



# METΡΟΛΟΓΙΑ 2018

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### The Greek METROFOOD-RI Node as a milestone of the PRO-METROFOOD project

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### Abstract

The PRO-METROFOOD project was funded to accomplish the “Early Phase” of the METROFOOD-RI “Infrastructure for Promoting Metrology in Food and Nutrition.” The general objective of PRO-METROFOOD was to pave the way to the construction, implementation, operability and sustainability of METROFOOD-RI. The latter, is a European Research Infrastructure (RI) aiming at enhancing scientific excellence in the field of food quality and safety by promoting metrology in food and nutrition, allowing coordination on a European and increasingly on a global scale. In the frame of PRO-METROFOOD, Aristotle University of Thessaloniki (AUTH), and more specifically the Laboratory of Food Chemistry and Technology (LFCT), took the initiative to build up the Greek METROFOOD-RI Node to strengthen the participation of Greece in the project. In the present work, the particular strengths of the Greek Node and how the existing physical and electronic RIs that cover a wide range of analytical expertise are expected to

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integrate into the METROFOOD-RI objectives and support research and public needs in food analysis are highlighted.

*Keywords: PRO-METROFOOD, METROFOOD-RI, Research Infrastructures, Greek Node*

## Περίληψη

Το έργο PRO-METROFOOD «Progressing towards the construction of METROFOOD-RI» (GA n. 739568, <http://www.prometrofood.it>) αποτελεί την πρώιμη φάση (“Early Phase”) της ερευνητικής υποδομής METROFOOD-RI «Research Infrastructure for Promoting Metrology in Food and Nutrition» (<http://www.metrofood.eu>) που ανήκει στον Τομέα της Υγείας και των Τροφίμων (“Health and Food” domain). Σκοπός του παραπάνω έργου είναι η ενίσχυση της επιστημονικής αριστείας αναφορικά με τη γνησιότητα, ποιότητα και ασφάλεια τροφίμων μέσω προώθησης της Επιστήμης της Μετρολογίας στα Τρόφιμα και τη Διατροφή. Προκειμένου να υποστηριχθεί καλύτερα η Ελληνική Συμμετοχή στο METROFOOD-RI, δημιουργήθηκε ο Ελληνικός κόμβος (Greek Node) του METROFOOD-RI, με το ακρωνύμιο «METROFOOD-GR» με πρωτοβουλία του Αριστοτέλειου Πανεπιστήμιου Θεσσαλονίκης (Α.Π.Θ.) και συγκεκριμένα του Εργαστηρίου Χημείας και Τεχνολογίας Τροφίμων του Τμήματος Χημείας (EXTT). Σκοπός της παρούσας εργασίας είναι η παρουσίαση των φυσικών και ηλεκτρονικών υποδομών του Ελληνικού Κόμβου που καλύπτουν ένα ευρύ φάσμα και ενισχύουν την Ελληνική συμμετοχή στη δράση.

## 1. Introduction

METROFOOD-RI “Infrastructure for Promoting Metrology in Food and Nutrition” ([www.metrofood.eu](http://www.metrofood.eu)) is a European Research Infrastructure (RI) aiming at strengthening scientific knowledge, promoting scientific cooperation and encouraging the interaction between the various stakeholders, as well as at the creation of a common and shared base of data, information and knowledge. The general objective of METROFOOD-RI is to enhance scientific excellence in the field of food quality and safety by promoting metrology in food and nutrition, allowing coordination on a European and increasingly on a global scale. To achieve its goals, METROFOOD-RI consists of physical-RI and electronic-RI (e-RI) units.

In particular, the physical-RI is composed by analytical laboratories for the development and validation of new methods and devices and plants for the development, production, characterization and certification of novel reference materials as well as by experimental fields/farms/plants and kitchen lab for studying food quality, safety and authenticity.

The e-RI provide a new free access web platform to share and integrate information and data on availability of metrological tools for food analysis.

## 2. The PRO-METROFOOD project

METROFOOD-RI was listed as an “Emerging project” in the ESFRI Roadmap 2016, and during 2017 it undertook its “Early Phase” under H2020 INFRADEV-02-2016

project PRO-METROFOOD “Progressing towards the construction of METROFOOD-RI” (GA n. 739568, [www.prometrofood.it](http://www.prometrofood.it)) that ended on 31<sup>st</sup> December 2017. The respective timeline is presented in Figure 1.

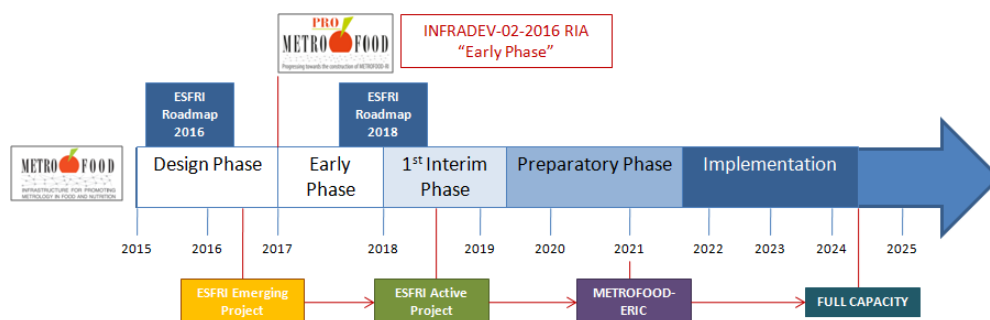


Figure 1. The METROFOOD-RI timeline.

The general objective of PRO-METROFOOD was to pave the way to the construction, implementation, operability and sustainability of METROFOOD-RI. Towards this direction, collaborations were sought and established not only at European level but also at national one. In this view, National Nodes were created inside some partner countries and specific agreements were signed by the interested parties. In particular, countries that currently have National Nodes are Italy, Greece, Slovenia, France, Czech Republic, Portugal, the Netherlands and FYROM. The Italian National Node is the largest one consisting of 11 institutes apart from ENEA, which is the Coordinator of the project. The second larger National METROFOOD-RI Node is the Greek one (i.e. METROFOOD-GR) consisting of seven different Institutes distributed all over Greece (Figure 2).



Figure 2: Distribution of the Institutes that participate to the Greek Node.

## 2.1. The Greek Node

Aristotle University of Thessaloniki (AUTH) and more specifically the Laboratory of Food Chemistry and Technology (School of Chemistry) took the initiative to build up the Greek Node of METROFOOD-RI. At a first stage, AUTH partnership was widened with the inclusion of four more Laboratories from various Schools of AUTH, i.e. Laboratory of Analytical Chemistry (School of Chemistry), Laboratory of Organic Chemistry (School of

Engineering), Pesticide Science Laboratory (School of Agriculture and Forestry) and Department of Food Hygiene and Technology of Food of Animal Origin (School of Veterinary Medicine). At a second stage, AUTH, joined forces with other Greek Institutes, namely Agricultural University of Athens (AUA), University of Ioannina (UoI), General State Chemical Laboratory (Independent Authority for Public Revenue, IARP), Hellenic Institute of Metrology (EIM), Hellenic Health Foundation (HHF) and CIHEAM Mediterranean Agronomic Institute of Chania (MAICh) in order to strengthen the Greek participation to the project.

The Greek Node, through the great variety of physical facilities that possesses, such as analytical laboratories and RM plants, will support the aims of METROFOOD-RI that include (a) serving a wide range of users (e.g. researchers, technicians, industries, consumer associations, citizens), (b) high-quality advanced training for academic and professionals and (c) dissemination actions for promoting educational activities addressed to consumers/citizens.

The analytical capacities of the Greek Node cover a wide range of topics related to “Food Safety” (e.g. allergens, mycotoxins, food contact materials etc), “Food Quality” (e.g. bioactive compounds, organoleptic properties, microbiological analysis etc), “Authenticity and Traceability” (e.g. metabolic profiles, elemental profiles, genetic markers etc), “Nutrition” (e.g. vitamins, fatty acids, minerals, water etc.), “Agrofood System” (e.g. soils and sediments characterization, bioavailability studies, air pollution etc) and “Materials” (e.g. plastic materials, ceramic materials and composites etc). In particular:

- AUTH: *Laboratory of Food Chemistry and Technology*: UHPLC, LC-DAD-Fluorescence Detection, semi-preparative HPLC, LC-RI, GC-MS, GC-FID-Olfactometry SPME, FT-MIR (ATR, Drift), LC-DAD-MS (single quadropole), liquid state NMR (500 MHz), nano-spray-dryer, UV-vis spectrophotometers, fluorimeter, Rancimat, Abencor extraction system, laminar flow clean bench, autoclave sterilizer, colony counters, cell culture media, Laboratory of sensory analysis, lyophilizer, rotary evaporator; *Laboratory of Analytical Chemistry*: HPLC-DAD, F-AAS, ET-AAS, CV-AAS, ICP-OES, IC-ICP-AES, UV-Vis spectrometers, technical balance, analytical balance, centrifuge, ultracentrifuge, ultrasound bath, SPME; *Laboratory of Organic Chemistry*: LC-MS/MS, GC-FID, extractors, scale up procedures, extraction and isolation equipment, sonication baths, equipment for preparation of pharmacotechnical formulations, NMR 600 (and solid state), XRD, particle sizer, Z-sizer, RAMAN, FT-IR, SEM, Fluorescence microscope, DSC, Thermogravimetric analyzer (TGA), laminar flow clean bench, CO<sub>2</sub> Incubator / Cell Culture Incubator, analytical balance, freezer (-80 °C), centrifuge, ultracentrifuge, grinder, sieve, mixer, lyophilizer, spray dryer, rotary evaporator, SPME, melting point measurement; *The Pesticide Science Laboratory*: HPLC, LC-DAD, LC-MS/MS, GC-MS/MS, GC-NPD/FID, GC-ECD/FID, QTOF LC-MS/MS, Headspace GC-MS/MS, IRMS, Realtime PCR, Hyperspectral camera, UV-Vis spectrometers, laminar flow clean bench, autoclave sterilizer, Compound Microscope, Compound Light Microscope, technical balance, analytical balance, oven, centrifuge, ultracentrifuge, heating bath, ultrasound bath, rotary evaporator, incubators, SPME, walk-in cold room, soil and water samplers; *Department of Food Hygiene and Technology of Food of Animal Origin*: HPLC, GC, UV-Vis spectrophotometers, Fluorescence microscope, PCR cyclers, laminar flow cabinet, electrophoresis apparatus, autoclave sterilizer, antimicrobial susceptibility tests, colony counters, cell culture media, CO<sub>2</sub> Incubator / Cell

Culture Incubator, Compound Microscope, Compound Light Microscopes, Microbial Identification System, autoclave, incubators, controlled atmosphere systems, technical Balance, analytical Balance, Freezer (-80 °C), Centrifuge, Ultracentrifuge, Rotary evaporator, stomachers, blenders

- **AUA:** *Laboratory of Dairy Research:* HPLC, FPLC, GC-MS, Atomic absorbance, Milscans, FoodScan, Proteomics full system, Flow cytometry, Electrophoresis, PCR, Microscope fluorescence, Incubators, Laminar flow, Centrifuges, Autoclaves, Deep freeze, Freeze drier, Speed Vac, Ultrasound, Bead Beater and all the small basic equipment, i.e. scales, pH meters, stirrers; *Laboratory of Food Chemistry and Analysis:* HPLC-DAD, HPLC-FL, HPLC-RI, GC-MS, GC-FID, GC-ECD, GC-NPD, UV-Vis spectrometer, Headspace analyser and Purge & Trap device, Ion Chromatograph, TLC applicator, automatic biochemical analyser, Bone Density and Human Body Measurement System (DEXA), Rancimat, Thermal cycler-PCR, freeze-drying unit, osmometer, Kjeldahl distillation apparatus and centrifuges, ultrasonic-water baths, ovens for moisture and ash analysis; *Laboratory of Chemistry:* HPLC/DAD/RI, LC/MS, LC/QTOF, GC/MS, GC/MS-MS, UV-Vis, FT-IR, Raman, Fluorometer, Microtox, ICPMS, F-AA, Freeze Dryer, Centrifuge, ball mill, US-Bath etc; *Laboratory of Food Process Engineering:* Lab bench top electrospinning device, jet mill for micro grinding, high pressure homogenizer, ultrasonic homogenizer, hybrid rheometer, particle size measurement of fine particles through dynamic light scattering, phase separation measurement apparatus through multiple light scattering at NIR, image analysis software, DSC, chromatometer/spectrophotometer, water activity apparatus and instruments for the measurement of density (porosimeter etc), freeze drier, drying ovens, analytical screens.
- **EIM:** EIM is the National Metrology Organization of Greece and the official advisor of the Greek State in the fields of metrology and calibration. It realizes the primary electrical, physical and mechanical standards related to the units of the SI system and provides traceability to organizations, institutes and companies in Greece and abroad calibrating their high accuracy equipment. It's scientific personnel has a high-level expertise in metrology, calibration techniques, measurement data analysis, inter-laboratory comparisons and quality management systems, according to international standard requirements. EIM has 18 years of experience in international committees ([www.euramet.com](http://www.euramet.com)) and projects representing the country in the field of metrology. In addition, it has a high-level expertise in matters of standardization and accreditation on the systems ISO 9001, ISO 17025 and has provided consulting services to national companies in Greece and abroad.
- **HHF:** HHF has its own servers and network infrastructure. It is protected with a Cisco firewall and all of 40 local stations have access to network printers, scanner and fax. A RAID-6 NAS holds all data and it is replicated daily to another storage server at a remote location. Remote connections to the server, allows users to work outside of the office. Statistical analyses are made with SAS and STATA software. Custom-made software is developed and used for a number of tasks concerning data collection mainly. HHF maintains blood samples of more than 28,000 Greek participants of the EPIC study, stored in four 600 lit tanks under liquid nitrogen (-196 °C), as well as in five deep freezers of 1 kw at -80 °C. The Foundation also

hosts blood samples of about 4000 residents of Greece in the context of the HYDRIA project, kept in three deep freezers at -80 °C.

- **IAPR:** *Chemical Metrology Service:* HR-ICP-MS, LC-MS/MS, GC-IT-MS, FT-IR (ATR and SR accessories) coupled to a Thermo Centaurus microscope, FT-Raman coupled to a LEICA DM/LM microscope, microwave digestion ovens and homogenizers (IKA), clean room available for the production of reference materials equipped with mixing and milling equipment, spray dryer and lyophilizer; *Food Contact Materials Lab:* It is also the NRL for the particular kind of analytical determinations. It is equipped with GC-MS, HPLC DAD/FLD, XRF, XRD, FT-IR spectrometer, high-speed milling unit, fully automated accelerated solvent extraction system.
- **MAICH:** *Laboratory of Analytical Chemistry & Chemistry of Natural Products* accredited since 2003 by the Hellenic Accreditation System – ESYD, according to the standard ELOT EN ISO 17025:2005 for some analyses it performs in oils, honey and drinking water, and is active in the steady supply of analytical services to third parties; *Plant Virology & Microbiology Lab:* ELISA, immunoprinting, western blot, RT-PCR and its variations, laboratory assays for the identification and characterization of a variety of other economically important phytopathogenic viruses, both in plants and in propagative material, are also available subject to consultation; *Laboratory of Soil Science and Plant Diagnostics:* modern, state-of-the-art facilities that allow the performance of advanced chemical and physico-chemical analysis of the soil, plant tissue, irrigation water and compost.
- **UOI:** *NMR Center:* a Brüker AV-250 spectrometer, a Brüker AV-400 spectrometer with the capability of obtaining CW photo-chemically induced dynamic nuclear polarization (CW photo-CIDNP) NMR, and a Brüker AV-500 spectrometer hyphenated with an LC-SPE system (equipped with a solvent delivery pump, a DAD UV detector and a solid phase extraction (SPE) unit. The AV-500 is equipped with a cryogenic platform and a cryo TXI-probe head. All spectrometers have probes that are optimized for <sup>1</sup>H NMR applications and probes that are capable of multinuclear detection. Three workstations are available to the users for data manipulation with the Topspin suite and the AMIX-Aurelia suite.

### 3. Future plans

Currently, METROFOOD-RI concluded its “Early Phase” through PRO-METROFOOD project and has been submitted to be included in the ESFRI Roadmap 2018 (Preparatory Phase). In the Interim Phase, National Nodes are expected to strengthen links at a national level in order to be ready to address the challenges of the preparatory phase at national, European and global level.

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