FROM THE EDITOR

Verba volant, scripta manent.
(Words vanish, writings remain—Latin proverb)

Human memory is imperfect and needs various aids to convey information and experience to the next generation, both to keep tradition alive and to enable progress. More than 25,000 years ago our Paleolithic ancestors made notches on bone to keep records. Writing first evolved about 5,300 years ago in Middle East. By the time of Roman Empire it was a necessary element of civilization and Romans were keenly aware of the importance and permanence of the written word. Is it still so important in the age of sound bites and pictures flashing across screens of computers, cell phones and TV sets? Although many young people do not relish reading and/or writing anything longer than SMS, it is difficult to imagine the further progress of science without publication of inspired lectures, experimental results, new books and reviews. Even reports from scientific meetings and informal newsletters are valuable, inasmuch they preserve memory of important events in the life and history of a particular scientific discipline. Therefore we are thankful to all who contributed articles and information to this issue of Carotenoid News and ask for your help in future.

Maria S. Sapuntzakis, Chicago, IL

In Memoriam


It is with much sadness that we report that one of the all-time greats of the carotenoid world, Trevor (T. W.) Goodwin, died on 7th October 2008 at the age of 92. He has left a great legacy of research papers and reviews and is particularly well known for his numerous books, notably the two volumes of The Biochemistry of the Carotenoids, which were published in the 1980s but remain a most valuable source of information today. Although he retired in 1983, he maintained a keen interest in carotenoids and in carotenoid people. Through his enthusiasm, Trevor Goodwin introduced many of us to the wonderful world of carotenoids and was a great influence and inspiration throughout our careers. His contribution to the carotenoid field is enormous and enduring. He was also a special person who will be much missed by all those who knew him.

George Britton, Liverpool, UK

Carotenoid Research Interactive Group (CARIG) RIS

Carotenoid Research Interactive Group (CARIG) has been active for nearly 20 years; this is our first year as ASN RIS. The CARIG Steering Committee has decided that we will retain the well known CARIG name for our group. The 2008-2009 Chair of the CARIG RIS will be Dr Elizabeth Johnson, from Jean Mayer Human Nutrition Research Center on Aging at Tufts University.

RIS Name: Carotenoid Research Interactive Group (CARIG)

Purpose and/or Mission: CARIG’s mission is to promote research into nutritional roles, functions, and actions of carotenoids and their metabolites; provide a mechanism for the dissemination of new research; serve as a liaison representing the interests of the carotenoid research community to government agencies and other organizations; promote and support the training of young researchers; communicate to the wider research community and the public.

General Organizational Structure: CARIG shall be managed by a Steering Committee consisting of, at minimum: a Chairperson (Elizabeth Johnson), a Chair-elect (Sherry Tanumihardjo), a Past-chair (John Landrum), a Treasurer (Mario Ferruzzi), an Advisory Committee consisting of 4-6 members.

Membership on the Steering Committee shall be by election of officers from among its membership at the annual meeting of the RIS. The Steering Committee members shall be elected for a term of 3 yrs. Members of the Steering Committee may serve multiple, consecutive terms.

The Advisory Committee shall consist of not less than four and not more than six members). Nomination to serve on the Steering Committee will be open to the general membership of the RIS and nominations may be made by any member of the CARIG RIS. Nominations will be solicited each year at the annual meeting of the CARIG RIS which shall be held during the EB meeting. The Steering Committee shall elect Advisory Committee members from among the nominees. The number of Advisory Committee members to be elected each year shall be determined at the annual Steering Committee meeting and shall be sufficient in number to ensure that the interests of the general membership are well represented. The election will be managed by the Chair and will be conducted by conference call or email.

Election of officers will be for a 1 year term with the exception of the treasurer who will serve a two year term. The Steering Committee shall nominate and elect officers from among its membership at the annual meeting of the Steering Committee. Terms shall begin June 1 and end May 31. In the event of a mid-term vacancy an officer may be replaced by a vote of the Steering Committee to be conducted by the Chair, past-Chair, or the Chair-elect.

The Chairperson, or his/her designate from among the Steering Committee membership, shall represent the RIS on the ASN Symposia Advisory Committee. The Treasurer shall be responsible for fundraising activities and shall maintain a record of the funds available for RIS
activities in concert with the ASN.

Planned Activities and Special Events: The CARIG RIS will hold a symposium devoted to recent advances in the field of carotenoids in conjunction with the annual Experimental Biology meeting. The keynote address of this symposium will be the James Allen Olson Memorial Lecture. A meeting of the general membership will be held during each Experimental Biology meeting at which business will be conducted, a young researcher poster session will be held, and awards and announcements shall be made.

News from the CARIG Steering Committee
The annual meeting of the CARIG Steering Committee was held during EB '08 in San Diego, CA. The Committee thanked Elizabeth Johnson for her excellent work as Chair of this year's CARIG Conference (see report below), and Harold Furr for organizing CARIG/VARIG social with poster competition and continuing preparation of the literature review, which is a traditional highlight of this newsletter. Elizabeth Johnson was elected the Chair of CARIG RIS for June 1, 2008 – May 31, 2009 and Sherry Tanumihardjo the next Chair for June 1, 2009 – May 31, 2010. The current membership of the CARIG Steering Committee includes:

Elizabeth Johnson (Chair, CARIG RIS) – Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University
John Landrum (Past Chair) – Florida International University
Sherry Tanumihardjo (Chair Elect) – University of Wisconsin, Madison
Mario Ferruzzi (Treasurer, Fundraising) – Purdue University
Klaus Kraemer – Task Force Sight and Life
Lewis Rubin (Chair, CARIG Conference 2009) – Cleveland Clinic
Maria Stacewicz-Sapuntzakis (Newsletter Editor and member ex officio) – University of Illinois, Chicago

The next issue of Carotenoid News will include the agenda for the CARIG Conference at EB 2009 in New Orleans, LA.

CARIG Travel Awards
CARIG will award one or more $500 travel grants based on a poster competition to be held in conjunction with the CARIG/VARIG social at Experimental Biology 2009. 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'09, printed copies of the slides may be used for the CARIG/VARIG poster competition. The time and location of the CARIG/VARIG Social will be announced in the February 2009 issue of Carotenoid News. No advance registration is required to participate in the poster competition. Contact: Dr. Elizabeth J. Johnson, Carotenoids & Health Laboratory, Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University, Boston, MA 02111, USA, tel: 1-617-556-3204, fax: 1-617-556-3344, E-mail: elizabeth.johnson@tufts.edu

2008 CARIG Conference Report
The Carotenoid Research Interactive Group (CARIG) annual conference was held on April 5, 2008 in conjunction with the Experimental Biology meeting in San Diego, CA. This year’s conference was chaired by Elizabeth Johnson, Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University.

Dr. Arun Barua, emeritus faculty member at the Iowa State University, presented the 7th Annual James Allen Olson Memorial Lecture, entitled “The Hidden Beauty of Carotenoids”. Dr. Barua provided a comprehensive view of the diverse roles carotenoids play in plant and animal kingdoms. These include β-carotene and other provitamin A carotenoids as precursors of vitamin A, the importance of lutein and zeaxanthin in the prevention of eye diseases, such as cataract and age-related macular degeneration, and the photoprotective action of carotenoids against sunburn and other skin conditions, such as photoaging. It was an excellent preview to the subsequent program.

The first half of the symposium evaluated the role of carotenoids in early life. Dr. Sherry Tanumihardjo, of the University of Wisconsin-Madison, spoke on “Carotenoid Content in Human Breast Milk” which described the mechanism of transport of dietary carotenoids to the mammary gland and secretion into milk, as well as the implications for carotenoids providing a source of vitamin A in early life. She provided data on the considerable variation in maternal milk carotenoid concentrations among various countries worldwide, as well as information on the relationships between dietary sources of carotenoids and their levels in breast milk. Information was presented on the milk carotenoids as a source of vitamin A. Dr. Tanumihardjo noted that the non provitamin A carotenoids may have health implications in early life. Such a role was explored in the following two talks.

Dr. John Landrum, of Florida International University, spoke on “Macular Pigment in Retina of Neonate Monkey”. Macular pigment in humans and macaques develops during the early stages of life. The research from Dr. Landrum’s research group finds that at birth retina contains more lutein than zeaxanthin and that there is virtually no meso-zeaxanthin. In humans, the ratio zeaxanthin to lutein increases with age, from a value of less than 1, until approximately 2 years of age, when zeaxanthin becomes dominant. In macaques, this ratio similarly changes, with zeaxanthin increasing to dominance at a rate roughly four times that of humans. Dr. Landrum concluded that the composition and distribution on the macular pigments may have a specific role in ocular health.

Dr. B. Randy Hammond, of the University of Georgia-Athens, carried the theme of xanthophylls in early life with a talk entitled “Dietary Lutein and Zeaxanthin in Vision and Visual Development”. Dr. Hammond reviewed the studies in rhesus monkeys fed diets devoid of carotenoids, resulting in distinct abnormal morphological changes in the retina, which could be reversed with xanthophyll supplementation. Retinal lutein and zeaxanthin, for instance, would influence the development of the visual system if they (1) altered input during a critical/sensitive period of visual development, (2) influenced maturation, (3) protected the retina when it was particularly vulnerable. Evidence was presented to
indicate that the pigments may play a role in all three areas.

The next half of the symposium focused on aspects of carotenoids in skin. Dr. Susan Mayne of Yale University spoke of the validation of an assessment tool for measures of carotenoids in skin, using a non-invasive method. The measure was discussed in the context of its use as biomarkers of dietary fruit and vegetable. Dr. Mayne presented data from a longitudinal study involving 75 subjects, in which dermal carotenoids were measured using the resonance Raman spectroscopy. The measure was evaluated against biochemical assays of carotenoids in skin biopsies. The results found a high correlation between the Raman and the biochemical measures. Dr. Mayne discussed the advantages of this noninvasive approach to assessing dietary carotenoid exposure, including its low costs.

The symposium concluded with Dr. Helmut Sies’ of the Heinrich Heine University presentation on “Carotenoids and Skin Health”. Dr. Sies discussed the results from his research group demonstrating the protective effects of carotenoid supplementation against erythema formation in skin exposed to UV radiation. Of interest was the finding that skin protection resulted from treatments with carrot juice, tomato paste, tomato extracts, and lycopene supplement containing phytoene and phytofluene, but not from a pure lycopene supplement. It was suggested that interaction among carotenoids provided protection against UV radiation.

The CARIG/VARIG social and poster competition was held on Saturday evening, after the conference. The competition was open the graduate and post-doctoral students. Youn-Kyung Kim, of Rutgers University was awarded top prize for her poster entitled “The Role of β-Carotene 15,15'-Oxygenase (CMO1) during Mammalian Embryonic Development”. The CARIG Committee would like to thank our sponsors: General Mills, Harvest Plus, International Food Policy Research Institute, Kemin Industries, Sight and Life, and Wyeth. The full text of the James Allen Olson memorial lecture and an expanded summary of CARIG 2008 can be found in the Sight and Life Newsletter 2/2008 (www.sightandlife.org).

Elizabeth Johnson, Boston, MA

The 15th International Symposium on Carotenoids, June 22-27, 2008

The 15th International Symposium on Carotenoids was held in the Moon Beach Hotel, Okinawa Island, Japan, with Wataru Miki as Chairman and Hideki Hashimoto as Secretary. We thank them and the ‘Hashimoto Army’ of willing helpers for making this an enjoyable, informative and stimulating event. In total, there were almost 300 participants and more than 30 countries were represented. The location was an opportunity for many of our Japanese colleagues to attend an International Carotenoid Symposium for the first time, and for all of us to enjoy this interesting Pacific island. An awe-inspiring demonstration of martial arts by the Symposium Secretary made sure that attendance in the lecture rooms was good in spite of the lure of the beach. The program, highlighted by the Plenary Lectures of Masayoshi Ito, Fred Khachik, Wataru Miki, Stefan Branth, Hideki Hashimoto, John Erdman, Gerhard Sandmann and Hansgeorg Ernst, and supported by about 70 other invited lectures, oral communications and lively poster sessions, gave us new research findings and progress reports covering all areas of the carotenoid field. There was a strong emphasis on astaxanthin, including its effects in relation to sports science and performance. At the Symposium banquet, the Otto Isler and Trevor Goodwin Awards of the International Carotenoid Society were presented, respectively, to Masayoshi Ito and, in absentia, to Johannes von Lintig. Fred Khachik has now taken over as President of the ICS and, following the elections, Hideki Hashimoto was announced as President Elect, and Liz Johnson, Bruno Robert, Wolfgang Schalch, Carmen Socaciu, and Johannes von Lintig as new Councilors. We congratulate them and thank Richard Cogdell and the retiring Councilors for their work on behalf of the Society. A note for your diary: the 16th International Symposium on Carotenoids will be held in July 2011 in the World Heritage city of Krakow, Poland, with Kazimierz Strzalka as Chairman. A more extensive report will appear shortly on the new website of the ICS.

George Britton, Liverpool, UK

UPCOMING EVENTS

April 18-22, 2009
Experimental Biology 2009, New Orleans, LA.
Contact: EB2009, FASEB Office of Scientific Meetings & Conferences, 950 Rockville Pike, Bethesda, MD 20814-3998, website: www.eb2009.org, tel: 301-634-7010, e-mail: eb@faseb.org

12-15 May, 2009
Micronutrient Forum "Micronutrients, Health and Development: Evidence Based Programs", Beijing, China. Contact: Micronutrient Forum Secretariat at A2Z Project, AED, 1825 Connecticut Avenue NW, Washington, DC, 20009, tel: 202-884-8785, e-mail: mnforum@aed.org

October 4-9, 2009
19th International Congress of Nutrition, Bangkok, Thailand. Contact: AsiaCongress Events Co., Ltd. 10 Soi Lasalle 56, Sukhumvit Rd, Bangna, Bangkok 10260, Thailand. Website: www.icn2009.com, e-mail: icn2009@asiacongress.com

RECENT / FORTHCOMING PUBLICATIONS


Alphabetical Listing of Recent Publications
Prepared by Dr. Harold Furr, Institute of Nutrition, Mahidol University, Thailand, and Department of Nutritional Sciences, University of Wisconsin, Madison. More extensive list may be found at www.carotenoidsociety.org.

Anonymous. [Pigmented basidiomyocyte yeasts are a promising source of carotenoids and ubiquinone Q10]. Mikrobiologija. 2008; 77: 5-10.


A. Effects of 6-month daily supplementation with oral Fuster, A., Pico, C., Sanchez, J., Oliver, P., Zingaretti, M. C., Isaksson, C., Johansson, A., & Andersson, S. Egg yolk quenching in... 


Isaksson, C. & Andersson, S. Oxidative stress does not influence... 


Giuliano, G., Tavazza, R., Diretto, G., Beyer, P., & Taylor, M. A. Abscisic acid deficiency in the tomato mutant high-pigment 3 leading to increased plastid number and higher fruit lycopene content. Plant J. 2008; 53: 717-730.


Nanoemulsions show potential for fighting cancer

Nanoemulsions containing bioactive compounds such as curcumin, or antioxidants like lycopene, may reduce the growth and spread of cancer cells. The research may lead to new and cost-effective ways of reducing the risk or improving the fight against certain cancers, if the results of early animal studies can be repeated in humans. Professor Robert Nicolosi from the University of Massachusetts told attendees at the IFT International Food Nanoscience Conference in New Orleans that nanoemulsions created using a high-pressure microfluidiser have led to the reduction in size and growth of cancer cells in lab animals. Animals injected with neuroblastoma to promote the growth of cancer cells and then exposed to antioxidant nanoemulsions experienced shrinkage in tumours by 65%. A combination of antioxidants called the antioxidant synergy formulation (ASF) showed potential to reduce cancer cell growth. An added advantage of the nanoemulsions is that smaller quantities of the bioactives can be used to achieve the beneficial effects. This makes for cost-saving on the ingredients. The bioavailability and efficacy of vitamin E, for example, is increased when formulated in the nanoemulsions. Preparation of the nanoemulsions, oil-in-water or water-in-oil mixture with particles in the nanometre scale, is achieved using a microfluidiser. Water and an emulsifier, like lecithin, are mixed with the bioactive compound, and then poured into the microfluidiser, which compresses the solution and forces it through tiny channels. These microchannels are then split and the solution forced to collide with itself at extremely high speed. The collision produces a stable nanoemulsion. Using the microfluidiser has enabled the production of stable nanoemulsions, making them commercially viable. Previously, the particles in nanoemulsions were found in a wide size range, from 5 nm to 5 µm and they weren't very stable. The University of Massachusetts researchers are exploring the potential of the microfluidised particles to formulate food; beverages, and nutritional supplements to reduce inflammation, and cholesterol, and thereby reduce the risk of chronic disease such as cardiovascular disease.

www.nutraingredients-usa.com (7/2/2008)

High Dose Lycopene Supplementation Increases Hepatic CYP2E1 Protein and Inflammation in Alcohol-Fed Rats

Excessive alcohol intake results in liver inflammation which may be prevented by antioxidant supplementation. The effect of supplementing the antioxidant lycopene has not been investigated in alcohol induced inflammation. Furthermore, it is not known if the effects of lycopene are dependent on the dose in which it is consumed. This study tested the effects of two doses of lycopene (1.1 or 3.3 mg/kg body weight per day) on liver inflammation in rats that were fed with or without alcohol for 11 weeks. Rats fed both alcohol and lycopene accumulated higher amounts of lycopene in the liver compared to rats that were fed the same dose of lycopene without alcohol. In addition, rats fed both the higher dose of lycopene and alcohol had higher amount of cytochrome p450E1 protein and tumor necrosis factor alpha, both of which are elevated with inflammation. Furthermore, these rats also had an increased number of inflammatory cells in the liver. Similar effects were not observed in animals that were fed the high dose of lycopene without alcohol. Our data indicate an interaction between excessive alcohol intake and high dose lycopene consumption and suggest a need for caution among individuals consuming high amounts of both alcohol and lycopene.


Xanthophylls are preferentially taken up by retinal cells via a SRBI-dependent mechanism

The purpose of this study was to investigate the mechanisms by which carotenoids (xanthophylls vs. β-carotene) are taken up by retinal pigment epithelial (RPE) cells. The human RPE cell line, ARPE-19, was used. When ARPE-19 cells were fully differentiated (7–9 weeks), the xanthophyll lutein and zeaxanthin were taken up by cells to an extent 2-fold higher than β-carotene (P<0.05). At 9 weeks, cellular uptakes were 1.6%, 2.5%, and 3.2%, respectively, for β-carotene, lutein and zeaxanthin. Similar extents were observed when carotenoids were delivered in either Tween 40 or "chylomicrons" produced by Caco-2 cells. Differentiated ARPE-19 cells did not exhibit any detectable β-carotene-15,15'-oxygenase activity or convert exogenous β-carotene into vitamin A. When using specific antibodies against the lipid transporters cluster determinant 36 (CD36) and scavenger receptor class B type I (SR-BI), cellular uptake of β-carotene and zeaxanthin were significantly decreased (40–60%) with anti-SR-BI, but not with anti-CD36. Small interfering RNA transfection for SR-BI led to marked knockdown of SR-BI protein
expression (~ 90%), which resulted in decreased \( \beta \)-carotene and zeaxanthin uptakes by 51% and 87%, respectively. Thus, the present data show that RPE cells preferentially take up xanthophylls versus \( \beta \)-carotene by a process that appears to be entirely SR-BI-dependent for zeaxanthin and partly so for \( \beta \)-carotene. This mechanism may explain, in part, the preferential accumulation of xanthophylls in the macula of the retina.

*During, A. et al., J. Lipid Res. 49:1715-24 (2008)*

**Aguaje, Amazon's Next Miracle Fruit?**

Once obscure Amazon fruits, like açai, are riding health claims to supermarket success. Could a scaly palm fruit be the rain forest's next popular export? In the rain forests of Peru's remote Pacaya-Samiria National Reserve, mothers don't make kids eat their carrots. Instead, kids munch on aguaje, a crisp, yellow fruit of *Mauritia flexulosa* palm tree, covered in maroon scales. It tastes a bit like a carrot, but packs three times the vitamin A punch. Oil high in provitamin A may be extracted from the pulp and is frequently used to treat burns because of its soothing qualities. The oil contains high concentrations of oleic acid, tocopherols and carotenoids, especially \( \beta \)-carotene. Aguaje is just one of more than a hundred wild and domesticated fruits available to people each year in this 8,000-square-mile chunk of protected Amazon wetland at the confluence of two rivers in northeastern Peru. And with so much variety and abundance, it's not surprising that these fruits form the centerpiece of the local diet. The reserve's 100,000 residents depend on them for many nutrients, like vitamins, protein, and oils that the rest of us normally get from a variety of other foods, including vegetables and nuts.

*National Geographic Magazine* (10/14/2008)

**Internet Addresses for Carotenoid Researchers**


2. Agricultural Research Service (ARS) prepared searchable database to view 60-nutrient profile (including carotenoids) for more than 13,000 foods: [www.ars.usda.gov/foodsearch](http://www.ars.usda.gov/foodsearch)


4. LIPID BANK for Web. Carotenoid Section of Lipid Database developed by Research Institute, International Medical Center of Japan, [http://lipidbank.jp](http://lipidbank.jp). Also available on ICS webpage: [www.carotenoidsociety.org](http://www.carotenoidsociety.org) through Articles button.

**National Geographic Magazine** (10/14/2008)