



N°13, August 2019

# NEWSLETTER



## EUROCAROTEN

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

### WELCOME

**We are pleased to welcome you to the 13<sup>th</sup> issue of the EUROCAROTEN newsletter.**

In this issue, dedicated to Johannes Roob, read about upcoming EUROCAROTEN's International Conference on Carotenoid Research and Applications in Agro-food and Health, which will be held in November 2019 in Lemesos, Cyprus.

Have a look on the "News from the Action" rubric to find finished STSMs during the last period and read "STSM experience report" by Nedeljka Spasevski, Milana Rošul and Nataša Đerić.

Read about our carotenoid of the month – phenicoxanthin and about the crucial role of zeaxanthin for plant tolerance to excess light.

In "Think Tank Information" rubric, check recent publications by EUROCAROTEN ECIs Sanja Krstić, Ludmila Bogacz-Radomska and Paula Mapelli Brahm while in "Working Group News" rubric, find out about EUROCAROTEN YouTube channel and first videos posted.

Also, you can find more information about EUROCAROTEN COST Action on its COST website [http://www.cost.eu/COST\\_Actions/ca/CA15136](http://www.cost.eu/COST_Actions/ca/CA15136) and on our website [www.eurocaroten.eu](http://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](mailto:info@eurocaroten.eu).

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### NEWS FROM THE ACTION

In memoriam Johannes Roob

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Conference on Carotenoid Research and Applications in Agro-food and Health  
November 2019, Lemesos, Cyprus

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"We understand much about how the body converts provitamin A carotenoids to vitamin A, but we're largely in the dark on how non-provitamin A carotenoids are broken down in the body."

### CAROTENOIDS IN DAILY LIFE

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Carotenoid of the Month: Phenicoxanthin

"Phenicoxanthin's more widely used name, adonirubin stems from the flower, Adonis annua, or Pheasant's Eye, where the pigment was first isolated from."

Zeaxanthin is a crucial carotenoid for plant tolerance to excess light

"The carotenoid zeaxanthin, a xanthophyll that accumulates under excess light by a reversible enzymatic reaction referred to as the "Xanthophyll Cycle"..."

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Publications by EUROCAROTEN ECIs: Sanja Krstić, Ludmila Bogacz-Radomska and Paula Mapelli Brahm

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EUROCAROTEN YouTube channel and videos



# IN MEMORIAM

## JOHANNES ROOB



# A farewell to our friend JOHANNES ROOB

Sadly, and completely unexpected, one of our active work-group members, Johannes Roob, passed away in Austria in the first week of July.

Johannes, working at the University of Graz, Austria, was a team leader in the Nephrology Unit of the Medical University.

Within our work-group Carotenoids and Health (WG 3), he was involved in the metabolism of

carotenoids, aiding to pave the way toward setting up dietary recommendations.

We will much miss a great and experienced colleague, his good ideas, his pleasant and calm personality, a benevolent and helpful friend. For his Family and close friends we wish much encouragement and inner strengths and peace.



# NEWS FROM THE ACTION

## CONTRIBUTION FROM THE ACTION & FINISHED STSMs



### 2<sup>ND</sup> SPANISH NATIONAL MEETING ON CAROTENOIDS

An updated program of the Second National Meeting on Carotenoids, which will be held in Granada on November 7<sup>th</sup> and 8<sup>th</sup>, 2019, is already available (<https://cared.cragenomica.es/wp-content/uploads/2019/07/Programa.pdf>).

More information about the Meeting you can find at event website (<https://rnc2.cragenomica.es>). You can also register and send communications on the website. Join us!

More news about this event and other information from CaRed – Spanish Carotenoid Network you can find at official website ([cared.cragenomica.es/](https://cared.cragenomica.es/)), Facebook (@carotenoid) and Instagram (@cared\_color).

### FINISHED STSMs

#### BIOACCESSIBILITY OF CAROTENOIDS FROM CEREAL-BASED PRODUCTS ENRICHED WITH PUMPKIN

##### Grant Holder

Milana Rošul , Institute of Food Technology Novi Sad (FINS), Serbia

##### Period

13<sup>th</sup> May – 12<sup>th</sup> July 2019

##### Host Institution

Centre for CardioVascular and Nutrition Research of Marseille – C2VN (INSERM/ INRA/ Aix-Marseille University Joint Unit), France

#### CELL UPTAKE OF CAROTENOIDS FROM CEREAL-BASED PRODUCTS ENRICHED WITH PUMPKIN

##### Grant Holder

Nataša Đerić, Institute of Food Technology Novi Sad, Serbia

##### Period

13<sup>th</sup> May – 12<sup>th</sup> July 2019

##### Host Institution

Centre for CardioVascular and Nutrition Research of Marseille – C2VN (INSERM/ INRA/ Aix-Marseille University Joint Unit), France

#### TRANSCRIPT-METABOLITE CHARACTERISATION OF CAROTENOID AND APOCAROTENOID PATHWAYS IN *Buddleja davidii* FLOWERS

##### Grant Holder

Dr Gianfranco Diretto, Italian National Agency for New Technologies, Energy and Sustainable Development (ENEA), Italy

##### Period

12<sup>th</sup> June – 27<sup>th</sup> August 2019

##### Host Institution

Universidad de Castilla-La Mancha, Spain





# NEWS FROM THE ACTION

## FUTURE EVENTS

### Save the date

26 -28 November 2019

The Royal Apollonia Hotel  
Lemesos

## International Conference on Carotenoid Research and Applications in Agro-food and Health

### Organisers:



We are delighted to invite you to attend the Final meeting of **EUROCAROTEN**, the “European network to advance carotenoid research and applications in agro-food and health” held under the auspices of the **COST Actions** (European Cooperation in Science & Technology). The Conference is a joint initiative of the **Cyprus University of Technology**, Department of Agricultural Sciences, Biotechnology & Food Science and the **Agricultural University of Athens**, Greece.

The 3-day Conference type meeting will be held in one of the most well-known resorts of the Mediterranean area, the **Royal Apollonia Hotel**, located in **Lemesos**, from **26<sup>th</sup> to 28<sup>th</sup> of November, 2019**. The congress will be comprised of plenary and ordinary sessions, that are expected to provide new knowledge and promote scientific dialogues during the conference. With the aim to attract and at the same time facilitate the participation of interested parties outside the COST action we tried to minimize the registration cost. We are looking forward to warmly welcome you in Cyprus.

### THE CONVENERS:

- **George Manganaris**, Associate Professor, Cyprus University of Technology, Cyprus
- **Serkos Haroutounian**, Professor, Agricultural University of Athens, Greece

The City: **Lemesos** is geographically located in the southern part of the island, with the second largest population numbering more than 230,000 inhabitants. The revival of the old city, the construction of modern buildings of great taste in design and panoramic views as well as the projects which took place recently; have reasonably renamed Lemesos “the epicenter” of the island. Among the richness of see sights and attractions, Lemesos features luxurious accommodation facilities. It can be an ideal place for conference meetings, dining, shopping and nightlife; as the choices are too many to suit each one's preferences.

### MAIN LINKS:

Conference website:

<https://www.eurocaroten.eu/?q=lemesos2019>

Registration Info:

<https://www.eurocaroten.eu/registration>

Registration Link:

<https://www.smarteventscy.com/congress/eurocaroten/>

Accommodation Info:

<https://www.eurocaroten.eu/accommodation>

Accommodation Link:

<https://theroyalapolloniahotel.reserve-online.net/?bkcode=EUROCAROTEN&checkin=2019-11-25>



# FINISHED STSM'S EXPERIENCE REPORT

Nedeljka Spasevski

## CAROTENOID SOURCES AND APPLICATIONS IN ANIMAL FEED

Affiliation	Institute of Food Technology, Novi Sad, Serbia
Position	PhD
Host Institution	Institute of Animal Science, Prague, Czech Republic
E-mail	<a href="mailto:nedeljka.spasevski@fins.uns.ac.rs">nedeljka.spasevski@fins.uns.ac.rs</a>

The topic of the COST Action EUROCAROTEN CA15136 is **very interesting in the field of animal nutrition because many carotenoid sources can be applied in animal feeds**. Accordingly, this STSM Grant provided new perspectives for my ongoing research, brought me an extensive experience and collaborations with other scientists which are in the same research topics as me.

My short-term scientific mission was carried out at the Institute of Animal Science, specifically **Department of Nutritional Physiology and Animal Product Quality and Department of Nutrition and Feeding of Farm Animals in Prague**, under the supervision of Prof Milan Marounek.

During this visit, I had an opportunity to learn basic principles of **HPLC method for determination of carotenoids in feed mixtures** and also go through the whole method for determination of **vitamins E and A in eggs**. I want to express my gratitude to the EUROCAROTEN network for offering me the opportunity to meet great people like **Prof Milan Marounek** and **Dr Tomáš Taubner**. Special thanks to Dr Tomáš Taubner for his kindness and great patience for all my questions.

This STSM brought an **added value** not only for my research, but also for the **established and a more efficient collaboration between the two involved COST partner groups**, and hence for the whole COST Action.





# FINISHED STSM'S EXPERIENCE REPORT

Milana Rošul

## BIOACCESSIBILITY OF CAROTENOIDS FROM CEREAL-BASED PRODUCTS ENRICHED WITH PUMPKIN

Affiliation	Institute of Food Technology, Novi Sad, Serbia
Position	PhD student
Host Institution	Centre for CardioVascular and Nutrition Research of Marseille – C2VN (INSERM/ INRA/ Aix-Marseille University Joint Unit), France
E-mail	<a href="mailto:milana.rosul@fins.uns.ac.rs">milana.rosul@fins.uns.ac.rs</a>



My STSM took place at Institution Centre for CardioVascular and Nutrition research of Marseille (C2VN), France. Together with colleague Nataša Đerić, I worked under the supervision of Dr Emmanuelle Reboul, our host.

The area of my research is functional food and its chemical characterization, as well as analysis of bioactive compounds that contribute to food functionality. The topic of my PhD thesis is creating a new functional product with the addition of pumpkin due to its main bioactive compounds – carotenoids, so I saw this open call as an excellent opportunity to broaden my knowledge in this research field.

The main goal of work done at C2VN was to evaluate the bioaccessibility of these carotenoids and to perform *in vitro* digestions in order to determine their fate during sample digestion. Samples I examined were cookies, biscuits and protein oatmeal with the addition of pumpkin powder (vacuum dried pumpkin puree).

The two technicians of the team Charlotte Halimi and Marion Nowicki helped me a lot by selflessly sharing their knowledge and experience with me. Most of the analyses were performed on HPLC so I improved my abilities related to this instrument. Dr Reboul and her team have tremendous experience and background in bioaccessibility and bioavailability of carotenoids in different kinds of food, and there is no doubt that the results I got there will be beneficial, not only for my PhD thesis but also for my future scientific career.

In the end, I want to thank the EUROCAROTEN network for providing such opportunities to young scientists. I highly recommend STSM to all young researches doubting whether to sign up, both personally and professionally. Of course, I am thankful to my mentor at home institution Anamarija Mandić; without her I would not have a chance to go there. I would also like to thank Emmanuelle Reboul and the whole team in Marseille who made our visit even better. If I get a chance again, I will apply for the STSM grant for sure!

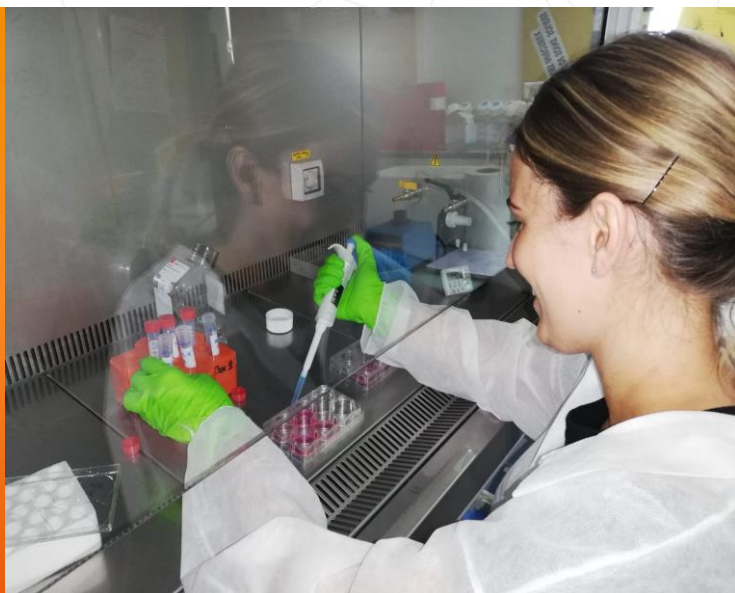


# FINISHED STSM'S EXPERIENCE REPORT

Nataša Đerić

## CELL UPTAKE OF CAROTENOIDS FROM CEREAL-BASED PRODUCTS ENRICHED WITH PUMPKIN

Affiliation Institute of Food Technology, Novi Sad, Serbia  
Position PhD student  
Host Institution Centre for CardioVascular and Nutrition  
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INRA/ Aix-Marseille University Joint Unit),  
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My two months stay took place in the Center for CardioVascular and Nutrition Research of Marseille – C2VN (INSERM / INRA / Aix-Marseille University Joint Unit), France. I worked in the research group of Emmanuelle Reboul, mostly with Charlotte Halimi and Marion Nowicki.

During my STSM I learned a lot about the cell uptake of pumpkin carotenoids. I learned the rules how to work in the cell laboratory and how to process the obtained results. All this was the result of team work: everybody participated and followed the experiment to make sure everything went well.

Thanks to the unselfish sharing of knowledge and experiences of my colleagues, but also because of the rich learning environment, my two months in Marseille flew by. I was fortunate to have this opportunity and work in a beautiful city, a very well-equipped and organized laboratory with professional and friendly colleagues.

I used every free moment after work and during weekends to explore the city and the surroundings (you can see in the pictures). Marseille is an amazing city, full of diversity and I think that no one can remain indifferent.

I would like to thank Emmanuelle Reboul and Anamarija Mandić for this memorable opportunity. Thanks to all team members, especially Charlotte and Marion, you

have been a great host. I must underline that all of this was possible due to the scholarship, received by COST action CA15136, EUROCAROTEN.





# EUROCAROTEN INTERVIEW

## TALKING WITH:

### Rachel E. Kopec

Affiliation	The Ohio State University, USA
Position	Assistant Professor of Human Nutrition
Country	USA
Area of Interest	carotenoid metabolism, fat-soluble nutrient-nutrient and nutrient-gene interactions, gastrointestinal health, targeted and untargeted metabolomics (LC-MS)



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

I use **analytical chemistry tools** (both targeted and metabolomics liquid chromatography high resolution mass spectrometry techniques) to answer questions of the metabolism of fat-soluble vitamins (A,D,E,K) and bioactives (e.g. carotenoids, omega-3 fatty acids, chlorophylls), with a particular focus on nutrient-nutrient/nutrient-bioactive interactions and gastrointestinal metabolism and health.

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

**Human carotenoid metabolism, of course!** We understand much about how the body converts provitamin A carotenoids to vitamin A, but we're largely in the dark on how non-provitamin A carotenoids are broken down in the body.

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

Certainly, a firm grasp of provitamin A metabolism has helped to attack, and **make significant progress in alleviating one of the top 3 nutrient deficiencies worldwide.**

#### As a STSM hosting lab, what type of collaborative projects would you envision?

The most appropriate projects would involve **carotenoid-nutrient/carotenoid-gene interactions**. We also have some exciting platforms established to study novel carotenoid structures (in any kind of sample).

#### From your observation, how can the EUROCAROTEN COST Action contribute to carotenoid research and how beneficial was your participation in this action?

It's been a great pleasure having hosted 2 visiting scholars from Europe, and participating in one of the workshops hosted by this group. **These activities have helped me maintain old ties and develop new ones, enhance the diversity of my work, and give me new ideas!** A big thank-you to the group for allowing me to participate in this COST Action program.

**Bonus fact** – my favorite carotenoid is astaxanthin, I love the color!

Read more @ [www.facebook.com/eurocaroten](https://www.facebook.com/eurocaroten)



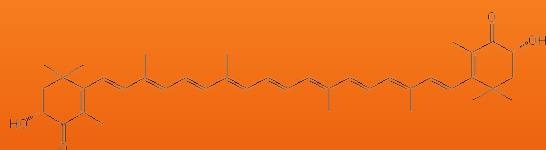
# CAROTENOIDS IN OUR DAILY LIFE

## CAROTENOID OF THE MONTH

Name: Phoenicoxanthin

Chemical Formula:  $C_{40}H_{52}O_3$

Molecular Weight: 580.85 g/mol



### PHOENICOXANTHIN

Phoenicoxanthin, or by its IUPAC name, 3-hydroxy- $\beta$ , $\beta$ -carotene-4,4'-dione, is a commercially valuable red ketocarotenoid molecule. With a hydroxyl group on one of its  $\beta$ -ionone rings and a ketone group on the other, phoenicoxanthin is both a xanthophyll and ketocarotenoid and is a precursor of the more well-studied ketocarotenoid, astaxanthin.

Phoenicoxanthin's more widely used name, **adonirubin** stems from the flower, *Adonis annua*, or Pheasant's Eye, where the pigment was first isolated from. The characteristic **ruby-red colour** of the flower is attributed to the presence of phoenicoxanthin as well as other red ketocarotenoids, such as **adonixanthin** and astaxanthin.

Like other ketocarotenoids, phoenicoxanthin is found in nature in a wide variety of organisms: within the **shells of crustaceans**, in **salmon**, in **yeast**, and in **green algae**. Also, like other ketocarotenoids, phoenicoxanthin is a valuable pigment for use in **food additives**. For example, the carotenoid's inclusion in feed for farm-grown fish can contribute to redder and healthier looking product. Studies have also shown that phoenicoxanthin has **antioxidant properties** and that phoenicoxanthin supplements, for humans, can help **suppress tumorigenesis and have an overall anti-carcinogenic effect**.

**Text by Marc Simanowitz, PhD student at the Hebrew University of Jerusalem, Israel**

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### ZEAXANTHIN IS A CRUCIAL CAROTENOID FOR PLANT TOLERANCE TO EXCESS LIGHT

**Photosynthesis** starts with capturing sunlight by large protein supercomplexes, called **photosystems**, which bind **chlorophylls** and **carotenoids**. This light-harvesting event fuels the photochemistry, namely the conversion of solar energy and  $CO_2$  from the atmosphere into chemical forms (sugars) which ultimately sustain life on Earth.

However, in high light conditions too much photons are absorbed by photosystems, which become overexcited and eventually **photodamaged**: a condition in which the energy excess leads to the massive release of singlet oxygen, a harmful reactive species that irreversibly harms the photosynthetic apparatus.

To prevent this sort of damage plants have evolved "**photoprotective**" mechanisms, like the so called **Non Photochemical Quenching (NPQ)**. This mechanism works on excited photosystems like pressure relief valves: when light becomes too much, NPQ turns on and discards the excess of energy safely.

The carotenoid **zeaxanthin**, a xanthophyll that accumulates under excess light by a reversible enzymatic reaction referred to as the "**Xanthophyll Cycle**", has a crucial role in this process:

- In few seconds upon its synthesis, zeaxanthin **up-regulates NPQ**, thus **de-excite photosystems** and **impairs the release of singlet oxygen**;
- zeaxanthin is particularly active in **detoxifying singlet oxygen**, having an **antioxidant activity higher than that of all other carotenoids**.

**Text by Dario Zappone and Prof Luca Dall'Osto from University of Verona, Italy**

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# THINK TANK INFORMATION

## PUBLICATIONS BY EUROCAROTEN ECIs

**Sanja Krstić: Characterisation of bioactive compounds and assessment of antioxidant activity of different traditional *Lycopersicum esculentum* L. varieties: chemometric analysis**

<https://www.tandfonline.com/doi/abs/10.1080/09637486.2019.1587742>

Eight different Serbian traditional genotypes) were analyzed for their polyphenol, carotenoid, vitamin C content and evaluated for their antioxidant properties. Carotenoids analyzed by HPLC-UV technique. The data demonstrate that the concentration of carotenoids can vary considerably according to the genotype, which may affect their biosynthesis and it can be observed that the colour and other sensory properties of the tomato may not be affected by the content of carotenoids. All results obtained in the study can serve as the basis for increasing the breeding, cultivation, and marketing of nutritionally superior varieties of tomato as a healthy alternative for consumers worldwide.

**Ludmila Bogacz-Radomska: chapter “Commercialization aspects of carotenoids” in book “Carotenoids: Properties, Processing and Applications”**

<https://www.elsevier.com/books/carotenoids-properties-processing-and-applications/galanakis/978-0-12-817067-0>

Although research has focused on the production of carotenoids in staple crops to improve nutritional welfare in developing countries, there is also an enormous market for carotenoids in the industrialized world, where they are produced both as commodities and luxury goods targeted

at the pharmaceutical, nutraceutical, food/ feed additive, cosmetics and fine chemicals sectors. This chapter discusses the importance of carotenoids in different market sectors, review current methods for commercial production and its regulation, summarize the most relevant patents and consider evidence supporting the health claims made by different industry sectors, focusing on the most commercially valuable carotenoids on the market: beta-carotene, lycopene, lutein, zeaxanthin and astaxanthin.

**Paula Mapelli Brahm: Comparison of the bioavailability and intestinal absorption sites of phytoene, phytofluene, lycopene and  $\beta$ -carotene**

<https://authors.elsevier.com/c/1ZSK16Ds1huK0>

In this article, the bioavailability in mice of the main tomato carotenenes (phytoene, phytofluene, lycopene and  $\beta$ -carotene) were analysed. In addition, each carotene absorption profile along the duodenal-ileal axis of the intestine were determined to identify their respective absorption sites and compared these profiles with the gene expression sites of their identified transporters, i.e. SR-BI and CD36.

The article is available free of charge using the link until 13<sup>th</sup> of September 2019.



OF EARLY CAREER INVESTIGATORS AND  
OTHER YOUNG RESEARCHERS

**Representatives for 4<sup>th</sup> grant period:**

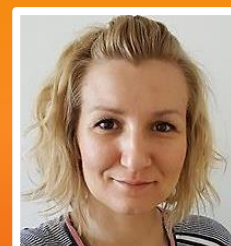
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Kristina Kljak  
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# WORKING GROUP NEWS

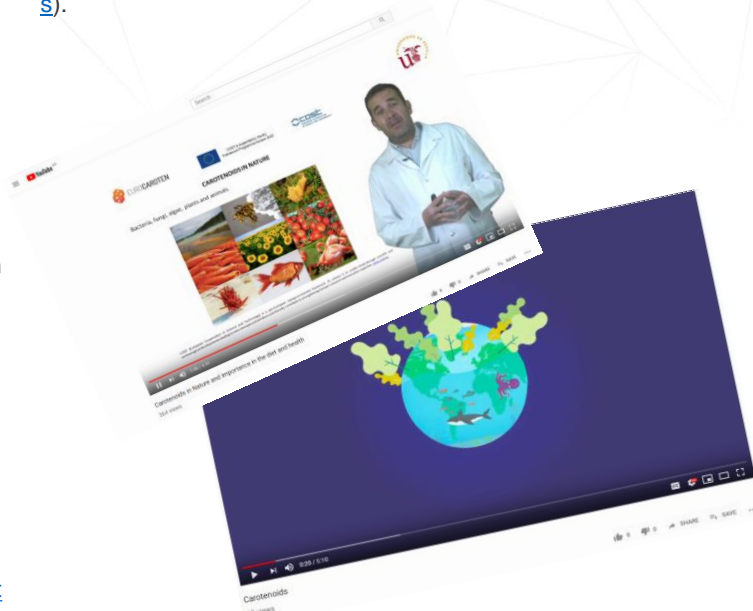
## EUROCAROTEN YouTube channel and videos

The first EUROCAROTEN video is posted at EUROCAROTEN YouTube channel (<https://www.youtube.com/watch?v=l3cXnznY7X8>). The video is part of **EUROCAROTEN strategy to inform all the non-scientific audiences** (industry, policymakers, professionals, teachers, general public, etc.) **about the importance of carotenoids in Nature and their applications in agro-food and health**. This is aligned with the dissemination objectives of EUROCAROTEN network.

After the approval of the Management Committee, Action chair **Dr Antonio J. Meléndez-Martínez** led the project by preparing the texts and working together with a company at Universidad de Sevilla, "**Secretariado de Recursos Audiovisuales y Nuevas Tecnologías**" (SAV). **Nora O'Brien** (WG2 leader) kindly revised the texts while MC members will produce subtitles in different languages. The video will be translated in approximately 20 languages, including Chinese and Japanese.

The video is already available at EUROCAROTEN YouTube channel ([https://www.youtube.com/channel/UCHq4\\_AE2vUiEArSt](https://www.youtube.com/channel/UCHq4_AE2vUiEArSt)

[4S2QNjw](https://www.youtube.com/watch?v=utD11sc8piM&t=152s)) where cartoon about carotenoids, produced by the same team as the first video, was recently posted (<https://www.youtube.com/watch?v=utD11sc8piM&t=152s>).



## ACKNOWLEDGEMENTS

**We would like to thank everyone who has so kindly contributed with the content present in this newsletter:**

**Antonio J. Meléndez Martínez and Cristina L.M. Silva** for their guidance and supervision during the making of the EUROCAROTEN Newsletter.

**Nedeljka Spasevski, Milana Rošul and Nataša Đerić** who have kindly given their testimony.

**Prof. Rachel E. Kopec** for her contribution to our EUROCAROTEN Interview.

**Marc Simanowitz, Dario Zappone and Prof Luca Dall'Osto** for their contribution to our "Carotenoids In Our Daily Life" rubric.

This newsletter is part of dissemination strategy of COST Action EUROCAROTEN, supported by COST (European Cooperation in Science and Technology).

**COST** (European Cooperation in Science and Technology) is a pan-European intergovernmental framework. Its mission is to enable break-through scientific and technological developments leading to new concepts and products and thereby contribute to strengthening Europe's research and innovation capacities.

## DISCLAIMER

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