Exploiting the multifunctional properties of polyphenols: from wastes to high value products

NEWSLETTER

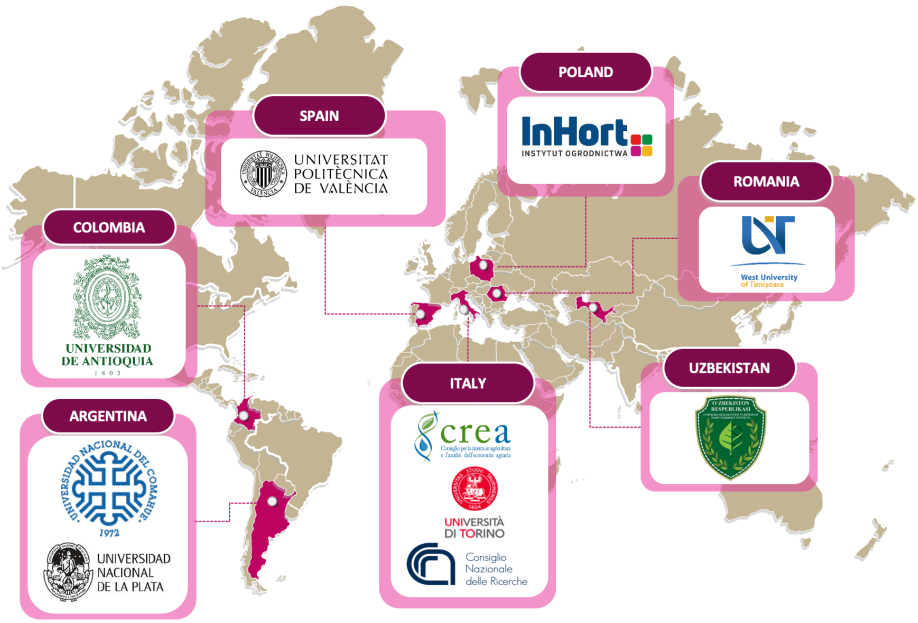
The project

PHENOCYCLES aims at exploring innovative use of polyphenols (PP) and at validating methods for their extraction with a green chemistry approach. PP extracted from agro-industrial wastes and herbs with therapeutic value will be purified/fractionated with pilot-scale nano/ultrafiltration membranes to recover different PP fractions, to be employed in four distinct sectors: health, plant production, environment protection, material science.

The interdisciplinary exchanges planned in PHENOCYCLES are thus expected to increase the knowledge of researchers, particularly young ones, on the different methods utilised by the partners fostering further developments in medicine, pharmacology, crop protection, food preservatives, nutraceuticals, cosmetics, and other industrial applications.

Consortium

PHENOCYCLES consortium consists in 10 institutions (Universities or Research Centres) belonging to 7 countries, both European (Italy, Poland, Romania, Spain) and non-European (Argentina, Colombia, Uzbekistan). All the partners are involved in the research activities on polyphenols and in the exchange of participants, with the aim to increase their personal skills and the scientific level of each institution.



PHENOCYCLES is a project funded under EU Marie Skłodowska-Curie Actions (MSCA)

Call: MSCA Staff Exchanges 2022 (HORIZON-MSCA-2022-SE-01)

Project: 10.3030/101131420

Start date: 01 March 2024

Events

The activities of PHENOCYCLES consortium started on April 8th, 2024 with the kick-off meeting. Other events in 2024 are shown below.

Friday, July 5th 2024 h 12.00 - University of Turin

Effective intracellular release of ibuprofen triggered by thermo-sensitive magnetic nanocarriers applied in PDT and PTT treatments

Prof. Gabriela N. Bosio
INIFTA-CONICET, Universidad Nacional de La Plata, Argentina.

Friday, October 11th 2024 h 15.00 - University of Turin

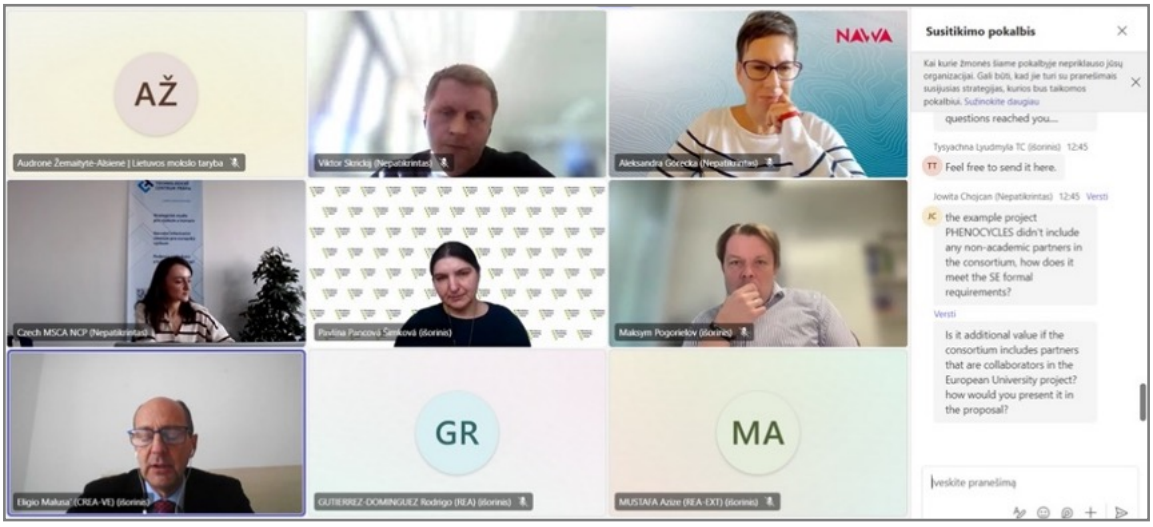
Nanometric MOFs for PhotoDynamic Therapy, Photo and Physico-Chemical characterization, a PhD thesis

Eduardo Gonik
INIFTA-CONICET, Universidad Nacional de La Plata, Argentina.

October 24th 2024 - MSCA Staff Exchange 2024, info day (online)

PHENOCYCLES: Exploiting the Multifuctional Proprierties of Polyphenols from Waste to High Value Products

Eligio Malusà
Institute of Horticulture in Skierniewice, Poland.



Thursday, November 28th 2024 h16.00 - CNR STEMS, Turin

A new perspective on health: from disease treatment to prevention

Niall J. Dickinson PhD
Institute of Horticulture in Skierniewice, Poland.

PHENOCYCLES Consortium

Coordinator:

(CREA) - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, ITA

Participants:

(UNITO) - Università degli Studi Di Torino, ITA

(WUT) - Universitatea de Vest Din Timişoara, ROM

(CNR) - Consiglio Nazionale delle Ricerche, ITA

(UPV) - Universitat Politecnica de Valencia, ESP

(InHort) - Instytut Ogrodnictwa - Panstwowy Instytut Badawczy, POL

Partners:

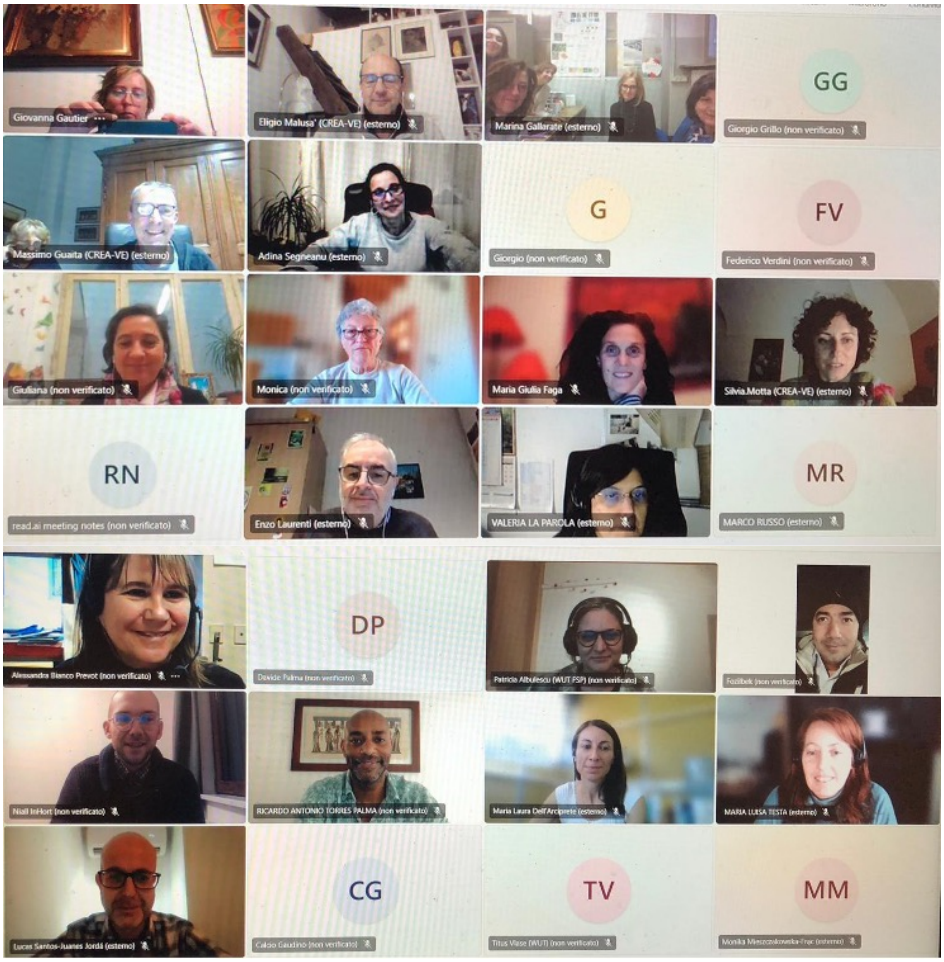
(UdeA) - Universidad de Antioquia, COL

(UNLP) - Universidad Nacional de La Plata, ARG

(UNCo) - Universidad Nacional del Comahue, ARG

(UPPSRI) - Plant Protection Scientific Research Institute, UZB

Thursday, December 10th 2024 - 6-month project meeting (online)



Secondments & other activities

In the first year of the project the following staff exchanges were already carried out:

Gabriela N.Bosio (UNLP) to UNITO

Giorgio Capaldi and Federico Verdini (UNITO) to UNLP

Eduardo Gonik (UNLP) to UNITO

Niall J.Dickinson (InHORT) to CREA

Paula Caregnato (UNLP) to UPV

Ada Montilla Saavedra (UNLP) to UPV

Mariana Ramirez (UnCO) to UPV

Some of the seconded persons shared their experience with us in this newsletter.

Moreover the activities of some students were also related with PHENOCYCLES research activities:

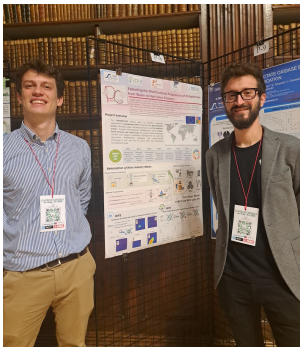
Carlo Ferrero, Master thesis in Forensic chemistry “Estrazione, frazionamento e utilizzo di polifenoli da scarti vitivinicoli nella sintesi di Ossido di Zinco” (UNITO-CNR-CREA)

Sara Venturi, Master thesis in Industrial Chemistry “Nanoparticelle di ZnO da matrici naturali di scarto per la degradazione fotocatalitica di inquinanti organici” (UNITO-CNR)

Riccardo Muzzachi, Master thesis in Industrial Chemistry “Estrazione di polifenoli in una matrice complessa attraverso l’impiego di monoliti mesoporosi a base di Silice e Titania” (UNITO-UNCo)

Laura Ridolfo, Master thesis in Industrial Chemistry, in progress (UNITO-UNCo)

Michela Quai, Master thesis in Forensic chemistry, in progress (UNITO-CNR)



Giorgio Capaldi with UNITO, CNR and CREA team presented a poster of the PHENOCYCLES project at XI Workshop Gruppo Interdivisionale Green Chemistry – Chimica Sostenibile - Torino (October 24-25th 2024). Poster is available on the PHENOCYCLES website.

People of WUT team was involved in several scientific activities and dissemination events during 2024: European Researchers' Night, Workshop Open Days in Timisoara, International Conference ANMBES-24 in Brasov and two International Exhibition of Inventions and Innovations (in Timisoara and Deva) awarding Gold medal in both of them.

Secondment's stories

Gabriela Bosio (UNLP)

A Journey from La Plata to Torino Science, Family, and Connection

In July, my family and I took an exciting journey from La Plata to Torino, heading to the University of Turin (UniTo). There, I had the opportunity to work with the Department of Drug Science and Technology. Combining scientific research with cultural exploration made this trip both meaningful and fulfilling.

Gabriela and her family in front of Teatro Carignano in Torino

Upon arrival, I was warmly greeted by the women of the Pharmaco team—Marina Gallarate, Simona Sapino, Elena Peira, and Daniela Chirio—and Giuliana Magnacca from the Department of Chemistry. Their warm welcome included coffee and delicious pastries, creating a comfortable and friendly atmosphere. They had prepared a detailed schedule for my stay but remained open to changes, new ideas, and, of course, taking time to enjoy a good cup of coffee every few hours. It was fantastic!

This experience was truly rewarding. The women of the Pharmaco team were not only kind and professional but also stylish and cheerful, reflecting their Italian roots. They were eager to collaborate, suggesting ideas like drafting agreements between universities and co-supervising students in future projects. Their willingness to share knowledge and build partnerships made my stay even more valuable.

My research focused on an exciting project: characterising magnetic mesoporous nanoparticles loaded with polyphenols. With the support of Chiara Riganti from the Department of Oncology at Molecular Biotechnology, we aimed to test their antioxidant activity in mammalian cells under temperature-controlled release. The early results were promising, showing the potential of this innovative approach and highlighting the importance of international collaboration in advancing scientific understanding.

But this trip wasn't just about science. One unforgettable evening, my family attended a dinner where my children confidently explained the Argentine card game "Truco" to Dr. Marina Gallarate. Their lively demonstration, complete with gestures for playful cheating, filled the room with laughter and created a fun connection that overcame language differences.

We also built a lasting friendship with Carola, the daughter of Simona. She and my daughter, Emma, quickly bonded, and they continue to stay in touch, showing how friendships can thrive even from afar.

This journey was much more than a professional achievement; it was a celebration of collaboration, cultural exchange, and personal growth. The kindness of our hosts, the excitement of discovery, and the friendships we formed made it an unforgettable experience. Torino gave me not only scientific knowledge but also lasting memories and connections that will continue to enrich both my life and work.

Giorgio Capaldi (UNITO)

I have been in La Plata for a Staff Exchange experience as part of the PHENOCYCLES project, and it has been an incredible professional and personal journey.

La Plata, Argentina, is a vibrant city known for its academic excellence and rich cultural heritage. During my stay, I worked at the INIFTA institute at the University of La Plata, collaborating with a skilled research team specialising in nanomaterial science and photochemistry. My research focused on integrating polyphenols extracted from agricultural by-products, specifically grape pomace, into Metal-Organic Frameworks (MOFs). The INIFTA team was instrumental in exploring sustainable solutions and identifying opportunities to apply polyphenols in fields such as agriculture and material science.

Giorgio Capaldi, Federico Verdini and Daniel Cacciari visiting Iguazù Falls (on the back the impressive Garganta del Diablo)

The Argentinian research group was exceptionally welcoming and cooperative, which greatly enriched my experience. Outside the lab, I had the privilege of visiting the stunning Iguazú Falls with my Italian colleague Federico Verdini and Daniel Cacciari, the researcher who supported and guided my experiments at INIFTA. I also experienced traditional asado gatherings and sampled alfajores, both of which are iconic elements of Argentinian culture.

This journey exposed me to innovative research techniques and fresh perspectives, significantly contributing to my personal and professional development. Looking ahead, I am eager to explore the potential of these materials further by integrating polyphenols into biopesticide and biostimulant formulations, aligning with the objectives of WP4 of the PHENOCYCLES project.

Federico Verdini (UNITO)

I am a postdoctoral researcher at the Department of Drug Science and Technology (DSTF) at the University of Torino, specialising in Advanced Oxidation Processes (AOPs) for wastewater purification. From September 6th to October 13th, 2024, I conducted a secondment at INIFTA in La Plata, Argentina, as part of WP3 - Polyphenols and environment.

My work focused on synthesising carbon and carbon nitride nanomaterials using polyphenolic fractions (PPs) and evaluating their potential as photocatalysts in AOPs. This innovative research allowed me to functionalize nanoparticles to modulate their properties, including fluorescence, through multidisciplinary collaboration.

This was my first visit to South America, and I didn't know what to expect. Fortunately, the colleagues at INIFTA warmly welcomed me and supported me in navigating both my research and the everyday challenges of life in what truly felt like the other side of the world. Their hospitality made a significant difference, from introducing me to local research facilities to offering practical guidance for my stay.

Life in La Plata had its own rhythm. I stayed in a cozy apartment not far from the institute. I spent my weekends exploring local attractions and immersing myself in the Argentine culture—tasting empanadas, asado, and of course, dulce de leche. I even tried my hand at a few words in Spanish, which was both fun and useful for day-to-day interactions. During my stay, I also visited few times Buenos Aires, a city that I found fascinating despite being completely different from the large European cities I am familiar with. Its unique blend of history, culture, and vibrant urban life made it a memorable experience. One of the most unforgettable experiences of my time in Argentina was a weekend trip to the spectacular Iguazú Falls. Standing before the immense waterfalls, surrounded by lush subtropical rainforest, was a truly humbling experience. The thundering roar of the water, the fine mist on my face, and the sight of the famous Garganta del Diablo (Devil's Throat) were awe-inspiring. It was a rare moment where nature's power and beauty left me completely speechless. The Iguazú Falls were not just a highlight of my trip, they were a memory I will cherish forever. At INIFTA, I was particularly grateful to Maria Laura Dell'Arciprete, Daniel Cacciari, Eduardo Gonik and Aldair Vergel Rangel, who guided me through the experimental processes and shared their insights into nanomaterial characterization. The collaboration extended beyond the lab, as I was able to participate in seminars and informal discussions that enriched my perspective. I left La Plata with a broader scientific outlook and a new appreciation for cultural exchange. This secondment was an enriching experience that not only advanced my research skills but also expanded my horizons personally and culturally. I look forward to continuing collaborations with my colleagues in Argentina and embarking on new scientific challenges in the future.

Eduardo Gonik (UNLP)

My secondment in Torino, Italy began on October 1st 2024. I was warmly received by UniTo's Prof. Giuliana Magnacca which proceeded to introduce me to the Physical chemistry staff, which would become my co-workers for the next two months. During those two months I had the opportunity to meet a lot of great people, both in a human and scientific sense, both with researchers in the Physical chemistry, Analytical chemistry and Pharmacological chemistry Departments. I would like to specifically mention Prof. Magnacca, who helped me in more ways than I can mention in this short text, Dr. Federico Verdini and Dr. Giorgio Capaldi, who I met in Argentina and continued our research together in Torino, I had also the opportunity to collaborate extensively with Prof. Enzo Laurenti and to attend an excellent XAS course with Prof. Elisa Borfecchia.

Eduardo Gonik with CNR-InHORT-UNITO team members enjoying an "apericena" in Torino

During my stay I worked on the synthesis and characterization of metal organic frameworks based on Zr, with possible applications in plant nutritional supplementation and treatment of contaminated waters. Also I helped Dr. Federico Verdini with the microwave synthesis of polyphenol-based carbon dots for environmental applications. Both tasks led me to learn and use new techniques, and greatly assisted in my formation. It is also worth to highlight that UniTo's chemical department is very well equipped, which also facilitated the tasks at hand.

That being said, my experiences in Italy transcended the academic realm, as I was able to visit Bologna, Milano, Verona and of course Torino, during my stay. Every city provided a really interesting touristic experience for me and left me wishing I could have visited more of Italy, something I'm sure I will do at some point in the future.