

## Fostering innovations in the Agri-Food Sector

A research infrastructure to explore the potential of food biotechnology

**Thursday 18 November 2021**

**Online workshop**



# Innovations in Food Bioprocessing Workshop Programme

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Organised by: Food Biotechnology Group

**FOOD INNOVATION RI** develops and provides services that will enhance the innovation capacity of companies, research centres and public bodies of the agri-food sector



To put science at the heart of societal and economic development, we need to devise strategies to push the limits of science in order to promote innovation, tackle societal challenges and deliver big results. In Europe, one such strategy is the development of research infrastructures - organizations that enable the research community to use specific facilities, resources and services, thus fostering collaboration between scientists from different countries, economic sectors, research fields, and institutions.

FOOD INNOVATION RI is a distributed national research infrastructure of Greece that aims to support research, education and innovation of the agri-food sector by implementing breakthrough research and providing access to first class facilities, knowledge and advanced services to researchers and professionals from the academic, domestic and industrial sector.

Going through its preparatory phase, it combines the facilities, knowledge and experience of high-quality research groups from 7 Universities of Greece with a complementary scientific background including food chemistry, biochemistry, microbiology, genetics, nutrition and biotechnology.

FOOD INNOVATION RI was included in the National Roadmap for Research Infrastructures in Greece in November 2016 and, two years later, initiated its activities in the city of Patras. It consists of research groups and laboratories from the University of Patras, which stands as the Central Hub, and from 6 Research Organisations of Greece operating as interlinked regional nodes. These Organisations are the University of Ioannina, the Agricultural University of Athens, the Harokopio University of Athens, the Aristotle University of Thessaloniki, the Democritus University of Thrace and the Ionian University.

Thursday 18 November 2021



# Innovations in Food Bioprocessing Workshop

**Chair:** Vasilis Panagopoulos, PhD student, Food Biotechnology Group, Greece

09:30-09:35

Opening remarks

09:35-10:05

Presentation of FOOD INNOVATION RI and innovations in brief

10:05-10:35

Demonstration Plants

10:35-11:50

Matured Technologies

11:50-12:10

Break

12:10-13:25

New Technologies

13:25-13:55

Nano-Technologies

13:55-14:00

Closing remarks



## 09:30-09:35 Opening remarks

**Maria Kanellaki,**  
Professor,  
Department of Chemistry, University of Patras, Greece

## 09:35-10:05 Presentation of FOOD INNOVATION RI and innovations in brief

**A.A Koutinas,**  
Professor Emeritus,  
Department of Chemistry, University of Patras, Greece

## 10:05-10:35 Demonstration Plants

### 10:05-10:20 Starter Culture Production of Multiple Application Using Whey

This technology concerns the production of a starter culture (kefir in this case) which can have multiple applications in the food industry. Whey, which is the main waste of the dairy industry, will be used as a raw material. The produced kefir culture will be dried and after its packaging it can be used as

- (i) bakery yeast,
- (ii) as a protein-rich feed for animal feed for milk and meat production,
- (iii) as an starter culture for cheese maturation,
- (iv) for fermenting milk for the production of kefir and
- (v) for alcoholic fermentation of whey.

**Agapi Dima,**  
Post-Doctoral Researcher,  
Food Biotechnology Group, Greece

### 10:20-10:35 Wine Making at Extremely Low Temperatures

This technology concerns wine making at the extremely low temperature fermentation (4°C) of grape must. The process is designed to be performed in batch and/or continuous mode using encapsulated cells in delignified tubular cellulose (TC) produced after delignification of lignocellulosic biomass. The innovative characteristics of technology are (i) the wine making at 4°C, (ii) the continuous fermentation, (iii) the use of tubular cellulose supported biocatalyst, (iv) the improvement of wine quality just after fermentation, (v) possible avoidance of sulfur dioxide, (vi) no additionally fining method needed. Furthermore, (vii) bottling just after fermentation, (viii) reduction of the size of the factory, (ix) reduction of investment and production cost.

**Konstantina Boura,**  
Post-Doctoral Researcher,  
Food Biotechnology Group, Greece

## 10:35-11:50 Matured Technologies

### 10:35-10:50 Cold Pasteurization

A nano/micro-porous cellulosic material (Tubular Cellulose, TC) produced after delignification of wood sawdust acts as filter in a packed column. The increase of the length of the TC filter increased the microbial load removal by attachment of cells on the TC surface. In the case of wine, the packed-bed bioreactor was supplied with white or red wine contaminated with *Saccharomyces cerevisiae* or *Acetobacter pasteurianus*, respectively. The microbial load removal remained constant to 97-100% for a long period, with few required filter regenerations which were done by washing with hot water (70-80°C).

**Maria Kanellaki,**  
Professor of Food Chemistry and  
Biotechnology,  
Department of Chemistry,  
University of Patras, Greece

## 10:50-11:05 Wine Making in Domestic Refrigerator

In the present study, a techno-economic analysis of the powder production process that will be used to produce high-quality wine in domestic refrigerators is carried out. Firstly, the composition of the flowchart will be presented and the type and size of the mechanical equipment of the process will be evaluated. Moreover, an economic analysis of the overall process, which includes the estimation of fixed capital cost (FCI), cost of direct labor (COL), cost of raw materials (CRM) and cost of ancillary benefits (CUT) will be presented, as well as a pre-paid cash flow study (DFC analysis) in order to find the minimum selling price (MSP) of the final product. Finally, the effect of annual capacity on MSP / 250 gr of final product is investigated.

**Andreas Deskali,**  
Post-Doctoral Researcher,  
**Chemical Engineer, Greece**

## 11:05-11:20 Brewing in Domestic Refrigerator

Development of a powder-based product enabling brewing at low temperature in a domestic refrigerator using yeast immobilization technology. Freeze-dried wort and immobilized cells of the cryotolerant yeast strain *Saccharomyces cerevisiae* AXAZ-1 on tubular cellulose (TC) were used. A high-quality beer was produced with low diacetyl concentration, improved polyphenol content, aroma profile and clarity. The proposed technology for beer production in a domestic refrigerator can easily be commercialized and applied by dissolving the content of two powder-bags in tap water; one bag containing dried wort and the other dried immobilized cells on TC suspended in tap water.

**Iris Plioni,**  
Post-Doctoral Researcher,  
**Food Biotechnology Group, Greece**

## 11:20-11:35 Continuous Brewing at Extremely low Temperatures

This technology is based on published results obtained through laboratory experimental work. The principle of this technology is based on extremely low temperature fermentations of wort, performed by immobilized cells of the strain AXAZ-1 in tubular cellulose (TC). Extremely low temperature fermentations have resulted to improvement of quality of the beer. This improvement has been proved by the reduction of higher alcohols, increase of esters analyzed via GC-MS, significant reduction of diacetyl, bitterness and on colour and clarity of beer.

**Magda Soupioni,**  
Associate Professor,  
**Food Biotechnology Group, Greece**

## 11:35-11:50 Continuous Milk Coagulation in a Filter of Encapsulated rennin in Tubular Cellulose

A novel process has been developed and validated for the production of coagulated milk for cheese production. It is based on low volume bioreactors containing encapsulated rennin in a TC/SG composite matrix (TC-nano/micro tubular cellulose, SG-starch gel). For the validation of the system, a scale up production with a 10L and 50L bioreactors provided valuable data for the efficiency of continuous milk coagulation. The advantages of the technology include among others the accelerated maturation, the reusability of the system and biocatalysts and the reduction of investment cost for a cheese production facility.

**Loulouda Bosnea,**  
Researcher,  
**Hellenic Agricultural Organization-  
Demeter, Greece**

## 11:50-12:10 Break

## 12:10-13:25 New Technologies

### 12:10-12:25 Probiotic Feta Type Cheese Production Using Kefir Starter Culture

Probiotic foods gain more and more ground due to their many beneficial properties for human health, and innovative probiotic foods are preferred for their benefits over traditional foods. So, the purpose of this investigation was the production of probiotic feta type cheese using kefir starter culture during its production. A comparison of its physicochemical and microbiological characteristics with a control cheese was conducted and the results were quite promising.

**Dimitra Dimitrellou,**  
Assistant Professor,  
**Ionian University, Greece**

### 12:25-12:40 Probiotic Yogurt Production Using Kefir Starter Culture

In recent years there has been great interest in so-called probiotic foods. Probiotic foods contain live cultures of various microorganisms and their consumption has multiple benefits. This technology concerns the production of probiotic yogurt using kefir. Kefir is usually used for the preparation of beverages. To produce of yogurt in a laboratory setting, free cells of kefir were used as well as kefir immobilized in banana chips with promising results.

**Archontoula Kalogeropoulou,**  
Researcher,  
**Food Biotechnology Group, Greece**

### 12:40-12:55 New Technology for Sparkling Wine Making

This is a novel method of sparkling wine making by using a new biocatalyst from commercial wine. Cells from an alcohol resistant and cryotolerant strain of *Saccharomyces cerevisiae*, were immobilized on tubular cellulose, covered with starch gel and freeze dried creating a composite biocatalyst. The biocatalyst and sugars from rectified concentrated grape must were added into commercial dry white wine 11.5 % v/v and were left for fermentation. On opening, carbon dioxide escaped from the wine and the characteristic sound was noticed.

**Vasilis Panagopoulos,**  
PhD student,  
**Food Biotechnology Group, Greece**

### 12:55-13:10 Natural Antimicrobial Compound from Aniseed for Preservation of Tomatoes Industrial Products

Over the last decade there is an increasing tendency for the replacement of conventional preservatives and synthetic chemicals, with natural materials from plant sources. Aniseed is a very versatile plant widely used in food and beverage industry, as flavoring-agent and natural preservative. The fractionated aqueous extract of aniseed was used as flavor enhancer and studied for the effect on self-life of tomato juice compared to juices containing Sodium benzoate, a synthetic chemical widely used in food industry and preservative-free juices.

**Christos Bontzolis,**  
PhD student,  
**Food Biotechnology Group, Greece**

## 13:10-13:25 **An Innovative Brewing Technology to Reduce Substantially Investment and Production Cost**

The principle of this novel technology is based on the development of an innovation in brewing industry by eliminating the malting stage, as less energy, production time and costs are expended. For this technique, two different cell factories (CFs) consisting of immobilized cells on processed cellulose, were created for the consolidated bioprocess of barley starch in one bioreactor. The results indicated that the objective of designed CFs were successfully performed, and the results of barley starch fermentation are very promising for industrial beer making.

**Thanos Drosos,**  
PhD student,  
**Food Biotechnology Group, Greece**

## 13:25 - 13:55 **Nano-Technologies**

### 13:25-13:40 **Carbohydrate Nano-Tubes Production for Drug Delivery**

The production of carbohydrate nano-tubes (CHNTs) using cellulose from available and free of cost agricultural wastes is proposed in this investigation. Four lignocellulosic raw materials were tested, from which corncob has been found most productive for the purpose of this project. These nano dimensions of CHNTs have suitability as an effective drug-delivery system, with easy and safer transmission in human-body, with no concerns for toxicity of carrier-material.

**Theano Petsi,**  
Permanent Post Doc,  
**Food Biotechnology Group, Greece**

### 13:40-13:55 **Chemical Preservative Delivery in Meat and Juices using Nano and Micro Tubular Cellulose**

The quality and safety of foods such as meat and juices are assured mainly through heat treatments and chemical preservatives. In the present study, the reduced use of chemical preservatives in meat and orange juice is proposed by using encapsulated potassium nitrite (KON2) and sodium benzoate (SB) in tubular cellulose (TC), derived from edible sources. Then, controlled delivery of the two preservatives in meat and orange juice was performed with encouraging results as a limited release of preservatives was observed in both products the preservatives maintained their effectiveness.

**Sissy Panitsa,**  
PhD student,  
**Food Biotechnology Group, Greece**

### 13:55-14:00 **Closing remarks**

**A.A Koutinas,**  
Professor Emeritus,  
**Department of Chemistry, University of Patras, Greece**

# Speaker and Chair Biographies

**Christos Bontzolis,**  
**PhD student,**  
**Food Biotechnology Group, Greece**

Chemical Engineer, MSc student in Quality Assurance, Ph.D. candidate in Food Biotechnology. His research interests are focused on bioactive compounds extraction and identification, natural antimicrobials, antimicrobial susceptibility testing, physical and chemical separation methods, air pollution control and management.

**Loulouda Bosnea,**  
**Researcher,**  
**Hellenic Agricultural Organization**  
**-Demeter, Greece**

She graduated from the Department of Agriculture of Aristotle University of Thessaloniki. In 2000, while in 2009 he obtained a PhD from the Department of Chemistry of the University of Patras. She is a Researcher in ELGO -DEMETER, in the Institute of Technology of Agricultural Products, Dairy Department. Her research interests include Dairy technology; Dairy microbiology; probiotics; Fermented food technology; fermentation processes and bioprocesses.

**Konstantina Boura,**  
**Post-Doctoral Researcher,**  
**Food Biotechnology Group, Greece**

Chemist, MSc In Medicinal Chemistry: Drug Discovery and Design, Ph.D., Post-doctoral Researcher. Her research interests are focused on fermentation; cell factories; wine making; immobilized biocatalysts; processing; whey exploitation; utilization and analysis of food by-products.

**Andreas Deskali,**  
**Post-Doctoral Researcher,**  
**Chemical Engineer, Greece**

Chemical Engineer; Post-Doctoral Researcher. His research interests are focused on Bio-process design; Techno-economic evaluation; risk assessment.

**Agapi Dima,**  
**Post-Doctoral Researcher,**  
**Food Biotechnology Group, Greece**

Chemist, M.Sc. in Food Biotechnology, Ph.D., Post-doctoral Researcher. Her research interests are focused on fermentation; cell factories; wine making; immobilized biocatalysts; processing; utilization and analysis of food by-products.

**Dimitra Dimitrellou,**  
**Assistant Professor,**  
**Ionian University, Greece**

Dr. Dimitrellou possess Bachelor in Chemistry, Bachelor in Food Technology, M.Sc. in Food Biotechnology, M.Sc. in Environmental Analysis, M.A. in Continuing Education and Lifelong Learning and Ph.D. in Chemistry. She also possesses Diploma in Oenology. She is an Assistant Professor in the Department of Food Science and Technology in the Ionian University. Her research interests include Milk technology; Dairy technology (cheese, yogurt, ice-cream, and fermented milk products); Development of novel dairy products with improved properties; Probiotics and prebiotics in dairy products; Evaluation of traditional dairy products; Valorization of whey. In addition, her research interests also include other foods like Bread, Fermented alcoholic beverages (wine, beer, etc.), Meat products, Valorization of food industry wastes, etc.

**Thanos Drosos,**  
**PhD student,**  
**Food Biotechnology Group, Greece**

Chemist, MSc In Medicinal Chemistry: Drug Discovery and Design; Pharmacist and Ph.D. candidate in Food Biotechnology. His research interests are focused on Cell Factories; fermentation; immobilized biocatalysts; bacterial cellulose and tubular cellulose.

**Archontoula Kalogeropoulou,**  
**Researcher,**  
**Food Biotechnology Group, Greece**

Chemist, MSc in Analytical Chemistry and Nanotechnology, Researcher. Her research interests are focused on Cell Factories; fermentation; immobilized biocatalysts; food analysis.



# Speaker and Chair Biographies

**Maria Kanellaki,**  
**Professor,**  
**University of Patras, Greece**

Professor Maria Kanellaki obtained her diploma in Chemistry in 1977 and her Ph.D. in 1983 from the Department of Chemistry, University of Patras (UP). She is member of the Food Biotechnology Group of the Department of Chemistry, UP, International Forum on Industrial Bioprocesses (IFIBiop Forum, former ICBF). She has coordinated 7 research/educational funded projects and participated in 18. She has acted as reviewer in many peer review scientific journals and she is co-author of more than 156 research publications in international journals (more than 2300 citations and 34 h-index) including 4 patents as also 6 chapters in books. She has participated in many national and international conferences and has open international collaborations with at least 5 Universities from different countries. She is Coordinator of the "Research Infrastructure on Food Bioprocessing Development and Innovation Exploitation – Food Innovation RI" - ΕΠΑΝΕΚ 2014-2020 [Greek State/EU; code 5027222; 3000000 €].

**A.A Koutinas,**  
**Professor Emeritus,**  
**University of Patras, Greece**

Emeritus Professor Koutinas Athanasios promoted successfully from the post of Lecturer to Full Professor and now is active Professor Emeritus of Food Biotechnology in the Department of Chemistry, University of Patras, Greece. He has published 206 papers in international journals, 6 patents, 5 books of which 4 textbooks for students, 13 chapters in books, 128 presentations in International conferences and 39 in National, more than 5000 citations and h-index 37. Supervised 21 PhD Graduates and from the Food Biotechnology Group established and headed by him, graduated 32 PhD and about 50 MSci scientists. Presented three technologies in Innovation conference held in Washington DC, June 18-21, 2015 of which one achieved award. Professor Koutinas invited to teach Graduate courses by Universities in Portugal, Spain and Poland in the fields of GMO Foods, Dairy Technology and DNA Economy. His research has been funded by about 6.000.000 Euros total budget including companies budget of consortia. He is vice-Coordinator of the "Research Infrastructure on Food Bioprocessing Development and Innovation Exploitation – Food Innovation RI" - ΕΠΑΝΕΚ 2014-2020 [Greek State/EU; code 5027222; 3000000 €].

**Vasilis Panagopoulos,**  
**PhD student,**  
**Food Biotechnology Group, Greece**

Chemist, MSc in Analytical Chemistry and Nanotechnology, Ph.D. candidate in Food Biotechnology. His research interests are focused on Cell Factories; fermentation; immobilized biocatalysts; bacterial cellulose and tubular cellulose; oenology; whey exploitation.

**Sissy Panitsa,**  
**PhD student,**  
**Food Biotechnology Group, Greece**

Chemist, MSc in Analytical Chemistry and Nanotechnology, Ph.D. candidate in Food Biotechnology. Her research interests are focused on Carbohydrate Nano-Tubes; Drug Delivery; Chemical Preservative Delivery.

**Theano Petsi,**  
**Permanent Post Doc,**  
**Food Biotechnology Group, Greece**

Chemist, Ph.D. Laboratory Teaching member staff in Department of Chemistry, University of Patras. Her research interests are focused on heterogeneous catalysis; interfacial chemistry; catalyst and biocatalyst preparation for various processes and bioprocesses.

**Iris Plioni,**  
**Post-Doctoral Researcher,**  
**Food Biotechnology Group, Greece**

Chemist, MSc in Synthetic Chemistry, Ph.D. Post-doctoral, Researcher focuses on fermentation; cell factories; brewing; immobilized biocatalysts; processing, biorefineries.

**Magda Soupioni,**  
**Associate Professor,**  
**Food Biotechnology Group, Greece**

Associate Professor Magdalini Soupioni studied at the Department of Chemistry of the University of Patras from where she graduated in 1979, while obtaining the title of Doctor of Chemistry at the Department of Chemistry of the University of Patras in 1987. She was elected Lecturer at the Department of Chemistry of Patras between 1988-1998 while between 1998-2016 she was elected Assistant Professor in the same Department. From 2016 until today she was elected to the position of Associate Professor. He was a fellow of the EU ERASMUS program. for transfer to European Universities (Germany, Belgium, Cyprus). He also received a scholarship from the DAAD (DEUTSCHER AKADEMISCHER AUSTAUSCHDIENST) for summer German language courses in Germany and the State Scholarship Foundation (IKY) in each year of university studies, due to good grade performance. Teaching students in the courses "General Chemistry", "Nuclear Chemistry", "Food Chemistry" at undergraduate and postgraduate level. She has 31 publications in international scientific journals (Scopus:> 339 citations and h-index 11), including 6 book chapters.

# NOTES

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*We acknowledge support of this work by the project "Research Infrastructure on Food Bioprocessing Development and Innovation Exploitation – Food Innovation RI" (MIS 5027222), which is implemented under the Action "Reinforcement of the Research and Innovation Infrastructure", funded by the Operational Programme "Competitiveness, Entrepreneurship and Innovation" (NSRF 2014-2020) and co-financed by Greece and the European Union (European Regional Development Fund).*



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