



Carotenoid News

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FROM THE EDITOR

"The aim of argument, or of discussion, should not be victory, but progress"- Joseph Joubert, French essayist and moralist, 1754 -1824)

Two upcoming meetings, CARIG Annual PreEB Conference on April 25 in San Diego, and the International Symposium on Carotenoids on June 29 to July 4 in Park City, promise many opportunities for lively discussions and friendly arguments after each talk and around posters. We should expect continuing progress in understanding of all aspects of carotenoids - their properties, biosynthesis, metabolism and biological importance. Both CARIG and International Carotenoid Society hope to see you at these events!

Maria S. Sapuntzakis (Chicago, IL)

CARIG Travel Awards

CARIG will award at least two monetary prizes, based on a poster competition to be held in conjunction with the CARIG/VARIG Social at Experimental Biology 2014. Graduate students and postdoctoral trainees are eligible. Posters must address carotenoid and/or vitamin A research. For those assigned an oral presentation rather than a poster at EB'14, printed copies of your slides with a print copy of your abstract and a small banner may be used for the CARIG/VARIG poster competition. No advance registration is required to participate in the poster competition. Contact: Loredana Quadro, e-mail: quadro@aesop.rutgers.edu.

UPCOMING EVENTS

March 13-14, 2014

Functional Food Center 15th International Conference, Tainin, Taiwan.

E-mail: ffc_usa@sbcglobal.net,

website: www.functionalfoodscenter.net

April 25, 2014

CARIG Annual Conference, San Diego, CA.

Contact: Dr. Loredana Quadro, CARIG RIS Chair,

e-mail: quadro@aesop.rutgers.edu [more information below]

April 26-30, 2014

Experimental Biology 2014, San Diego, CA.

Contact: EB2014, FASEB Office of Scientific Meetings & Conferences, 950 Rockville Pike, Bethesda, MD 20814-3998, e-mail: eb@faseb.org website: www.experimentalbiology.org

May 7-10, 2014

Oxygen Club of California 2014 World Congress,

Davis, CA. Oxidants and Antioxidants in Biology. Nutritional and Redox Biology in Development and Health. E-mail: oxyclubcalifornia@ucdavis.edu website: www.oxyclubcalifornia.org

June 29 – July 4, 2014

The 17th International Symposium on Carotenoids, Park City, UT, USA. Contact: Paul S. Bernstein, M.D., Ph.D., Department of Ophthalmology and Visual Sciences, Moran Eye Center, University of Utah, 65 Mario Capecchi Drive, Salt Lake City, UT 84132, USA. Tel: 801-581-6078. Fax: 801-581-3357, paul.bernstein@hsc.utah.edu [more information below]

CARIG Events at Experimental Biology 2014

CARIG Annual Symposium

Friday, April 25, 2013, 1 – 5 PM

San Diego Convention Center

Chairs: Loredana Quadro and Earl Harrison

James Olson Memorial Lecture: *Emerging Science on Lutein in the Brain*. Elizabeth Johnson, Human Nutrition Research Center on Aging, Tufts University, Boston.

Biological actions of apocarotenoids

Picking up the pieces – analysis of apocarotenoids by LCMS, Kenneth Riedl, Ohio State University, Columbus

Substrate specificity and reaction mechanism of vertebrate carotenoid cleavage oxygenases, Carlo dela Sēna, Ohio State University, Columbus

Two carotenoid oxygenases and provitamin A metabolism, Johannes von Lintig, Case Western Reserve University, Cleveland

Selective apocarotenoid metabolism facilitates avian color vision, Matthew Toomey, Washington University St. Louis

6:30-8:30PM, CARIG/VARIG Social, Poster Competition & Business Meeting

Saturday, April 26, 2013: Minisymposium: Carotenoids, Retinoids and Health. Room 30A, 10:30am -12:30pm: Chaired by Zeina Jouni (CARIG Chair-Elect) and Elizabeth Johnson (Tufts University)

Sunday, April 21, 2013: Poster Sessions:
Bioavailability and metabolism of carotenoids and vitamin A
Biofortification of staple crops with micronutrients

CARIG needs YOUR ideas and participation! If you are attending EB 2014, please plan to attend Friday's social and business meeting. We welcome your ideas and suggestions and are always looking for new members for our steering committee. Also, we need to elect the next Chair-Elect later this year, so we would appreciate receiving nominations for this position (including self nominations). Please contact any of the following persons with your questions and suggestions: Earl Harrison (Past Chair, Harrison.304@osu.edu), Loredana Quadro (Chair, quadro@AESOP.Rutgers.edu) or Zeina Jouni (Chair-Elect, zejouni2013@gmail.com).

The 17th International Symposium on Carotenoids
June 29 – July 4, 2014
Park City, UT
Sections and Speakers
(plenary speakers in **bold** type)

Biosynthesis and Metabolism, **Eleanore Wurtzel**,
Salim Al-Babili, Kevin McGraw, Barry Pogson

Carotenoids in the Eye and Brain, **Emily Chew**, Tos Berendschot, Paul Bernstein, John W. Erdman, Billy Hammond, Elizabeth Johnson, John Landrum, John Nolan

Carotenoid Metabolism and Function, **Earl Harrison**, William Blaner, Volker Böhm, M. Luisa Bonet, Johannes von Lintig

Chemical Synthesis, Analysis and Industrial Production, **József Deli**, Fred Khachik, Sangho Koo, Maria Mayorga, Betina Wuestenberg

Epidemiology, Genetics and Nutrition, **Loredana Quadro**, Patrick Borel, Georg Lietz, Julie Mares

Food and Biotechnology, **Antonio Meléndez-Martínez**, Delia Rodriguez-Amaya, Tim O'Hare, Carmen Socaciu

Chronic Disease Prevention and Treatment, **Xiang-Dong Wang**, Catherine Caris-Veyrat, Steven

Clinton, Manubo Ishiki. Omer Kucuk, Yoav Sharoni

Photochemistry, Photophysics, and Photosynthesis, **Gregory Scholes**, Hideki Hashimoto, Tom Moore, Tomáš Polívka, Bruno Robert

RECENT / FORTHCOMING PUBLICATIONS

SIGHT AND LIFE Magazine 27 (2) and (3), 2013. PO Box 2116, 4002 Basel, Switzerland, tel: 41-61-815-8756, e-mail: klaus.kraemer@sightandlife.org website: www.sightandlife.org. See especially:

The show must go on. Carotenoid Research Interaction Group (CARIG) Conference, Boston, April 19, 2013. Solomons NW, (2) 64-65.

Are dietary bioactives ready for recommended intakes? Gaine PC, Balentine DA, Erdman JW, Dwyer JT, Ellwood KC, Hu FB, Russell RM. Adv Nutr: 539-41 (2013).

Strong and weak plasma response to dietary carotenoids identified by cluster analysis and linked to β -carotene 15,15'-monooxygenase 1 single nucleotide polymorphisms. Wang TTY, Edwards AJ, Clevidence BA. *J Nutr Biochem* 24:1538-46 (2013).

Two carotenoid oxygenases contribute to mammalian provitamin A metabolism. Amengual J, Widjaja-Adhi MAK, Rodriguez-Santiago S, Hessel S, Golczak M, Palczewski K, von Lintig J. *J Biol Chem* 288: 34081-96 (2013).

Substrate specificity of purified recombinant human β -carotene 15,15'-oxygenase (BCO1). dela Sena C, Narayanasamy S, Riedl KM, Curley RW, Schwartz SJ, Harrison EH. *J Biol Chem* 288: 37094-103 (2013).

Chemistry and Biology of Retinoids and Carotenoids. A special issue of *Chemical Reviews* 114 (1):1-254 (2014).

Alphabetical Listing of Recent Publications may be found at www.carotenoidociety.org/articles-books-and-databases. Prepared by Dr. Harold Furr, Department of Nutritional Sciences, University of Wisconsin, Madison.

TECHNICAL NOTES

Search for life on Mars

Raman spectroscopy is being adopted as a nondestructive instrumentation for the robotic exploration of Mars to search for traces of life in the

geological record. A novel miniaturized Raman spectrometer is scheduled to fly as part of the analytical instrumentation package on a remote robotic lander in the European Space Agency/Roscosmos ExoMars mission to search for evidence for extant or extinct life on Mars in 2018. The Raman spectrometer will be part of the first-pass analytical stage of the sampling procedure, after detailed surface examination by the PanCam scanning camera unit on the ExoMars rover vehicle. Miniaturized Raman spectrometers of two different types equipped with 532 and 785 nm lasers for excitation, respectively, were compared for the detection of microbial biomarkers in natural halite from the hyperarid region of the Atacama Desert in Chile. Halite samples revealed endolithic colonization dominated by cyanobacteria, containing carotenoids and a black UV-protective pigment scytonemin. Measurements were performed directly on the rock as well as on the homogenized, powdered samples prepared from this material. From these results, the 532 nm excitation was found to be superior for the analysis of powdered specimens due to its high sensitivity toward carotenoids and hence a higher capability for their detection at relatively low concentration in bulk powdered specimens. For the same reason, this wavelength was a better choice for the detection of carotenoids in direct measurements made on the rock samples. The 785 nm excitation wavelength, in contrast, proved to be more sensitive toward the detection of scytonemin (Jehlicka VP et al., *Astrobiology* 12:1095, 2012). In another experiment, ten powdered samples of various terrestrial rocks, representative of the mineralogy and possible biogeologically modified structures that may be identified on Mars, have been examined with Raman spectroscopy. It is concluded that the Raman spectroscopic technique does indeed demonstrate the capability to identify biomolecular signatures (carotenoids, chlorophyll, phycobilins, thermally degraded carbonaceous matter) and the mineralogy in real-world terrestrial samples (Edwards HGM et al., *Astrobiology* 13:553, 2013).

NEWS AND VIEWS

Low nitrogen fertilization does not impair carotenoid content in peppers

Producers of horticultural products face new and growing standards regarding food quality and safety as well as environmental responsibility and sustainability. The objective of this research was to reduce environmental pollution by increasing nitrogen use efficiency in vegetables without

negatively affecting fruit yield or quality. Bell pepper was used as a case study for intensive vegetable cropping. Pepper cultivars with different vegetative vigor were drip-irrigated with solutions containing 9.2, 56.2, 102.3, and 158.5 mg/L of nitrogen (N). Fruit yield, quality, and nutritional value were measured. N balance was determined by quantifying N in soil and in plant tissues. Maximum yields were found when peppers were irrigated with 56.2 mg/L. N concentrations of 102.3 and 158.5 mg/L loaded 400 and 800 kg N per ha into the environment, respectively, whereas for the 56.2 mg/L, N was almost completely taken up and used by the plants. N treatments had no significant negative effect on pepper fruit physical or chemical quality parameters including sugar content and acidity. Reduced N application did not affect nutritional quality components of the pepper fruit such as β -carotene and lycopene content or total antioxidant activity. The vigorous cultivar used N more efficiently. The results demonstrate how the environmental impact of intensive agriculture can be minimized without harming fruit yield or quality by reducing N application level and adopting cultivars with improved N use efficiency.

Yasuor H et al. *HortScience* 48:1241, 2013

Autumn olive – a rich source of lycopene



Autumn olive (*Elaeagnus umbellata* Thunb.), a shrub native to East Asia, was introduced to America in 1830 as an ornamental plant, but it escaped cultivation and is considered to be a noxious invasive weed in many locations. It produces an abundance of red berries, prized in Asia for their sweet-tart flavor. The berries are rich in lycopene (15-54 mg/100 g), α -cryptoxanthin (1-4.5 mg/100 g) and β -cryptoxanthin (2-7 mg/100 g) (Fordham IM et al. *HortScience* 36:1136, 2001). These values are $\approx 17\times$ higher than lycopene in tomatoes, and $\approx 10\times$ higher than β -cryptoxanthin in oranges and tangerines. At present, numerous varieties of autumn olive are

cultivated and processed into concentrated puree, dried flakes, or fine powder, and sold as Lycoberry products by From The Wild, Inc. One tablespoon of puree delivers 7 mg of lycopene. To produce puree, the berries are picked fresh, washed, vacuum sealed, frozen, and ground before they are high-pressure processed to preserve the taste and nutritional profile. The puree or syrup work well in yoghurt, smoothies, juices, seltzers, alcoholic drinks or sauces. The powder and flake forms are dried using infrared technology, and then can be added to flour, baked goods and supplements. As a semi-soft ingredient it can be added to cereals, power bars, trail mixes or confections.

www.nutraingredients-usa.com 11/15/2013

Effects of tomato and soy on serum adipokine concentrations

Breast cancer risk among postmenopausal women increases as body mass index and circulating leptin increase, but is inversely associated with circulating adiponectin. Practical preventive methods to reduce risk of breast cancer are lacking. The aim of this study was to examine the effects of lycopene- and isoflavone-rich diets on serum adipokines. This was a 26-week, two-arm, longitudinal crossover trial. Seventy postmenopausal women at increased breast cancer risk participated in the study. The mean age and body mass index of participants was 57.2 y and 30.0 kg/m², respectively; 81.4% were white. The interventions included 10 weeks of consumption of a tomato-based diet (≥25 mg lycopene daily) and 10 weeks of consumption of a soy-based diet (≥40 g of soy protein daily), with a 2-week washout in between. Changes in serum adiponectin, leptin, and the adiponectin to leptin ratio were examined for each intervention through linear mixed models, with ratio estimates corresponding to postintervention adipokine concentrations relative to preintervention concentrations. After the tomato intervention, among all women, adiponectin concentration increased (ratio 1.09, 95% confidence interval (CI) 1.00–1.18), with a stronger effect observed among non-obese women (ratio 1.13, 95% CI 1.02–1.25). After the soy intervention, adiponectin decreased overall (ratio 0.91, 95% CI 0.84–0.97), with a larger reduction observed among nonobese women (ratio 0.89, 95% CI 0.81–0.98). Overall, no significant changes in leptin or the adiponectin to leptin ratio were observed after either intervention. Increasing dietary consumption of tomato-based foods may beneficially increase serum adiponectin concentrations among postmenopausal women at increased breast cancer risk, especially those who are not obese. Additional studies are essential to confirm these effects and to elucidate the specific mechanisms that may make

phytonutrients found in tomatoes practical as breast cancer chemopreventive agents.

Llanos AA et al.
J Clin Endocrinol Metabol 99:625, 2014

Pizza contribution of lycopene in the U.S. diet

Food Surveys Research Group reports that on any given day 13% of the U.S. population consumed pizza (NHANES 2007-2010), most frequently (22%) by children (6-19 years old). On the day of consumption, pizza contributed 51% of daily intake of lycopene in children 2-19 years old, and 58% in adults (≥20 years old).

Rhodes DG et al. *Dietary Data Brief* No.11, February 2014, www.ars.usda.gov

Internet Addresses for Carotenoid Researchers

1. USDA Nutrient Database for Standard Reference (SR25) is a major source of food composition data for epidemiologists and nutritionists. The carotenoid database contains the best available estimates of carotenoid content in foods. The Agricultural Research Service (ARS) searchable database allows one to view carotenoid profile for more than 13,000 foods: www.ars.usda.gov/foodsearch, www.ars.usda.gov/Services/docs.htm?docid=2114.
2. International Carotenoid Society (ICS) Website: www.carotenoidsociety.org
3. Carotenoid Section of the Lipid Database developed by Research Institute, International Medical Center of Japan webpage: www.lipidbank.jp. Also available on ICS webpage: www.carotenoidsociety.org through **Articles** button.

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