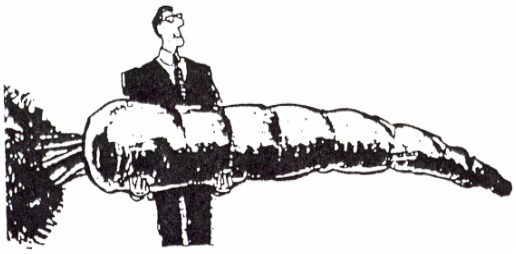

Carotenoid News

Vol. 15, No. 2
August 2005

FROM THE EDITOR

"You may prove anything by figures"
(Thomas Carlyle, 1795-1881)

This ironic remark of the famous XIX century historian, essayist and Rector of the University of Edinburgh, Scotland, still rings true in the XXI century, when we read sensational captions of press releases. A recent title[1] warned us that "**Lutein and zeaxanthin could increase heart attack risk**". Apparently the dietary intake and the levels of these two carotenoids in adipose tissue were positively associated with the risk of myocardial infarction in adult Costa Ricans[2], a population with a low intake of dietary supplements, but high prevalence of cardiovascular disease. However, the same study found an inverse association between β-carotene and the risk of heart attack. Should we avoid eating spinach and consume more carrots? Forget the prevention of macular degeneration and concentrate on guarding ourselves against heart attack? Journalists like to create melodramatic titles for their articles, but a popular presentation of scientific studies should inform and not confuse the public by bombarding it with overreaching conclusions, supposedly supported by statistics.

Turning back to Thomas Carlyle, he would have been happy that the International Carotenoid Society Symposium in Edinburgh (July 17-22, 2005) held a traditional Scottish dinner, complete with recitation of Robert Burns' poetry, which he extolled in his famous *"Essay on Burns"* (1829). You will find a report of this extraordinary Symposium, as well as the CARIG Conference in San Diego (April 2, 2005), and an abundance of other interesting news in this issue.

Maria S. Sapuntzakis (Chicago, IL)

[1] Lutein, zeaxanthin could increase heart attack risk. *NutraIngredients-USA*.com 7/13/2005

[2] Kabagambe EK, Furtado J, Baylin A, Campos H. Some dietary and adipose tissue carotenoids are associated with the risk of nonfatal acute myocardial infarction in Costa Rica. *J Nutr* 135:1763-9, 2005.

News from the CARIG Steering Committee

The annual meeting of the CARIG Steering Committee was held during EB '05 in San Diego, CA. Richard Allison, Executive Officer, American Society for Nutritional Sciences (ASNS), discussed CARIG's future affiliation with ASNS given the consolidation of ASNS, the American Society for Clinical Nutrition (ASCN), and the Society for International Nutrition Research (SINR) to form the American Society for Nutrition. The Steering Committee recommended CARIG also pursue formal affiliation with the International Carotenoid Society. The Committee thanked outgoing members Cheryl Rock and Noel Solomons for their service, and Noel for outstanding fundraising efforts. Wendy White agreed to continue as Chair and Harold Furr as Treasurer. John Landrum was elected Vice Chair in charge of fundraising. The Steering Committee welcomes newly elected members, Mark Failla and Cindy Schweitzer. The current membership of the CARIG Steering Committee includes:

Wendy White (Chair) – Iowa State University
John Landrum (Vice Chair) – Florida International University
Harold Furr (Treasurer) – Craft Technologies, Inc.
Maria Stacewicz-Sapuntzakis (Newsletter Editor and member *ex officio*) – University of Illinois, Chicago
Julie Mares (Chair, CARIG Conference 2006) – University of Wisconsin, Madison
Alexandrine During – USDA Human Nutrition Research Center, Beltsville
Mark Failla – Ohio State University
Elizabeth Johnson – Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University
Cindy Schweitzer – Cognis Corporation
Sherry Tanumihardjo – University of Wisconsin, Madison

The Committee thanked the organizers of this year's CARIG Conference, Julie Mares, Alexandrine During, Elizabeth Johnson, and Wendy White, for their contributions to a very successful meeting. (Please see the report below). The next issue of Carotenoid News will include the agenda for the CARIG Conference at EB 2006 in San Francisco, CA.

2005 CARIG Conference Report

The 2005 CARIG Conference focused on the following themes: 1) biological activities of carotenoid metabolites; 2) biofortification of staple crops with β-carotene and other micronutrients to combat malnutrition in developing countries; and 3) non-invasive approaches to measure carotenoids in the retina and other human tissues. Dr. Norman Krinsky (Tufts University) presented the James Allen Olson Memorial Perspectives on Carotenoids Lecture entitled "Carotenoid Metabolites and Their Biological Activity". Dr. Xiang-Dong Wang (Tufts University, USDA Human Nutrition Research Center on Aging) spoke on the topic "Carotenoids, Gene Regulation and Cancer Prevention". Dr. Penny Nestel, Nutrition Coordinator, HarvestPlus, presented "Breeding Crops to Alleviate Deficiencies of Vitamin A and Other Micronutrients". HarvestPlus is an interdisciplinary, international research collaboration funded in part by the Bill and Melinda Gates Foundation. A session entitled "Non-Invasive Methods for Measurement of Carotenoids in Tissues" was moderated by Dr. Susan Mayne (Yale University). Drs. Paul Bernstein (University of Utah) and Max Snodderly (Medical College of Georgia) presented state-of-the art approaches for *in vivo* carotenoid measurement. Dr. Bernstein's presentation was entitled "Measurement of Carotenoids in the Skin and Retina Using Raman Spectroscopy", and Dr. Snodderly talked about "Measurement of Carotenoids in the Retina Using Heterochromatic Flicker Photometry". Dr. Noel Solomons (Center for Studies of Sensory Impairment, Aging and Metabolism – CESSIAM) presented a tribute to our late, distinguished colleague, Dr. Clive West (Wageningen University), whose groundbreaking studies provide the foundation for much of our ongoing research. The Graduate Student Travel Award ($500) was presented to Fuzhi Lian (Tufts University) whose research is directed by Dr. Xiang-Dong Wang. The Conference Organizing Committee (Julie Mares, Alexandrine During, Elizabeth Johnson, Wendy White) would like to thank our sponsors: Wyeth Consumer Healthcare, BASF, Sight & Life, Kemin Foods LC, M&M Mars Inc, Craft Technologies Inc, General Mills Inc, The Procter & Gamble Co, Cognis Corporation.

Wendy White (Ames, IA)

CARIG Travel Awards

CARIG will award one or more $500 grants for travel to Experimental Biology 2006 in San Francisco, CA. The award will be based on the scientific merit of EB'06 abstracts submitted by graduate students who have not yet received a Ph.D. degree. Please send a copy of your abstract (in the EB 2006 format)

and a letter that briefly describes the significance of the research and your role in the research to: Wendy S. White, Ph.D., Department of Food Science and Human Nutrition, 1127 Human Nutritional Sciences Building, Iowa State University, Ames, IA 50011; FAX: 515 294-5390; E-mail (preferred): wswhite@iastate.edu. **The deadline for submitted abstracts is March 1, 2006**.

UPCOMING EVENTS

September 19-23, 2005
18th International Congress of Nutrition, Nutrition SAFARI 2005, Durban, South Africa. Contact: Nutrition Safari, PO Box 74576, Lynwood Ridge 0040, South Africa, **tel:** (27)12-3463866, **fax:** (27)12-4600378, **e-mail**: secretariat@ebsconsulting.co.za, **website**:www.puk.ac.za/iuns

October 30-November 2, 2005
4th American Association for Cancer Research International Conference, Frontiers in Cancer Prevention Research Baltimore, MD. Contact: Special Conference Registration, AACR, 615 Chestnut St, 17th floor, Philadelphia, PA 19106-4404, **tel:** 215-440-9300, **fax:** 215-351-9165, **website:** www.aacr.org

November 16-20, 2005
12th Annual Meeting of the Society for Free Radical Biology and Medicine, Austin, TX. Contact SFRBM by **tel:** 317-205-9482, **e-mail:** info@sfrbm.org

April 1-5, 2006
Experimental Biology 2006, San Francisco, CA
Contact: EB2005, FASEB Office of Scientific Meetings & Conferences, 9650 Rockville Pike, Bethesda MD 20814-3998, Website: www.faseb.org/meetings/eb2006

June 6-8, 2006
7th World Congress on the Processing Tomato, Tunisia. Contact: Sophie Colvine, **tel/fax**: 44-1387-820322, **email:** colvine@tomate.org

RECENT / FORTHCOMING PUBLICATIONS

Sight and Life Newsletter 1/2005 and 2/2005, publication of the Task Force SIGHT AND LIFE, PO Box 2116, 4002 Basel, Switzerland, **web:** www.sightandlife.org, **tel:** 41-61-688-7494, **fax**: 41-61-688-1910, See especially:

Burri BJ & Clifford AJ. β-Carotene metabolism measured by accelerator mass spectrometry.
Green MH & Green JB. Contribution of mathematical modeling to understanding whole-body vitamin A metabolism and to the assessment of vitamin A status.
Krinsky NI. The biological activity of carotenoid metabolism.
Solomons NW. Report from the 2005 annual CARIG Conference in San Diego.

Carotenoids and Dietary Lipids. Special issue of *Biochemica et Biophysica Acta*, *Molecular Basis of Disease*. 1740 (2) 2005. Proceedings of DLARFID Conference, Cracow, December 9-12, 2004, ed. A Dembinska-Kiec, which was reported in two previous issues of *Carotenoid News, 14 (2), 15(1).* Contains 20 minireviews and research articles on Carotenoids.

Promises and Perils of Lycopene/Tomato Supplementation and Cancer Prevention. *J Nutr 135(8S):2014S-2074S.* Proceedings of conference held February 17-18, 2005 in Bethesda, MD, containing executive summary report of the discussion and 15 articles.

Alphabetical Listing of Recent Publications

Prepared by Dr. Harold Furr, Craft Technologies, Inc.
More extensive list may found at www.carotenoidsociety.org

Anonymous (2005) β-Carotene supplements pose risks. *Health News* 11: 15.

Ablin, R. J. (2005) Lycopene: a word of caution. *Am.J.Health Syst.Pharm.* 62: 899.

Actis-Goretta, L., Carrasquedo, F., & Fraga, C. G. (2004) The regular supplementation with an antioxidant mixture decreases oxidative stress in healthy humans. Gender effect. *Clin.Chim.Acta* 349: 97-103.

Adom, K. K., Sorrells, M. E., & Liu, R. H. (2005) Phytochemicals and antioxidant activity of milled fractions of different wheat varieties. *J.Agric.Food Chem*. 53: 2297-2306.

Aguilo, A., Tauler, P., Fuentespina, E., Tur, J. A., Cordova, A., & Pons, A. (2005) Antioxidant response to oxidative stress induced by exhaustive exercise. *Physiol Behav*. 84: 1-7.

Ahmad, M. S., Sheeba, & Afzal, M. (2004) Amelioration of genotoxic damage by certain phytoproducts in human lymphocyte cultures. *Chem.Biol.Interact*. 149: 107-115.

Ahmadi, A. J., Saari, J. C., Mozaffarian, D., Garwin, G. G., Tarbet, K. J., Orcutt, J. C., Hargiss, J. L., & Sires, B. S. (2005) Decreased carotenoid content in preaponeurotic orbital fat of patients with involutional ptosis. *Ophthal.Plast.Reconstr.Surg.* 21: 46-51.

Ahmed, S. S., Lott, M. N., & Marcus, D. M. (2005) The macular xanthophylls. *Surv.Ophthalmol.* 50: 183-193.

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Aman, R., Carle, R., Conrad, J., Beifuss, U., & Schieber, A. (2005) Isolation of carotenoids from plant materials and dietary supplements by high-speed counter-current chromatography. *J.Chromatogr.A* 1074: 99-105.

Andersen, L. F., Veierod, M. B., Johansson, L., Sakhi, A., Solvoll, K., & Drevon, C. A. (2005) Evaluation of three dietary assessment methods and serum biomarkers as measures of fruit and vegetable intake, using the method of triads. *Br.J.Nutr.* 93: 519-527.

Andreeva, A. & Velitchkova, M. (2005) Resonance Raman spectroscopy of carotenoids in Photosystem I particles. *Biophys.Chem.* 114: 129-135.

Ansari, M. S. & Gupta, N. P. (2004) Lycopene: a novel drug therapy in hormone refractory metastatic prostate cancer. *Urol.Oncol.* 22: 415-420.

Ansari, M. S. & Sgupta, N. P. (2005) A comparison of lycopene and orchidectomy vs orchidectomy alone in the management of advanced prostate cancer. *BJU.Int.* 95: 453.

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Azevedo-Meleiro, C. H. & Rodriguez-Amaya, D. B. (2005) Carotenoids of endive and New Zealand spinach as affected by maturity, season and minimal processing. *J.Food Composition and Analysis* 18: 845-855.

Badyaev, A. V. & Young, R. L. (2004) Complexity and integration in sexual ornamentation: an example with carotenoid and melanin plumage pigmentation. *J.Evol.Biol.* 17: 1317-1327.

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Ballottari, M., Govoni, C., Caffarri, S., & Morosinotto, T. (2004) Stoichiometry of LHCI antenna polypeptides and characterization of gap and linker pigments in higher plants Photosystem I. *Eur.J.Biochem.* 271: 4659-4665.

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Bando, N., Yamamoto, M., Yamanishi, R., & Terao, J. (2004) Synergistic effect of vitamin E and β-carotene on the suppression of ovalbumin-specific immunoglobulin E production in mice. *Ann.N.Y.Acad.Sci.* 1031:415-7.: 415-417.

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Bartlett, H. & Eperjesi, F. (2005) Possible contraindications and adverse reactions associated with the use of ocular nutritional supplements. *Ophthalmic Physiol Opt.* 25: 179-194.

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MEETING REPORT

14th International Symposium on Carotenoids, Edinburgh, Scotland, July 17-22 2005.

Edinburgh in high summer is a good place to be: long days, bright sunlight, fresh, clean air and many attractions in the city. But the attraction that drew more than 270 people from about 40 countries to Edinburgh in July 2005 was the 14th International Symposium on Carotenoids, held in the impressive Edinburgh International Conference Centre. The highly professional staff there, always efficient, courteous and helpful, ensured that everything ran smoothly and enhanced the special friendly relaxed atmosphere that we've come to expect when the carotenoid family gathers together. In many ways the Symposium followed the established pattern - Sunday evening Welcome Reception and scientific sessions Monday to Friday - but with a hint of local tradition in the social events. The Tuesday evening whisky tasting experience was well attended and much appreciated and, surprisingly, didn't greatly affect the size or state of the audience for the Wednesday morning session. The Scottish-themed Symposium Dinner, complete with piper, haggis and the unintelligible words of Robbie Burns, was quite an event and was followed by Scottish dancing to a Ceilidh band, which prompted many of us who should have known better, to make fools of ourselves on the dance floor. Everybody joined in and had a great time. At the banquet, as his last official act as outgoing President of the International Carotenoid Society, Harry Frank presented George Britton with the President's Outstanding Service Award "In appreciation for exceptional service and dedication to the principles and scholarship of the International Carotenoid Society". A strike of

bus drivers on Monday morning deprived us of most local transport, but everyone found their way in from their hotels scattered around the city, and the 300-seat auditorium was full for the opening and the first session, on Carotenoids and Skin Protection, with Helmut Sies, Peter Schroeder and Regina Goralczyk as invited speakers. After this session, two International Carotenoid Society Awards were presented, the Trevor Goodwin Award for achievement in research on carotenoid biochemistry and a lifetime of dedicated service to the carotenoid field to Norman Krinsky, and the Otto Isler Award for a lifetime of achievement in research on carotenoid chemistry and of dedicated service to the carotenoid field to Synnove Liaaen-Jensen. Sadly, Norman could not be with us, but his award was presented to him later. Health and nutrition were well served in the programme, with sessions on Eye Health, Cancer, and other aspects of human health, and invited lectures by Fred Khachik and Aldona Dembinska-Kiec. Work from different experimental approaches was presented, with molecular studies very much to the fore. A session on Nutrition and Conversion into Vitamin A was dedicated to the memory of Clive West, and it was a fitting tribute that two of his former students, Machteld van Lieshout and Carolien Bouwman, presented their work and treated us to some of their personal memories of Clive and his achievements. Other sessions reported progress in the areas of Photosynthesis and Photochemistry (invited speakers Alexander Ruban and Hideki Hashimoto), Biosynthesis, Commercial Production and Applications (invited speakers Alan Mortensen and Eiji Yamashita) and Chemistry, and generated lively discussion and interactions. Some special sessions introduced new or unusual themes, particularly with an interdisciplinary approach. A session on Oxidation and Breakdown Products explored a number of different aspects, including chemistry (invited lecture by Catherine Caris-Veyrat), significance in health (invited talk by Werner Siems) and the value of carotenoid breakdown products in flower scents and perfumes. Roman Kaiser illustrated his very entertaining lecture with examples of carotenoid-derived perfumes distributed around the audience - a first for our Symposia. Another interdisciplinary session covered the natural states and physical interactions of carotenoids *in vivo* in relation to applications and functioning. Carotenoids are extremely important in nature for colour and as behavioural signals. An invited talk by Jon Blount introduced a session on this expanding theme. Most of us find physical chemistry daunting, but Tom Moore and Bob Birge treated us to two fascinating and imaginative lectures to illustrate a new direction for the carotenoid field and the potential application of carotenoids and retinoids in the world of information technology. Besides the invited lectures, about 65 contributed talks and 140 posters were presented, attesting to the health and strength of the carotenoid field. Congratulations to four young researchers, Marc David Grynbaum (Germany), Thais Guaratini (Brazil), Nicole Tillinger (Austria), and Tokutake Sashima (Japan), who will each receive a copy of the Carotenoids Handbook as a prize for best poster presentation.

We would like to thank again all speakers, poster presenters and all participants for their contributions to the success of the meeting and say a special word of thanks to all those who were cajoled, often at very short notice, into agreeing to chair sessions and who universally did a great job keeping sessions running smoothly and timely, leading, stimulating and, when necessary, controlling discussions. We are also extremely grateful to all our sponsors, without whose generous contributions the symposium could not have taken place. Full page abstracts of all presentations have been collected in a special edition of *Carotenoid Science* (thanks to Hideki Hashimoto and the Japanese Society for Carotenoid Research) and the texts of invited lectures will be published, as usual, in *Pure and Applied Chemistry* (Symposium Editors: Richard Cogdell and Peter Bramley); details of how to order will appear in due course on the Society website. We now look forward to seeing you at the 15th International Symposium on Carotenoids, in Okinawa, Japan in 2008.

George Britton, (Liverpool, UK)
Harry Frank, (Storrs, CT)

TECHNICAL NOTES

Approval of Method for β-Carotene as an AOAC(R) Official Method(SM)

AOAC INTERNATIONAL is pleased to announce the approval as an AOAC Official First Action a method for the analysis of dietary supplements for β-carotene. The method was developed under an AOAC/NIH, Office of Dietary Supplement Program/FDA contract.

An Expert Review Panel (ERP) selected the method, which was originally developed by J.Schierle, J.Klipfel and B.Pietsch at DSM. The ERP for β-carotene was chaired by Ed Waysek of Caravan Products, Inc. and composed of five experts from government (FDA), industry, and academia. Subsequently, J. Schierle and his group submitted the method for Single Laboratory Validation (SLV), and the results of the study were found, under peer review, to be acceptable and to justify proceeding to a full collaborative study. The SLV study was published in the *Journal of AOAC INTERNATIONAL* (*J.AOAC Int. 87 (5), 1070-82, 2004*).

An international collaborative study, led by J.Szpylka and J.DeVries of Medallion Laboratories, General Mills, was conducted. The study included 12 laboratories in 4 countries; 11 of the laboratories successfully completed the study. The method involves an enzyme digestion followed by extraction with ethanol:dichloromethane, and determination by reversed phase HPLC with a visible light absorbance detector. The method is applicable to a wide range of supplement types (13 were included in the study), including vitamin tablets, softgels and capsules, and measures trans-β-carotene as well as total β-carotene. The results of the study will be published in the Sept.-Oct. issue of the *J. AOAC Int*. The method performance on a beadletted raw ingredient was found to be unsatisfactory, because of the inhomogeneity of the beadlets themselves. Because other carotenoids are also protected from oxidation through the beadletting process, AOAC has initiated a study, led by J. DeVries of General Mills, to examine this problem and develop techniques for handling dietary supplements containing such beadlets.

AOAC is now looking for analytical methods for **Lycopene** and **Lutein** in dietary supplements, applicable to the raw material as well as the processed product. If you are aware of, or are using a method which is applicable to this dietary supplement ingredient, please contact Al Pohland at 301-924-7077 x123 apohland@aoac.org or Mai Nguyen at 301-924-7077 x145 mnguyen@aoac.org.

NEWS AND VIEWS

Role of Scavenger Receptors in Intestinal Absorption of Carotenoids

Recent experiments with knockout mice indicate that brush border membrane-resident class B scavenger receptors (SR-BI and CD 36) can facilitate the absorption of β-carotene and cholesterol[1]. Other experiments, using Caco-2 TC-7 cell monolayers as a model for lumen intestinal epithelium, suggest that lutein absorption is, at least partly, protein mediated and proceeds through SR-BI, which are also expressed in this cell line[2]. These results bring us closer to the exploration of long-unresolved issue of carotenoid absorption, so variable within and between animal species.

[1]van Bennekeem et al. Biochemistry 44:4517-25, 2005
[2]Rebaul E, et al. Biochem. J. 387:455-61, 2005

Organic Ketchup Contains More Lycopene

Organic varieties of tomato ketchup contain three times as much of a cancer-fighting chemical called lycopene as non-organic brands. In the US, tomato ketchup comes in purple and green varieties as well as the traditional red. Betty Ishida and Mary Chapman at the Agricultural Research Service in Albany, California, wondered if the colouring might be indicative of low levels of lycopene, the pigment that makes tomatoes red. Lycopene has been shown to help protect against breast, pancreatic, prostate and intestinal cancer, especially when eaten with fatty foods. There is also evidence that lycopene can reduce the risk of heart attacks. The researchers tested lycopene levels and antioxidant activity in 13 ketchup brands: 6 popular ones, 3 organic, 2 store brands and 2 from fast-food chains. Purple and green ketchups had similar lycopene content to their plain red counterparts. But organic ketchups excelled, with one brand containing 183 µg of lycopene per gram of ketchup, about 5 times as much per weight as a tomato. Non-organic brands averaged 100 µg/g, with one fast-food sample containing just 60 µg/g. If you want high lycopene levels, says Ishida, the rule of thumb is to pick the darkest red ketchup.

New Scientist, January 9, 2005

Increased Astaxanthin Demand

Astaxanthin has been popular in Japan for quite some time, but in the US it is the newest carotenoid and is only just beginning to gain consumer attention. Astaxanthin is produced by the *Haematacoccus pluvialis* algae, when water supplies in its habitat dry up to protect itself against the effects of UV radiation. The structure is similar to lutein and zeaxanthin, but there are indications that it has an even stronger antioxidant activity. Fuji Health Science, the US subsidiary of Japan's Fuji Chemical Industry Co, announced last week that its AstaREAL biomass astaxanthin, produced at its facility in Gustavsberg, Sweden, is now registered as a new dietary ingredient (NDI) for use in dietary supplements in the US. The Swedish powder, standardized to 3.8% astaxanthin, joins Fuji's Hawaiian-produced astaxanthin extract (a 10% standardized oil). Fuji is not the only company seeking to address America's enthusiasm for astaxanthin, however. Last month Valensa International's Zanthin astaxanthin, also a 10% extract, was notified as a NDI. Valensa (formerly US Nutra) said that Zanthin is the only supercritical carbon dioxide extract of natural astaxanthin approved for sale and use as a dietary supplement in both the US and the EU. While Valensa holds both US and world patents for the use of astaxanthin in retarding and ameliorating central nervous system and eye damage, Fuji has world patents for its use in physical and muscle endurance, gastric health, fertility and for the immune system disorder Crohn's disease. Fuji also has a patent pending for eye fatigue and visual acuity.
NutraIngredients-USA.com, July 26, 2005

β-Cryptoxanthin from Citrus Fruits May Fight Polyarthritis

Increasing intake of the carotenoid β-cryptoxanthin, found in citrus fruits, may reduce the risk of developing inflammatory disorders such as rheumatoid arthritis, report UK researchers. Prior studies have suggested that the antioxidant potential of dietary carotenoids may protect against the oxidative damage that can result in inflammation. A team from the University of Manchester and the University of Cambridge in the UK analyzed data from the European Prospective Investigation of Cancer Incidence (EPIC)-Norfolk study, a study of more than 25,000 subjects who completed a baseline 7-day diet diary. They were followed to identify new cases of inflammatory polyarthritis, which was defined as synovitis that affected at least two or more joint groups. The average daily intake of β-cryptoxanthin was 40% lower in those who developed the condition than the 176 controls, while zeaxanthin intake was 20% lower, write the researchers in this month's issue of the *American Journal of Clinical Nutrition* 82 (2): 451-455. People in the top one-third of β-cryptoxanthin intake were almost half as likely to develop the condition as those in the lowest third, and this association was still significant after adjustments were made for total energy and protein intakes, and for cigarette smoking. "These data are consistent with previous evidence showing that a modest increase in β-cryptoxanthin intake, equivalent to one glass of freshly squeezed orange juice per day, is associated with a reduced risk of developing inflammatory disorders such as rheumatoid arthritis" conclude the researchers. Rheumatoid arthritis affects one in 100 people in the UK. In 2003, researchers using data from the Iowa Women's Health study found that women who consumed less than 40 µg of β-cryptoxanthin were at a slightly higher risk of developing rheumatoid arthritis than women who consumed more than that amount.

NutraIngredients-USA.com, August 9, 2005

Internet Addresses for Carotenoid Researchers

1. USDA Nutrient Database for Standard Reference (SR17) is a major source of food composition data for epidemiologists and nutritionists. Carotenoid Food Database contains best available estimates of carotenoid content in foods: www.nal.usda.gov/fnic/foodcomp/Data/car98/car98.html

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

3. 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.

4. International Carotenoid Society (ICS) Webpage: www.carotenoidsociety.org. Anyone wishing to join the society and be listed in the web directory, please contact Hideki Hashimoto at hassy@sci.osaka-cu.ac.jp

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

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

Published twice a year, in February and August by **CAROTENOID RESEARCH INTERACTIVE GROUP (CARIG)**

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