



# INNOVATION IN ACTION ACROSS RIA4FOOD

## Innovation, Collaboration, Impact

The fifth edition of the RIA4FOOD newsletter brings the spotlight to the dynamic work carried out within each partner institution. Across the consortium, research teams are translating project objectives into tangible scientific and technological progress, reinforcing our shared commitment to sustainable food systems and circular innovation. In recent months, partners have advanced pilot activities, optimized protocols, validated innovative solutions, strengthened collaboration through secondments and technical meetings, and expanded dissemination efforts to ensure impactful RIA4FOOD results within the agri-food ecosystem.

As the project progresses, the collective dedication of our partners remains the driving force behind impactful innovation. This issue celebrates their commitment, expertise, and the concrete steps being taken to transform research into sustainable solutions for the future of food.

## INSIDE OUR PARTNERS' INSTITUTIONS

Partner institutions are actively advancing pilot-scale validation activities across all work packages.

Cross-institutional collaboration has intensified through secondments, technical workshops, and joint dissemination events.

New experimental results are strengthening the sustainability and circular bioeconomy objectives of RIA4FOOD.





# REZOS BRANDS

REZOS is the Project Coordinator of the RIA4FOOD project, responsible for overall project management, partner coordination, quality assurance, and communication with the funding authority. REZOS oversees the implementation of the work plan, monitors milestones and deliverables, and ensures effective risk management and alignment among partners.



## OSMOTIC DEHYDRATION

In addition, REZOS leads the organic cultivation and preparation of Sea Buckthorn (*Hippophaë rhamnoides* L.) samples at the Hippocrates Farm (Meteora, Greece), where three SB varieties are cultivated using Precision Agriculture practices. After harvest, an osmotic dehydration procedure is applied, enabling REZOS to provide both fresh and osmotically dehydrated Sea Buckthorn samples (leaves, seeds, and fruits) for the development of extraction protocols and metabolic profiling.

# UNIVERSITY OF PATRAS

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The UPAT's Department of Pharmacy, group of the Biomolecular NMR, brings extensive expertise in biomolecular conformational dynamics, natural product analysis, and the identification of food-related signature molecules and disease biomarkers.

The group offers a broad range of advanced analytical techniques, including high-definition 700 MHz NMR, CD, UV-Visible and fluorescence spectrometers, SEC-MALS, and micro-isothermal titration calorimetry (ITC), enabling comprehensive physicochemical characterization of complex biological and plant-derived samples, as well as proteins and polypeptides.



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## ANALYSIS & METABOLOMICS

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The newest “omics” field focuses on the systematic study of small molecules, such as sugars, organic acids, amino acids, and vitamins, providing a direct snapshot of an organism’s biochemical activity. UPAT has extensive experience in metabolomics, applying NMR-based approaches to both biological samples and plant extracts. As a complete metabolomic profile of Sea Buckthorn (SB) is currently lacking in the literature, UPAT is conducting an in-depth analysis of three SB varieties cultivated at the REZOS farm: CLARA, RORI, and HABEGO.

# UNIVERSITY OF PATRAS



UNIVERSITY OF  
**PATRAS**  
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ



Within the framework of the RIA4FOOD project, UPAT efforts are focused on the development and optimization of the extraction protocols for both fresh and osmotic SB, aiming to maximize metabolite recovery and ensure reproducibility and comparability across samples. Advanced NMR-based methods is then applied for identification and structural elucidation of metabolites in each variety. This systematic approach enables the characterization of variety-specific natural products' profiles and the identification of signature metabolites, providing key molecular markers to support varietal differentiation, quality assessment, and the evaluation of potential bioactivity in sea buckthorn products.

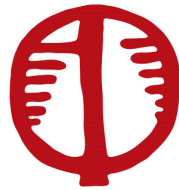
## HIPPOCRATES FARM (METEORA, GREECE)



**REZOS BRANDS** leads the organic cultivation and preparation of Sea Buckthorn (*Hippophaë rhamnoides* L.) samples at the Hippocrates Farm (Meteteora, Greece), where three SB varieties are cultivated using Precision Agriculture practices.



# THE "PROTEOMIC UNIVERSE" AT FLEMING



"ALEXANDER FLEMING"  
Biomedical Sciences Research Center

The "Proteomic Universe" refers to the complexity and diversity of the proteome, the entire set of proteins expressed by an organism, tissue, or cell.

If genomics tells us what might happen, proteomics tells us what is happening. The scale of the proteomic universe is far larger than the genomic one because of several layers of complexity:

- **Alternative Splicing:** A single gene can be "edited" to create multiple different protein versions.
- **Post-Translational Modifications (PTMs):** After a protein is made, the cell can add chemical "tags" (like phosphate or sugar groups) that act as on/off switches or GPS coordinates.
- **Protein-Protein Interactions (PPIs):** Proteins rarely work alone; they form massive, shifting "social networks" or complexes to carry out tasks.
- **Turnover:** Proteins are constantly being created and destroyed. Their "half-life" can range from minutes to years.

While a traditional telescope uses light to see distant stars, a Mass Spectrometer uses mass and charge to identify thousands of different proteins in a single sample. It is the gold standard for navigating this complex landscape. The field has evolved rapidly with several key breakthroughs currently shaping research:

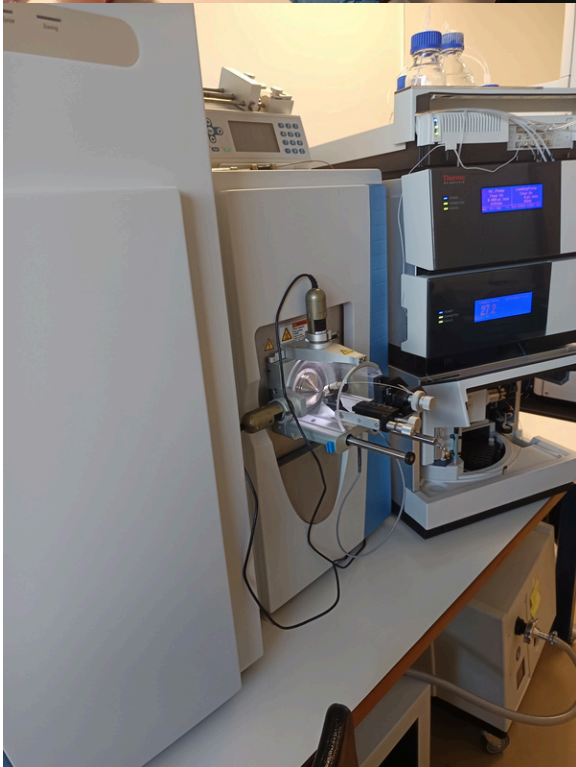
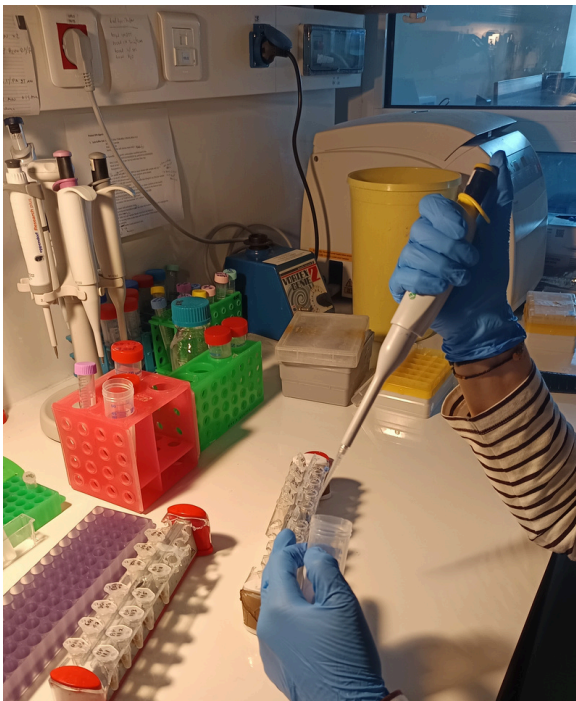
- The timsTOF Ultra 2 (released by Bruker) is essentially the "Formula 1" car of the mass spectrometry world. This specific instrument is designed for Single-Cell Proteomics—meaning it doesn't just look at a tissue sample; it can see the protein universe inside one solitary cell.

# THE “PROTEOMIC UNIVERSE” AT FLEMING

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**“At FLEMING, we employ state-of-the-art instrumentation.”**

Martina Samiotaki, PhD, Proteomic Operational Scientist



Today, the challenge of the Proteomic Universe is no longer just "seeing" the proteins with the timsTOF Ultra 2; it is making sense of the mountains of data it generates. Analyzing single-cell data is like trying to map a galaxy where every star is flickering and moving at the same time.

*“To handle this, we use a sophisticated software 'toolkit' that relies heavily on AI to separate biological signals from background noise. The main software used in our analyses is Spectronaut 20 (Biognosys), often referred to as the "Gold Standard" for DIA (Data-Independent Acquisition). It uses advanced AI to perform "library-free" analysis, meaning it can identify proteins even if it hasn't seen that specific sample type before, and DIA-NN (Data-Independent Acquisition Neural Network): A fan-favorite in the open-source community. It uses deep learning to predict peptide behavior, which is essential when you only have a few picograms of sample from a single cell.”*

Martina Samiotaki



# USAMV CLUJ-NAPOCA

Exploring Bioaccessibility and Gut Health in RIA4FOOD



In recent months, USAMV Cluj-Napoca has focused extensively on the *in vitro* digestion and bioaccessibility assessment of sea buckthorn-based formulations developed within RIA4FOOD. Using a standardized three-phase static digestion model (oral, gastric, and intestinal), the research team simulated human gastrointestinal conditions to evaluate the release and stability of bioactive compounds during digestion.

## IN VITRO DIGESTION

Following simulated digestion, intestinal fractions were subjected to further analysis to determine bioaccessibility percentages and the stability of key metabolites. These investigations provide essential insight into how bioactive compounds behave under physiological conditions and support the validation of scientifically substantiated health claims. In parallel, digested samples were introduced into a proximal colon model to investigate their interaction with selected gut microbiota strains. This approach enables the assessment of microbial fermentation patterns and potential prebiotic effects, strengthening the understanding of the functional impact of the developed prototypes.



# USAMV CLUJ-NAPOCA

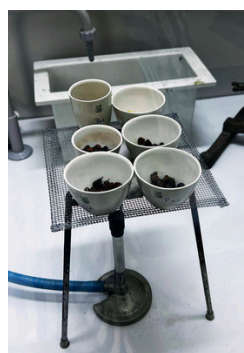
## From Bioaccessibility to Functional Food Validation

USAMV Cluj-Napoca continues to play a key role in validating innovative solutions developed within RIA4FOOD. Current activities include optimizing processing parameters, monitoring quality indicators, and assessing the nutritional and functional performance of developed food prototypes.



## FOOD INNOVATION

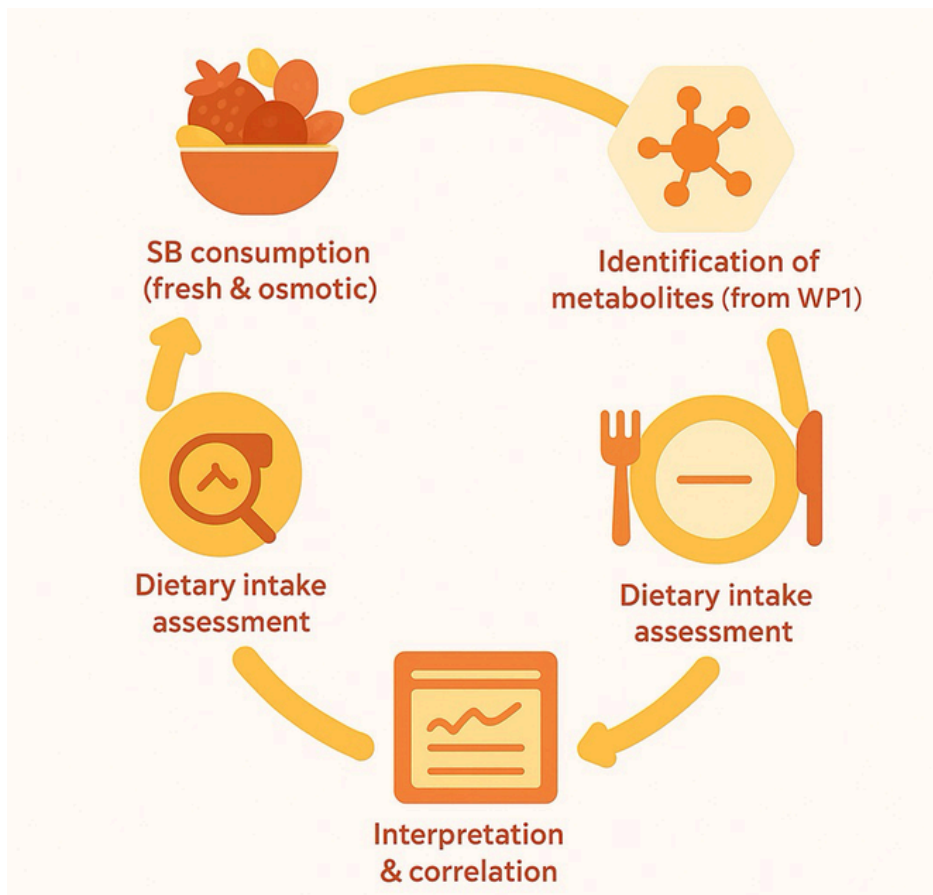
Research activities have centered on improving process efficiency, enhancing the valorization of agri-food by-products, and generating robust analytical data to support sustainable food system transformation. Laboratory work has included physicochemical analyses, bioactive compound assessment, and functional property evaluation of developed formulations. These efforts aim to ensure scientific reliability while strengthening the innovation potential of the proposed solutions. Particular attention has been given to sustainability indicators, resource efficiency, and the valorization potential of raw materials. The generated datasets contribute directly to work package objectives and strengthen the scientific foundation of the project's outcomes.



# INSPIRE SCIENCE: BRIDGING RESEARCH, CONSUMERS AND IMPACT IN RIA4FOOD



INSPIRE SCIENCE  
EMPOWERING TOMORROW'S INNOVATORS



Within RIA4FOOD, Inspire Science plays a pivotal role in translating complex scientific findings into meaningful health, dietary, and societal insights. The team contributes to the assessment of dietary intake patterns, epidemiological correlations, and consumer-oriented research, ensuring that the developed functional food prototypes are grounded in real-world nutritional relevance.

Recent activities have focused on evaluating the intake of key bioactive compounds identified in sea buckthorn matrices, correlating compositional data with existing nutritional databases and epidemiological evidence.

By analyzing intake patterns across different populations, Inspire Science supports the scientific substantiation of potential health benefits and contributes to the development of the project's nutritional algorithm.



# INSPIRE SCIENCE

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## Dissemination, Communication and Impact Strategy

As leader of dissemination and communication activities within RIA4FOOD, Inspire Science coordinates the development of the Dissemination & Communication Plan, project newsletters, promotional materials, and stakeholder engagement actions.

The team actively manages communication channels, including digital platforms and outreach events, ensuring broad visibility among scientific communities, industry actors, policymakers, and the general public.

Through integrated dissemination, clustering activities, workshops, and public engagement initiatives, Inspire Science strengthens the project's impact and long-term sustainability.

### CONNECTING SCIENCE WITH SOCIETY

By integrating scientific evidence, consumer insights, and strategic communication, Inspire Science ensures that RIA4FOOD outcomes extend beyond research outputs and contribute meaningfully to sustainable food innovation, public health awareness, and stakeholder engagement.



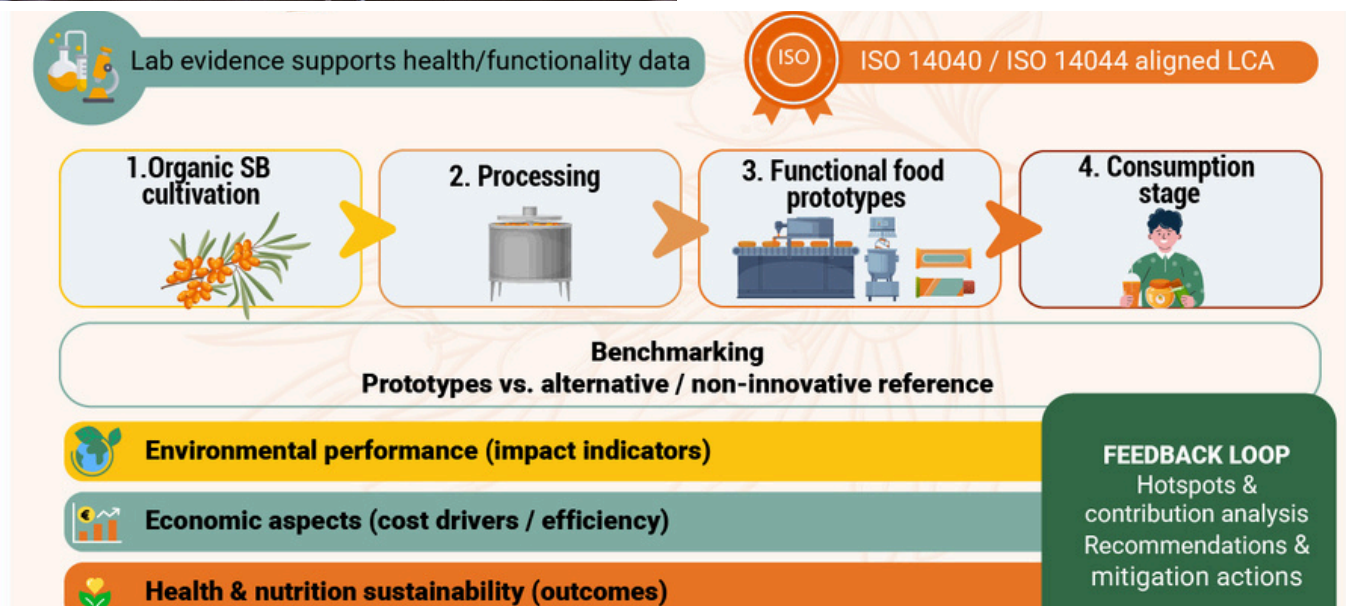


FOODSCALE HUB

# FOODSCALE HUB



Foodscale Hub (FSH) leads WP5 in RIA4FOOD by delivering Life Cycle-based sustainability assessment for the sea buckthorn (SB) value chains developed in the project. FSH integrates environmental, economic, and health-related sustainability considerations into a single evidence framework.



## SUSTAINABILITY ASSESSMENT

The assessment follows ISO 14040/14044 principles and covers the full chain from organic SB cultivation and processing routes to final production and the consumption stage. This integrated approach is important for RIA4FOOD because it tests whether innovations that target health benefits also perform well across broader sustainability dimensions, and it prevents improvements in one area from creating burdens elsewhere in the value chain.

# FOODSCALE HUB

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## Environmental and Nutritional Sustainability Integration

In practice, WP5 provides quantified performance evidence and clear priorities for action.

*“Across a defined set of indicators, we assess environmental performance, identify hotspots and their main drivers through contribution analysis, and translate findings into improvement levers. We then benchmark RIA4FOOD prototypes against an alternative/non-innovative reference product to demonstrate the sustainability benefits attributable to the project’s solutions. In parallel, we connect environmental results with economic aspects and cost drivers, and relate them to nutritional and health sustainability considerations, so the consortium can make transparent trade-offs and communicate results with credible, decision-grade evidence.”*

Sunčica Vasiljević  
Environmental Specialist

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### CONTRIBUTION ANALYSIS

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Beyond impact quantification, WP5 includes contribution analysis to identify critical subprocesses and resource-intensive steps. Based on these findings, FSH collaborates with technical partners to:

- Optimize processing parameters
- Improve resource efficiency
- Reduce emissions and waste streams
- Enhance overall environmental performance

This iterative approach ensures continuous improvement of the developed prototypes.





## UNIVERSITY OF EASTERN PIEDMONT

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Biological Mass Spectrometry Lab from UPO is specializes in multi-omics analysis by mass spectrometry, with expertise in metabolomics, lipidomics, and proteomics for the biochemical phenotyping of cell lines, tissues, biological fluids and food and environmental samples.



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### MULTI-OMICS ANALYSIS

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*Our platform includes two LC-HRMS systems (Exploris 480 and Q Exactive Plus), one GC-MS (LECO BT), one GC×GC-MS (LECO BT 4D), one GC×GC-HRMS (LECO BT 4D HRT), and an AP-MALDI source soon to be added, supported by a dedicated bioinformatics unit. We combine advanced analytical workflows with multivariate analysis, data integration, and systems biology approaches to study aging, cancer, autoimmune, neurodegenerative, and cardiac diseases, as well as microbiota-related processes, biomarker discovery, and diagnostic test development.*

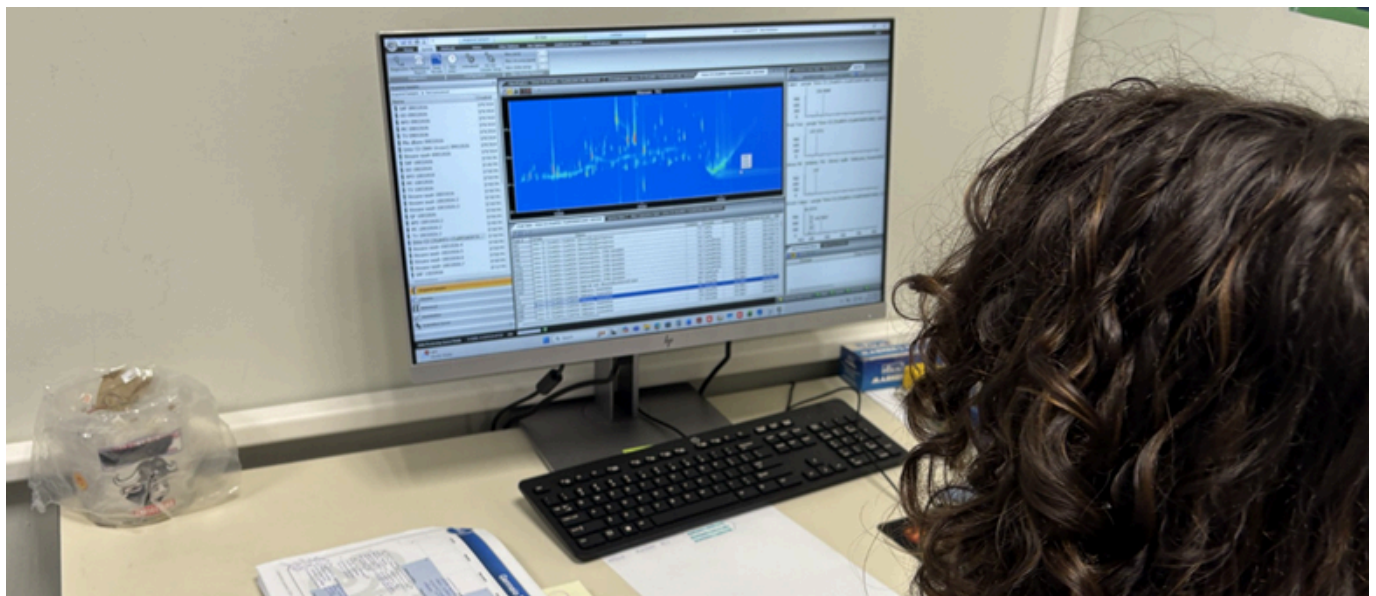
*Prof. Marcello Manfredi PhD*



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FROM MOLECULES TO IMPACT:  
MULTI-OMICS EXPLORATION OF  
SEA BUCKTHORN FOR NEXT-  
GENERATION FUNCTIONAL  
FOODS



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## MULTI-OMICS ANALYSIS

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*Within the RIA4FOOD project, our expertise is applied to the comprehensive characterization of sea buckthorn through metabolomic and lipidomic profiling, enabling the identification of its bioactive molecular components. We also investigate the impact of sea buckthorn on cancer cell metabolism using metabolomics, providing mechanistic insight into its biological effects and its potential value as a functional food ingredient.*

*Prof. Marcello Manfredi PhD*

# CYPRUS INSTITUTE OF NEUROLOGY AND GENETICS



THE CYPRUS INSTITUTE OF  
NEUROLOGY & GENETICS

The Department of Cancer Genetics, Therapeutics & Ultrastructural Pathology at the Cyprus Institute of Neurology and Genetics (CING) is actively engaged in multidisciplinary biomedical research and specialized diagnostic services in the fields of cancer biology, therapeutics, molecular genetics, and ultrastructural pathology. Its research activities include the development and evaluation of novel targeted anticancer agents, the repurposing of existing drugs as improved tumor-targeted therapies, the investigation of nutri-epigenomic approaches to minimize the toxicity of conventional anticancer treatments, and the study of sustainable bioactive compounds with potential anti-cancer, anti-inflammatory, and anti-aging properties.



## MULTIDISCIPLINARY BIOMEDICAL RESEARCH

The department also focuses on understanding tumor pathophysiology and the mechanisms that hinder treatment efficacy, with the goal of designing new therapeutic strategies to overcome these barriers.

# CYPRUS INSTITUTE OF NEUROLOGY AND GENETICS

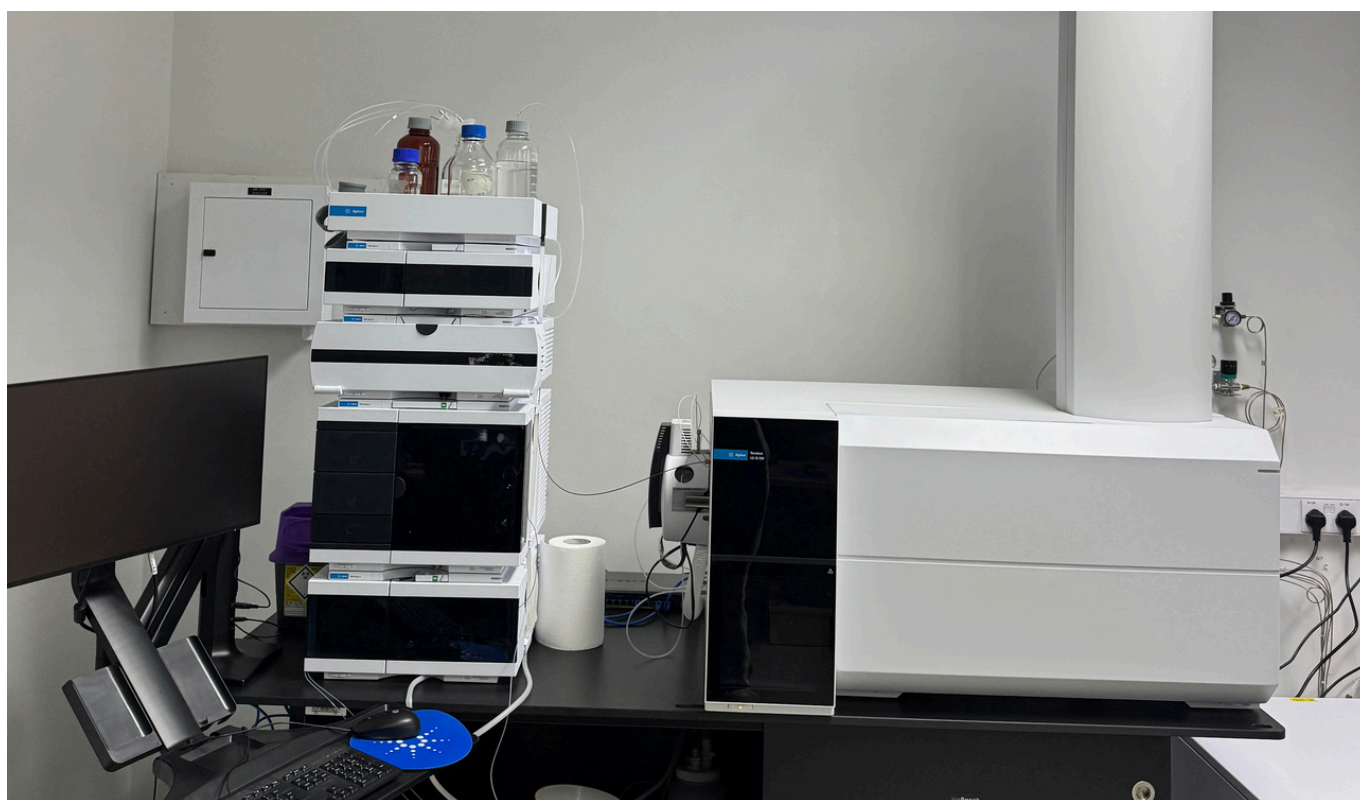


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In the context of the RIA4FOOD project, the department is responsible for investigating the health-promoting potential of sea buckthorn cultivars and processing methods in anticancer and anti-inflammatory models.



Its role is to identify biological effects and mechanistic signatures associated with sea buckthorn activity and to combine these findings with multi-omics datasets produced by other partners, thereby contributing to a holistic understanding of its functional value in cancer and inflammation.



NovaMechanics, within the RIA4FOOD project, leads the data analytics and predictive modelling activities. Specifically, it leads Task 1.4 (Metabolomics data analysis) and Task 1.5 (Sustainability algorithms linking fresh and osmotic sea buckthorn metabolic content to cultivation and processing conditions) under Work Package 1, focusing on the development and implementation of statistical and machine-learning analyses on metabolomics datasets, the identification of informative marker subsets, and the transformation of project data into predictive models that support interpretation and decision-making.



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## DATA ANALYTICS

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NovaMechanics also leads Task 3.5 (Development of a nutritional algorithm), in which metabolomic, bioinformatics, bioavailability, and epidemiological results are integrated into predictive nutritional algorithms. These activities are implemented through the Isalos Analytics Platform, which supports statistical analysis, clustering, regression, classification, and predictive model development, while the resulting trained models and tools are intended to be deployed as standalone, user-friendly web applications through the Enalos Cloud Platform.



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## Shaping the Future of Functional Food

RIA4FOOD continues to advance sustainable, science-driven innovation across Europe. From metabolic profiling and *in vitro* validation to functional food development and sustainability assessment, our partners are working together to transform research into real-world impact.

RIA4FOOD is building a data-driven framework for designing functional foods with scientifically validated health benefits and improved sustainability performance.

Together, we are bridging agriculture, biotechnology, computational modelling, and food innovation to create solutions that support healthier consumers and more resilient food systems.



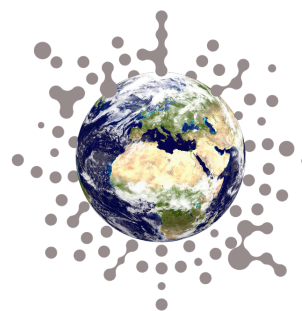
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