *Brassica* species, mustard. Mustard oil is the second most commonly consumed edible oil in India, where vitamin A deficiency is a major nutritional problem. The use of genetic engineering to increase carotenoids in plants has now been demonstrated in rice, potato and tomatoes as well. Dr. Shewmaker pointed out that, while the means to develop plants engineered to produce carotenoids has been largely worked out, there is still much ongoing work on the nutritional, cultural and regulatory aspects of this technology.

Richard Cotter, Wyeth Consumer Healthcare: Carotenoids – An industrial perspective. A large and growing percentage of Americans take vitamin supplements and consider them an essential part of a healthy lifestyle. Because of this, the vitamin supplement industry has an important role in producing carotenoid containing supplements and educating consumers in a manner consistent with emerging science. Dr. Cotter explained the scientific support for addition of β-carotene, lutein, and most recently, lycopene, to daily vitamin and mineral supplements. This science includes data from laboratory, clinical and epidemiological studies and nutritional surveys showing carotenoid intake is below optimal levels. He explained the efforts of the supplement industry to educate health professionals through scientific meetings and consumers through advertising on the emerging science. His analysis concluded that the emerging science supports a role for supplemental carotenoids to address health issues of

importance to consumers such as eye health and heart disease and cancer risk. The addition of carotenoids has been a key reason for the very rapid growth in the sales of Centrum and other carotenoid containing products. Finally, Dr. Cotter pointed out that the science for health benefits for other carotenoids important to consumers continues to develop and will be used to continually reevaluate the addition of carotenoids to supplements.

The winner of the 2003 CARIG travel award was Zahide Nuray Unlu of Ohio State University for her abstract, "Absorption of lycopene isomers following single meals containing tomato sauces with varying isomer patterns".

CARIG appreciates the generous financial support of the conference by the following sponsors: BASF, Cognis, Craft Technologies, DHI Water and Environment, General Mills, Kemin Foods, LycoRed, The Procter & Gamble Co., Robert G. Laughlin, Ph.D., Roche, Royal Canin, Sight and Life, and ZeaVision.

Dale Cooper (Cincinnati, OH)

TECHNICAL NOTE

Raman Spectroscopic Detection of Carotenoids in Human Skin

A new noninvasive optical method, based on Raman spectroscopy, has been utilized to develop a skin scanner for carotenoids (Pharmanex BioPhotonic Scanner) by the University of Utah researchers, Dr. Werner Gellermann, Igor Ermakov and Robert McClane. Carotenoids have a characteristic Raman spectrum, with distinct peaks at 1159 cm^{-1} and 1524 cm^{-1} (from C-C single-bond stretch vibrations, and C=C double-bond stretch vibrations, respectively)[1]. The spectroscope uses an argon laser beam at 488 nm to excite the carotenoid molecules in 2 mm spot of the skin, with 20 seconds exposure time. The intensity of the Raman peaks is directly proportional to the total carotenoid concentration (except phytoene and phytofluene). The highest readings are obtained from the palm. The method is highly reproducible and was used to evaluate 1375 subjects of various age[2]. The mean value was 19,000 ± 8800 units (Raman intensity counts of 1524 cm^{-1} peak) with the range of 1,550-73,400 units. Most people fell between 10,250 and 27,900 units. There was a significant positive correlation with fruit and vegetable intake, and negative correlation with smoking status.

Dr. Susan Mayne, Yale epidemiologist, received $1 million in funding from the National Cancer Institute to evaluate nutrition status and the risk of cancer by assessing skin carotenoids in large populations with the portable spectroscope developed by the Utah physicists. The speed, portability and noninvasive character promise a wide application of this method in research and clinical practice of nutrition and medicine.

Maria S. Sapuntzakis (Chicago, IL)

[1] Hata TR, Scholz TA, Ermakov IV, McClane RW, Khachik F, Gellermann W, Pershing LK. Non-invasive Raman spectroscopy detection of carotenoids in human skin. J Invest Dermatol. 115:441-8, 2000.

[2] Smidt CR. Clinical screening study: use of the Pharmanex® BioPhotonic Scanner to assess skin carotenoids as a marker of antioxidant status. Pharmanex Study Report, 2003.

News and Views

Pizza Cuts Cancer Risks?

In a twist to the accepted medical wisdom that food you really enjoy tends to be bad for you, researches at a Milan pharmacology center found that eating one or more pizzas a week dramatically reduced the incidence of some types of cancer. A study of 8,000 Italians found that regular pizza-eaters were 59 percent less likely to contract cancer of the esophagus, while the risk of developing cancer of the colon fell by 26 percent.

"We knew that tomato sauce was protective against certain tumors, but we certainly didn't expect that pizza as a whole would provide such strong protection," researcher Silvano Gallus told Sunday's *La Repubblica* newpaper.

CNN.com July 20, 2003

New Lycopene Product

LycoRed Natural Products Lts., producers of Lyco-O-Mato natural tomato lycopene, is introducing another lycopene-based ingredient designed for the food industry. Lyc-O-Mato Fibers are produced from the same specially bred and cultivated lycopene-rich tomato used in Lyc-O-Mato. Using proprietary technology, the tomato fibers with natural lycopene still attached are separated from the fruit and carefully dried into a free flowing red powder. No chemicals are involved in this process. Lyco-O-Mato Fibers contain lycopene in its native state. The resulting 100% natural Lyco-O-Mato Fibers have a lycopene content 8 times higher than that of conventional tomato powder, are free of additives, and, because they contain only a small amount of soluble tomato solids, can be added to practically any food without affecting its flavor, according to the company.

NHANES: Everything You Always Wanted to Know

In 2003 Craft Technologies, Inc. was selected to perform the analysis of plasma carotenoids, retinoids and tocopherols for the National Health and Nutrition Examination Survey (NHANES) administered by the Centers for Disease Control (CDC). As a result, the methods used by CTI will permit the inclusion of lutein, zeaxanthin, β-cryptoxanthin, *trans*- and *cis*-lycopene, *trans*- and *cis*-β-carotene, phytoene, phytofluene, and β-tocopherol, in addition to the compounds previously reported. These additional analytes will allow closer examination of associations of carotenoids with eye disease and tomato carotenoids with prostate cancer.

ANNOUNCEMENTS

New Roche Human Nutrition Research Award

Roche Vitamins Ltd is pleased to announce the introduction of its International Award for Innovative Research in Human Nutrition. Roche Vitamins has a longstanding tradition and commitment in
research activities investigating the effect of vitamins, carotenoids, polyunsaturated fatty acids (PUFAs) and other natural compounds on human health.

Scope: The award will be given to scientists in recognition of their innovative research in the field of human nutrition, with special emphasis on naturally occurring dietary bioactive compounds which promote human health. The award is established to encourage and recognize excellence in research that significantly broadens the understanding of the role of nutrition in human health.

Award: The value of the award will be a total of EUR 25 000 and will be granted every two years, starting in 2003.

Submission: Candidates should provide an abstract and a detailed description of the research accomplishment. The submission should highlight the importance of the contribution to human nutrition, and include recently published peer-reviewed papers supporting the research. A curriculum vitae and supporting letter(s) from recognized scientists in the field are required. The submission, either as a printed copy (in duplicate), or in electronic form (by e-mail or on diskette or CD; preferably MS Word for PC format), should be sent to one of the following:

Postal address: Roche Vitamins Ltd, attn. Dr Manfred Eggersdorfer, Head of Research and Development, Dept. VF, Building 241/553, CH-4070 Basel, Switzerland

E-mail address: vitamins.award@roche.com

An international scientific advisory board will review the submission. The award will be presented at the European Nutrition Conference in Rome, Italy, which takes place from 1-4 October 2003. Recipients must be present to accept the award and present a paper on their research achievements.

Gordon Research Conference on Carotenoids

January 4-9, 2004
Ventura Beach Marriott
Ventura, CA

Chair: Harry A Frank
Vice Chair: John T Landrum

Sunday PM, January 4

Session 1: Structures of Protein-bound Carotenoids

Chair: *Richard Cogdell* (University of Glasgow)

John Helliwell (University of Manchester). The Molecular Basis of the Bathochromic Shift in Crustacyanin.

Cheryl Kerfeld (University of California, Los Angeles). The Structure and Function of the Water-Soluble Cyanobacterial Carotenoid Protein.

Monday AM, January 5

Session 2. Chemistry, Radicals, and Interactions

Chair*: Norman Krinsky* (Tufts University)

David McGarvey (Keele University). Laser Flash Photolysis Studies of the Reactions of Acylperoxyl Radicals with Carotenoids: Do Carotenoid Addition Radicals React with Oxygen?

Lowell Kispert (University of Alabama). Carotenoid Radical Cations and Dications: EPR and Spectroscopic Studies.

Alan Mortensen (Chr. Hansen). Carotenoids and Peroxyl Radicals.

Synnøve Liaaen-Jensen (Norwegian University of Science and Technology). Recent studies on charged carotenoid species.

Monday PM, January 5

Session 3. Carotenoids in Photosynthesis

Chair: *Hideki Hashimoto* (Osaka City University)

Ron Christensen (Bowdoin College). Optical Spectroscopy of Short and Long Polyenes: Implications for Carotenoids.

Kris Niyogi (University of California, Berkeley). Xanthophylls and regulation of photosynthetic light harvesting.

Alison Telfer (Imperial College). Carotenoid Photooxidation in Photosynthesis.

Tuesday AM, January 6

Session 4. Carotenoids in Health and Disease I

Chair: *Julie Mares* (University of Wisconsin)

Yoav Sharoni (Ben-Gurion University). Carotenoids and Gene Regulation by the Anti-oxidant Response Element.

Paola Palozza (Catholic University). Redox Regulation of Cell Growth by Carotenoids.

Leonard Cohen (Institute for Cancer Prevention). Tomato Carotenoids, Lycopene and Cancer: Preclinical Studies in Animal Models.

Karin Wertz (Roche Vitamins Ltd.). Lycopene and Vitamin E Interfere with Autocrine/Paracrine Loops in the Dunning Prostate Cancer Model.

Tuesday PM, January 6

Session 5. Carotenoids in Health and Disease II

Chair: *D. M. Snodderly* (Medical College of Georgia)

Martha Neurenger (Oregon Health and Science University). Dietary Lutein and Zeaxanthin Supplementation in Xanthophyll-free Rhesus Monkeys: Reflectometry, Biochemistry and Retinal morphology.

Emily Chew (National Eye Institute). The Results of the Randomized Trial of Dietary Supplements in the Age-Related Eye Disease Study (AREDS).

Steven Beatty (Waterford Regional Hospital). The Relationship between Macular Pigment and the Dietary and Serum Levels of its Constituent Carotenoids.

Wednesday AM, January 7

Session 6. Nutrition, Bioavailability and Metabolism

Chairs: *Klaus Kraemer* (BASF)

Alexandra During (ARS-USDA). Intestinal Absorption and Metabolism of Carotenoids: Insights from Cell Culture Studies.

Mark Failla (Ohio State University). Accessibility and Absorption of Carotenoids.

Andrew Clifford (University of California, Davis). Absorption and Metabolism of Carotenoids: Insights from Isotope Tracer Studies in Humans.

Clive West (Wageningen Agricultural University). Bioavailability and bioconversion of □-carotene in oil and mixed plant foods.

Wednesday PM, January 7

Session 7. Biological Effects of Carotenoids

Chair: *Robert Russell* (Tufts University)

Kyung-Jin Yeum (Tufts University). Biological Actions of Carotenoids in Humans.

John Bertram (University of Hawaii). Mechanism and Biological Significance of Carotenoid Up-regulated Expression of Connexin43 in Human Cancer Cells.

Jonathan Blount (University of Glasgow). Carotenoids and the Costs of Reproduction: Perspectives from Evolutionary Ecology.

Thursday AM, January 8

Session 8. Carotenoids and Gene Expression

Chair: *Francis Cunningham* (University of Maryland)

Joseph Hirschberg (Hebrew University of Jerusalem). Role of Gene Expression in the Regulation of Carotenoid Biosynthesis in Plants.

Bilal Camara (Université Louis Pasteur). Biosynthesis and Remodeling of Chromoplast Carotenoids.

Christine Shewmaker (BluGoose Consulting). Use of Plant Biotechnology to Modify Carotenoid Content in Seeds.

Peter Beyer (University of Freiburg). Ways to Improve Golden Rice.

Thursday PM, January 8

Session 9. GENOMICS, GENETICS, PLANT METABOLISM AND HUMAN HEALTH

Discussion Leader: *George Britton* (University of Liverpool)

Dean DellaPenna (Michigan State University). It's been fun figuring out carotenoid synthesis in plants; could it now be time for plant and animal researchers to converge?

Applicants will be admitted by the Chair on an ongoing basis beginning October 3, 2003, based on the information provided on the application. Applications are encouraged from scientists active in the research area of the Conference. Attendance at the Conference is limited to about 135 conferees principally on a first come basis. This Conference will be full long before the deadline; therefore, submit your application early. Early registration will also incur a fee reduction. Application may be made on the **GRC Web site** or by E-mail using the **form** available from the GRC office (send to **app@grc.org**). Upon acceptance to the Conference, individuals will receive registration information. The Conference fee covers registration, meals and room.

It is hoped that limited support will be available to young investigators to enable these individuals to attend the Gordon Research Conference on Carotenoids. Contact the Conference chair, Harry Frank, at **harry.frank@uconn.edu** for more information. Preference will be given to individuals presenting posters. Titles of posters should be e-mailed to John Landrum at **landrumj@fiu.edu**.

NIST Quality Assurance Micronutrient Analysis Workshop

2004 Experimental Biology
Washington, DC
Date to be announced

9:00 am. Opening Remarks
9:15 am. Review of results from interlaboratory comparison exercises. *Jeanice Brown Thomas*
9:30 am. Carotenoid standards and stability. *Kathy Sharpless, Maria Sapuntzakis*
10:00 am. Sample matrix: Lycophilized vs. Fresh-frozen serum. *Dave Duewer*
10:30 am. The B-vitamin Profile: findings from NHANES. *Christine Pfeiffer*
11:00 am. Simultaneous quantification of folate and homocysteine in human plasma or serum using mass spectrometry. *Bryant Nelson, Mary Satterfield*
11:30 am. Lunch (on your own)
1:00 pm. Discussion of coenzyme Q10 measurements in human plasma/serum. *Iris Osberg, Paul Ullucci*
1:30pm. New method development for vitamin C in serum measurement. *CDC staff*
2:00 pm. Discussion of QA program needs
2:30 pm. Wrap-up

Internet Addresses for Carotenoid Researchers

1. USDA Nutrient Database for Standard Reference (SR13) is a major source of food composition data for epidemiologists and nutritionists. Carotenoid Food Database contains best

available estimates of carotenoid content in foods, also used in NDS-R: www.nal.usda.gov/fnic/foodcomp/data/index.html

2. This list is intended to be an open forum for carotenoid researchers from around the world to discuss recent developments in this field: CARIG.Forum@lists.unh.edu. To subscribe, send e-mail to: listproc@lists.unh.edu. In the body of the message write: subscribe CARIG Forum, your name.

3. International Carotenoid Society Webpage: www.carotenoidsociety.org Anyone wishing to join the society and be listed in the web directory, please contact Andrew Young at a.j.young@livjm.ac.uk

4. Newsletter of CaroteNature GmbH, offering carotenoids standards, analysis, custom synthesis and consultancy. **E-mail**: info@carotenature.com **website**: www.carotenature.com

5. Carotenoid Section of the Lipid Database developed by Internal Medicine Center of Japan and Japan Science and Technology Cooperation; www.lipidbank.jp. Also available on International Carotenoid Society Webpage (above) through Articles button.

6. Reference library prepared by LycoRed Natural Product; www.lycopene.com-references

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"Stop! Roadblock ahead! The food police administers mandatory skin scans for carotenoids!"

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