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NEWSLETTER

EUROCAROTEN

EUROPEAN NETWORK TO ADVANCE CAROTENOID RESEARCH AND APPLICATIONS IN AGRO-FOOD AND HEALTH

WELCOME

We are pleased to welcome you to the 15th issue of the EUROCAROTEN newsletter.

In this issue read about EUROCAROTEN's Training School " Functional and omics analysis of carotenoid interventions held in February 2020 in Palma de Mallorca, Spain.

Also, in this issue, we would like to introduce you to Elisabeth Johnson, Research Associate Professor at Tufts University, USA.

Check out STSM experience report by Gabriella Dono and read about our carotenoid of the month – neoxanthin. Also, find out about microalgae as a novel source of carotenoids.

In "Think Tank Information" rubric, read about experience of being ECI spokesperson within EUROCAROTEN by Kristina Kljak, and in "Working Group News" rubric, find out summarized progress report of WG2, Quality along the food chain, given by Prof. Nora O'Brian.

Also, you can find more information about EUROCAROTEN COST Action on its COST website http://www.cost.eu/COST_Actions/ca/CA15136 and on our website www.eurocaroten.eu.

Yours sincerely,
Anisa Peçuli,
Ng'andwe Kalungwana,
Kristina Kljak

Subscription to the e-mailing list is available via the EUROCAROTEN website.

Send your comments and proposals to info@eurocaroten.eu.

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NEWS FROM THE ACTION

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CONTRIBUTION FROM THE ACTION & FINISHED STSMs

SPECIAL ISSUE OF FOODS "NATURAL CAROTENOIDS AS FUNCTIONAL FOOD INGREDIENTS"

Dr. Mantzouridou Fani and Dr. Stella Ordoudi (Aristotle University of Thessaloniki , Greece) will be guest editors of special issue "Natural Carotenoids as Functional Food Ingredients" of Foods. Deadline for article submission is 1st October 2020. For more information visit http://www.mdpi.com/journal/foods

A NOTE FROM GUEST EDITORS:

As the Guest Editors of a Special Issue of Foods, we expect to gather interdisciplinary research about carotenoids/apocarotenoids, highlighting the potential for novel applications in foods. In particular, we encourage the submission of manuscripts on new sustainable sources and/or technologies of carotenoid production and stabilization, development of up-to-date analytical methods for identification and quantification in raw and processed foods, human uptake processes (bioaccessibility/bioavailability), and mechanistic pathways of health-promoting effects. The design and application of effective delivery systems into the food matrix (novel emulsions/nanoemulsions, coated particles) are also welcome.

FINISHED STSMs

DEVELOPING A TANGERINE SAN MARZANO TOMATO LINE WITH INTROGRESSIONS BREEDING AND GENOME EDITING

Grant Holder

Gabriella Dono, University of Tuscia, Italy

Period

1st September – 30th November 2019

Host Institution

Institute for Molecular and Cellular Plant Biology (IBMCP), Spain

NEWS FROM THE ACTION
PAST EVENTS

EUROCAROTEN TRAINING SCHOOL: FUNCTIONAL AND OMICS ANALYSIS OF CAROTENOID INTERVENTIONS

UIB, Mallorca, Balearic Islands, Spain

10th – 14th February 2020

Organisation

- Joan Ribot and M. Luisa Bonet, University of Balearic Islands (UIB) - Centro de Investigación Biomédica en Red-Fisiopatología de la Obesidad y Nutrición (CIBERobn) - l'Institut d'Investigació Sanitària de les Illes Balears (IdISBa), Palma de Mallorca, Spain
- Jaap Keijer and Evert van Schothorst, Wageningen University & Research (WUR), Wageningen, Netherlands

Venue: University of Balearic Islands, Palma de Mallorca, Spain

In total, 20 young researchers from 10 countries participated at Training School: Functional and omics analysis of carotenoid interventions, held in February 2020 in Palma de Mallorca. The ECIs (Early Career Investigators) and PhD students highly appreciated given the opportunity to attend this event.

Training school started with the introductory lecture by Dr Ana M. Rodríguez, the Director of the Doctoral School of the UIB, and Dr Joan Ribot, and opening lecture “Health claims and nutritional information” by Prof Andreu Palou. Next day started with presentation of a definition of basic terms in experiments by Dr Joan Ribot, and participants were afterwards divided into working groups with a task to prepare project proposal presentation with carotenoid product and health effect of their choosing. Participants worked on their proposals each day of Training School and were tutored by organizers, lecturers and ECIs from University of Balearic Islands, Sebastià Galmés and Bárbara Reynés. Lectures followed topics related to animal models and cell cultures in designing experiments and were given by Prof M. Luisa Bonet, Teresa de Francisco (UIB), Dr Jean François (C2VN, AMU, France), Dr Priam Villalonga (UIB). Doctoral students at UIB, Catalina A. Pomar and Pedro Castillo, presented animals facilities and routinely procedures in animal-based models during an experiment at UIB. The last day of lectures was reserved for topics related to omics, biomarkers and intervention studies, and they were given by Dr Evert van Schothorst (WUR), Dr Paula Oliver (UIB) and Dr Begoña Olmedilla Alonso (ICTAN, Spain).

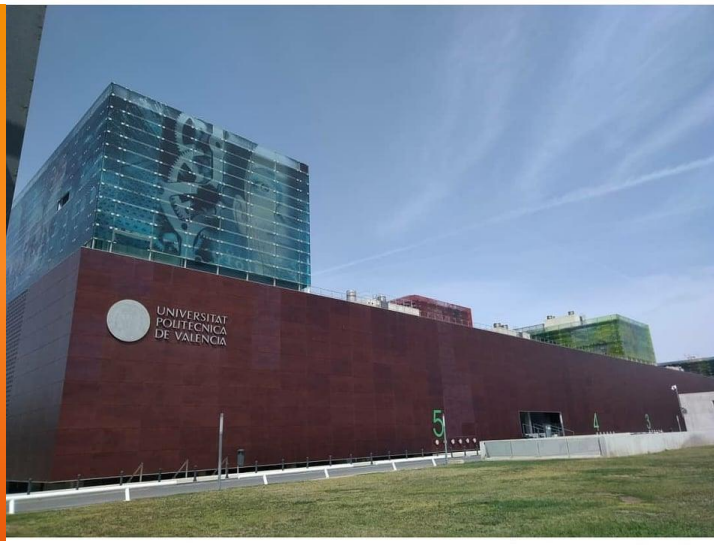
The last day of the Training School, working groups of participants presented their project proposals and discussed them with other participants and tutors Dr Evert van Schothorst, Prof. M. Luisa Bonet, Joana Sánchez (UIB) and Dr. Ana M. Rodríguez. Participants presented interesting topics and approaches to test different applications of carotenoids or their sources in disease prevention and recovery. As a special added value of the training school, all participants of training school had the opportunity to network with each other and socialize during breaks or meals

FINISHED STSM'S
EXPERIENCE REPORT

Gabriella Dono

CHARACTERIZATION OF AN EDITED TANGERINE LINE IN SAN MARZANO ITALIAN TRADITIONAL VARIETY

Affiliation	University of Tuscia, Viterbo, Italy
Position	PhD student
Host Institution	Universitat Politècnica de Valencia, IBMCP department, Valencia, Spain
E-mail	gabriella.dono91@hotmail.it



Thanks to the Cost Action CA15136, I was able to spend three months at the Istituto de Biologìa Molecular y Celular le Plantas, which showed to be a great way to continue with a scientific collaboration which started three years ago with my visit through Erasmus. Furthermore, it offered opportunities to achieve scientific and technical knowledge from the research experts of the institutions, to improve my PhD research.

Our main aim was to improve the nutritional content of San Marzano (SM), which is a traditional Italian landrace widely cultivated in the Agro Sarnese Nocerino region (Italy) and used as preferred variety for peeling. It has acquired worldwide popularity for its outstanding agronomic, technological and organoleptic qualities. We were interested in studying the effect of introducing the tangerine type on the carotenoid profile of this variety. To do this, we made use of the CRISPR-Cas9 technology that I had the possibility to learn at the host department. This COST STSM provided the best tool to achieve our research goal; we have obtained satisfactory results which will be part of my PhD thesis, published in future scientific papers and that have been already presented at scientific conferences.

I would like to thank Prof. Antonio Granell and Dr. Josè Luis Rambla for their willingness to receive me, a pleasant stay and shared knowledge. I believe this STSM was an added step to achieve research goals and the basis to a stronger collaboration between these two complementary teams to cooperate and exchange their knowledge.

In addition to professional experience, I believe that every young researcher should open up new opportunities for study and comparison outside his own borders, guaranteeing continuous personal growth.

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EUROCAROTEN INTERVIEW

TALKING WITH:

Elizabeth (Liz) J. Johnson

Affiliation	Friedman School of Nutrition Science and Policy, Tufts University
Position	Research Associate Professor
Country	USA
Area of Interest	phytonutrients, carotenoids, healthy aging, cognitive health, visual health

Please tell us a bit about your lab and what you work on?

Our research interests recognize a role for carotenoids contained in whole foods, with the understanding that bioactives work together for optimal biological effects. Therefore, a major focus of our research has involved intervention trials and meta-analyses of carotenoid-containing foods and health outcomes

In general terms, which area of the carotenoids do you find most interesting?

I find that the role that lutein and zeaxanthin may have in neural (eye, brain) health particularly compelling. To the exclusion of the hundreds of other carotenoids they are selectively taken up into neural tissue. However, they are not considered to be essential despite the strong evidence that has accumulated to point to a role in human health. Given this, there may be a need to consider recommended levels for these bioactives.

From your point of view, what are the greatest impacts that the study of the carotenoids has on society?

The recognition that components of the plant foods we eat have positive biological effects. Not only are some carotenoids significant sources of vitamin A for many global communities, but the science strongly suggests that intake of carotenoids is related to health benefits for the brain, heart, bone, liver – the whole body.

What would you say to encourage a young student who is considering undertaking a career in carotenoid research?

Research needs to look towards where the problems lie. What are the major public health issues and how can dietary carotenoids contribute to these? What is the compelling evidence (from the basic science to the epidemiology) to support this?

In your eyes, how can the EUROCAROTEN COST Action contribute to carotenoid research and how beneficiary was for you being part of this action?

The most important lies in previous question. Carotenoid Research needs to endure. These are bioactive components of our diet that have positive biological effects that relate to major public health issues. There is a need to provide the evidence that supports and communicates this.

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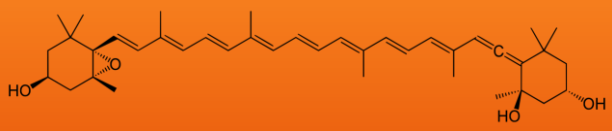
CAROTENOIDS IN OUR DAILY LIFE

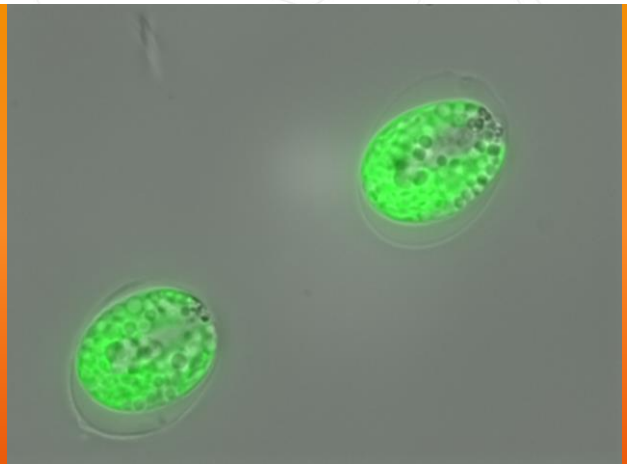
CAROTENOID OF THE MONTH

Name: Neoxanthin

Chemical Formula: $C_{40}H_{56}O_4$

Molecular Weight: 600.9 g/mol





NEOXANTHIN

Neoxanthin is a carotenoid which contains three hydroxyl and one epoxide functional group and belongs to the xanthophylls. Two forms of this carotenoid can be presented, all-trans and 9'-cis isomer. Contrary to the other carotenoids, neoxanthin is presented almost exclusively as the 9'-cis isomer.

It is an intermediate in the biosynthesis of the abscisic acid, a plant hormone, responsible for the adaptation and survival of the plants after their exposure to the stressful conditions.

Neoxanthin can be found in oranges, apples and red peppers apart from being a major carotenoid in green leafy vegetables. It plays a significant role in the photooxidative stress protection, because it is one of the carotenoids that typically accompanies the chlorophylls, in the chloroplast transferring energy towards chlorophyll b.

Although it is not efficiently absorbed in humans, neoxanthin has been shown to exhibit anti-proliferative and apoptotic functions. Additionally, neoxanthin has been reported to exhibit antioxidant capacity *in vitro*.

Text by Elena Mirtsi, PhD student at Agricultural University of Athens, Greece

E-mail: mir.elena@windowslive.com

MICROALGAE AS A NOVEL SOURCE OF CAROTENOIDS

In a growing population with increased life expectancies, the demand for sustainable food with high nutritional value or pharmaceutical properties is increasing. Microalgae can meet this need, as they are rich in high value proteins, omega-3 polyunsaturated fatty acids, minerals, carotenoids and other bioactive compounds with obvious benefits to human health.

Therefore, microalgae are considered to be an innovative and promising novel source of food, food ingredients or nutraceutical compounds such as carotenoids. The large-scale production of microalgae like the highly salt tolerant *Dunaliella* and the blood-red *Haematococcus* are long used in the industrial production of β-carotene (i.e., provitamin A) and astaxanthin (a feed ingredient used to impart colour to salmon), respectively.

However, there are other microalgal species entering the market such as *Tisochrysis* for fucoxanthin, *Chlorella* for lutein or *Chlorococcum* for astaxanthin. Interestingly, the production of carotenoids by microalgae can be upregulated by environmental cues — e.g., nutrient availability, temperature, salinity and/or light intensity. Under these conditions, microalgae can turn from green into red or orange, depending on the carotenoid produced. Because of this, products of microalgae on the market are versatile in colour and form, ranging from extracted carotenoids in powder sold in pills and tablets to the direct consumption of microalgal biomass.

Text by Lisa Schüler, PhD student, Universidade do Algarve, Portugal

E-mail: lmschueler@ualg.pt

THINK TANK INFORMATION

MY EXPERIENCE AS AN ECI SPOKESPERSON BY KRISTINA KLJAK

How did you become an ECI spokesperson within EUROCAROTEN?

EUROCAROTEN chair Dr Antonio J. Meléndez-Martínez invited me to participate in this Action during proposal preparing. Although I knew about COST, the invitation encouraged me to find about more about projects within COST. As to a young researcher, networking was very important to me, and I happily participated. After project was granted, I became one of two representatives of Croatia in Management Committee of EUROCAROTEN, and Dr Meléndez-Martínez invited me to be an ECIs spokesperson. That is a 4-year position and I am a member of the Think Tank Committee with two additional Think Tank representatives who are selected every grant period.

What are your tasks as ECIs spokesperson?

As a part of the Think Tank Committee, the primary purpose of ECI spokesperson is an intermediary role between the ECIs and the EUROCAROTEN Committees. In that regard, I disseminate information relevant to ECIs through social media and Newsletter, and communicate with young researchers in the field of carotenoids, in general. I coordinate activities of Think Thank, and majority of these activities are related to preparation of Newsletter or administration of social media. Since material used for these dissemination tools covers any information relevant to carotenoids or this Action, I communicate with scientists from and outside EUROCAROTEN. Additionally, I was a part of different Committees within EUROCAROTEN, so I also participated in decision-making activities.

What advantages of this position have you experienced?

Although this position requires dedication, there are several advantages that are worth its while. Some of them like networking or participation at training schools or STSMs are because I am an ECI participant of the Action. In that regard, I would point out networking since it enabled my participation in future projects that have been submitted recently. And there is also networking with other young researchers, in sharing knowledge and experience, but also in socializing. Some of them became my friends and I will be in contact with them after this Action ends. The other advantages related to the position are in developing skills – in communication, preparation of newsletter or social media, or presenting activities of your team.

What would you recommend young scientist joining COST Action?

I encourage all young researchers to participate in COST Action since networking could be beneficial for further research. Furthermore, participate in as much as possible activities organized within Action; STSMs, workshops and training schools are excellent for development of research skills, and participation at conferences are an ideal place to present your work so far. But I have to point out that young researcher does not have to be part of specific Action to use its tools; as long as they work in the field of Action, they can apply.

THINK TANK
OF EARLY CAREER INVESTIGATORS AND OTHER YOUNG RESEARCHERS

Representatives for 4th grant period:

Anisa Peçuli
apeculi@ubt.edu.al

Ng'andwe Kalungwana
fsnak@leeds.ac.uk

ECI spokesperson:

Kristina Kljak
kkljak@agr.hr

WORKING GROUP NEWS

At the final meeting of COST Action EUROCAROTEN held in November 2019, in Lemesos, Cyprus, Anamarija Mandić presented an overview of WG2 progress so far, and Nora O'Brien summarized it for this rubric of the newsletter.

During the WG2 meeting the following tasks were discussed

(a) harmonization of key protocols,
(b) inter-laboratory comparisons,
(c) developing and sharing of databases,
(d) identification of knowledge gaps and establishment of roadmaps, and
(e) maximizing EUROCAROTEN impact through communication.

The first task, harmonisation of key protocols, is complete.

Inter-laboratory comparisons on analysis of carotenoids in freeze dried blanched spinach and lyophilized egg yolk has commenced and results will be collected until the end of March 2020.

Maria Graça Dias updated the group on the European food carotenoid database. Data checking, quality evaluation is ongoing, and finalisation of the database is planned for Summer 2020.

Progress on the 2 reviews was discussed. While the first review on carotenoids in foods and feeds is complete and will be submitted shortly, the second review, on possible applications of carotenoids in functional foods and nutraceuticals and safety aspects, is 75% complete and will be finalised in Spring 2020.

The E-questionnaire for high school children is currently being translated into a number of European languages and will be distributed to schools in Spring 2020.

WG leader: Nora O'Brien (nob@ucc.ie)

WG vice-leader: Anamarija Mandić (anamarija.mandic@fins.uns.ac.rs)

ACKNOWLEDGEMENTS

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Gabriella Dono who have kindly given her testimony.

Elizabeth (Liz) J. Johnson for her contribution to our EUROCAROTEN Interview.

Elena Mirtsi and Lisa Schüler for their contribution to our "Carotenoids In Our Daily Life" rubric.

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NEWSLETTER CONTRIBUTORS

Editors:

Antonio J. Meléndez-Martínez (ajmelendez@us.es)
Kristina Kljak (kkljak@agr.hr)
Anisa Peçuli (apeculi@ubt.edu.al)
Ng'andwe Kalungwana (fsnak@leeds.ac.uk)

Dissemination:

Anneli Ritala (anneli.ritala@vtt.fi)
George Manganaris (george.manganaris@cut.ac.cy)
Cristina Luisa Silva (clsilva@porto.ucp.pt)
Mladen Brncic (mbrncic@pbf.hr)

Design and Layout:

Miguel Braga (miguel.braga@brag.pt)