



## Metabolic Engineering & Systems Biology Laboratory @ FORTH/ICE-HT

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## ABSTRACT

The mission of Metabolic Engineering & Systems Biology Laboratory (MESBL) @ FORTH/ICE-HT in Patras is to carry out R&D in experimental & computational metabolic phenotyping and biomolecular network analysis in the context of systems and network biology and medicine. MESBL research focuses on: (i) the development and application of experimental and computational methodologies & tools for mass spectrometry-based metabolomics and fluxomics, (ii) multi-omic studies in systems biology, and (iii) mathematical modeling of metabolic and protein interaction networks. The main scientific directions of the lab are: 1. The development and standardization of experimental and computational protocols and workflows for untargeted mass spectrometry (MS) metabolomics in various biological contexts; 2. The reconstruction and modeling of metabolic and protein interaction networks aiming at a combined metabolic and protein network analysis framework; and 3. the standardization of multi-omic study workflows: from experimental design to consistent integration of multi-omic data through biomolecular network analysis and AI.

MESBL PI is Dr. M. Klapa and MESBL members are post-doctoral researchers, PhD candidates, Master's and senior undergraduate students, carrying out, respectively, their PhD, Master's or B.S/Diploma thesis research under the PI's co-supervision. MESBL hosts also undergraduates for short-term internships.

MESBL research and training activities belong to ICE-HT Research Area (RA) 3: Biosciences and Biotechnology, contributing to its (a) biosystems engineering & systems/synthetic biology, and (b) precision/network medicine and tissue engineering/regenerative medicine subdomains. MESBL has had significant contribution to the standardization of experimental and computational protocols for untargeted Gas Chromatography-Mass Spectrometry (GC-MS) metabolomics in various biological contexts and multi-omic studies in systems biology, and has established the FORTH/ICE-HT Mass Spectrometry Metabolomics Core Facility with numerous national and international collaborations. Through long collaboration with U. of Patras Medical School, MESBL has been involved in network medicine research and the development of a human and mouse protein-protein interaction meta-database of unique features, while recently extended the application of metabolic profiling and network analysis to tissue engineering/regenerative medicine through internal collaboration and with KU Leuven. MESBL represents (i) FORTH/ICE-HT, in 3 National Infrastructure structural funding projects, ELIXIR-GR (Bioinformatics) – coordinating the computational metabolomics and protein interactomics pilot study -, INSPIRED (Structural Biology) and EATRIS-GR (Translational Medicine); and (ii) FORTH, in the Board of the Greek Node of the European Infrastructure ELIXIR, MESBL Group Leader being the Technical Coordinator of the Node, in ELIXIR Metabolomics, Microbial Biotechnology and Systems Biology Communities, in Expert Center for Metabolomics – a consortium of European metabolomic laboratories in biomedical applications - (EXCEMET, since 2015), and in the European Metabolomics Infrastructure (EMI) Foundation (founding member since 2018).

In this poster presentation, we will show the major MESBL outcomes and achievements in 2018-2022, which include increased participation in national and European infrastructures & networks in life sciences, research achievements in biomedical research and in ecological restoration-biodiversity of the Metabolomics Core Facility through collaborative projects, significant results in systems and network biology research and involvement in H2020 projects for the standardized application of metabolomics & metabolic modeling in tissue engineering, cell therapy & nanotoxicity, shaping the strategic plans and future directions of the lab.