



H.F.R.I.
Hellenic Foundation for
Research & Innovation

Description of the funded research project
1st Call for H.F.R.I. Research Projects to Support Faculty
Members & Researchers and Procure High-Value
Research Equipment

Title of the research project:
Innovative immobilized functional starter cultures: Characterization and application in production of novel foods with health-promoting potential using agricultural wastes-iFUNcultures

Principal Investigator:
Ioannis Kourkoutas, Associate Professor

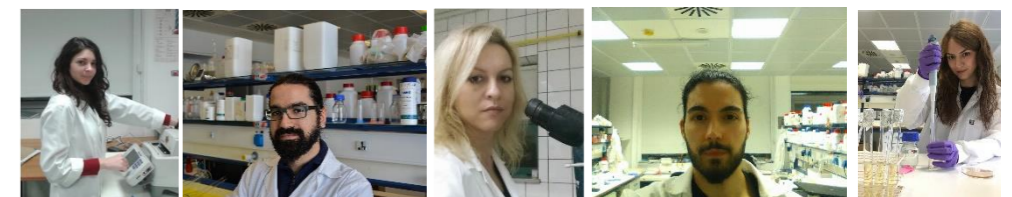
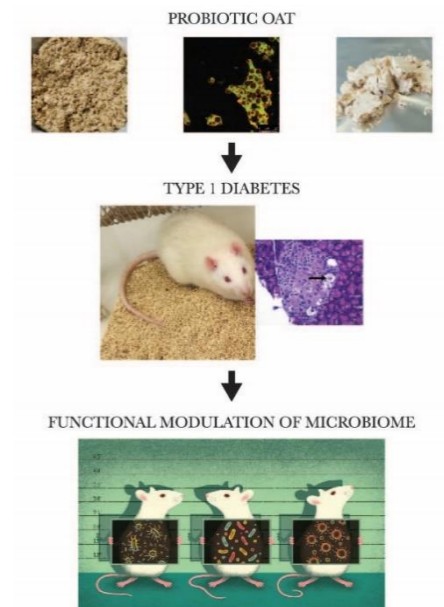
Reader-friendly title:
Functional immobilized cultures for the production of novel health-promoting foods

Scientific Area:
Food Sciences and Technology

Host Institution:
**Department of Molecular Biology & Genetics,
Democritus University of Thrace**

Collaborating Institution(s):
1) Biomedical Research Foundation of the Academy of Athens
2) Harokopio University
3) Faculty of Biology, University of Bucharest

Project webpage
www.ifuncultures.gr



Budget: 170,000 €

Duration: 36 months

Research Project Synopsis

Nowadays, there is a growing interest in developing novel foods enriched with beneficial microorganisms, prebiotic fibers and proteins that promote human health, such as the restoration of gut microbiome in metabolic diseases. At the same time, the need to utilize "bio-wastes" for the production of high value added products is considered imperative, mainly due to the problems associated with their disposal, but also issues related to economic development and circular economy.

In this context, the iFUNcultures project aims to exploit agro-industrial and food wastes as substrates for the cultivation of functional cultures, as well as to isolate prebiotic dietary fibers and/or proteins that will be used as immobilization supports of beneficial microorganisms. The goal is to further assess the immobilized cultures as functional ingredients for the development of novel foods with potential health effects, targeting regulation of the intestinal microbiome in Type 1 Diabetes mellitus (T1D).

Thus, the project aims are:

1. The isolation of presumptive beneficial microbial cultures from Greek traditional products and the *in vitro* evaluation of their functional properties.
2. The assessment of the suitability of agricultural and food wastes as potential substrates for growth of functional cultures and for the isolation of prebiotic dietary fibers and/or proteins.
3. The development of technologies for the incorporation of immobilized functional cultures on prebiotic dietary fibers and/or isolated proteins in various foods.
4. The *in vitro* and *in vivo* evaluation of cell survival of the immobilized functional cultures during passage through the gastrointestinal tract and adhesion to the intestinal epithelium.
5. The assessment of the activity of the functional cultures against pathogenic biofilms.
6. The *in vivo* study of the effect of the dietary intervention with functional ingredients/foods on the intestinal microbiome in healthy and T1D animal models.
7. Management of intellectual property rights, cost-benefit analysis, elaboration of a feasibility study and investment plan and maximum possible dissemination of scientific results.

Project originality

The last decades, the incidence of T1D has dramatically increased in developed countries. Beyond the genetic impact, environmental factors, including diet, seem to play an important role in the onset and the development of the disease. The intestinal microbiome might affect the interaction between the GI tract and the immune system and result in altered immune responses, affecting the development of T1D. Thus, the restoration of the normal microbiota composition constitutes a new target for the prevention and management of the disease.

At the same time, the need for efficient and sustainable exploitation of by-products and residues of the agro-food sector for high added value products is urgent and critical, as FAO estimates that 1/3 of all food produced for human consumption is wasted, amounting to 1.3 billion tons losses per year.

In this vein, iFUNcultures project constitutes an advanced technological contribution to the current state-of-the-art, exploiting major agro-industrial and food wastes through the development of new marketable functional food ingredients, suitable for production of a series of health-promoting novel foods, targeting gut microbiome modulation in T1D condition. The project is in line with the EU priorities for waste and natural resources and the specific national target for maximizing the recovery of materials and energy from residues through the development of technologies for wastes exploitation.

Expected results & Research Project Impact

The **direct expected results** are:

- (a) Marketable "ready-to-use" dried immobilized beneficial cultures on prebiotic dietary fibers and/or proteins to be used as functional food ingredients, and
- (b) Novel food products with prolonged shelf-life, enhanced microbial safety and beneficial health effects, targeting maintenance of intestinal microbiome balance in T1D melitus and aiming at TRL 4 (technology readiness level).

The **general benefits** of the research project are summarized in:

- (i) **Impact on science.** The project will demonstrate clear achievement of unsurpassed knowledge on one of the most important priorities for the entire EU, namely innovative and safe food products with a positive impact on human health.
- (ii) **Impact on economy.** It is estimated that the scientific results and their industrial applications will create new job positions in science and industry, contributing to decrease of the unemployment rate and sustainable economic growth.
- (iv) **Impact in society.** The potential health-promoting properties of the novel functional food ingredients and products are expected to have a remarkable beneficial impact on public health and quality of life. Understanding the gut microbiome/foods interaction is estimated to significantly contribute to the design of properly-designed dietary patterns tailored to specific needs.
- (v) **Impact on the environment.** Exploitation of high amounts of agro-industrial and food wastes, which are difficult to dispose of or treat, as cultivation media for beneficial microorganisms and as immobilization supports of functional cultures, is expected to create a high added value in the Greek and European food Industry, leading to the development of economically feasible, marketable and environmentally-friendly processes and applications.

The importance of this funding

Through the funding from H.F.R.I., the research group and the involved Research Institutions, in addition to promotion of scientific knowledge and research activity for the development of innovative products, are also focusing at the commercial utilization and exploitation of the results, mainly through royalties or licensing, providing a successful example on how innovation can contribute to the transformation of the Greek economy into a *knowledge-driven economy*.



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