

Sustainable Development of functional foods and nutraceuticals from marine side streams for Cardiometabolic Health

Project Outline

This project will examine how bioactive ingredients recovered from marine side-streams can be used in the development of functional marine foods and nutraceuticals with potential relevance to cardiometabolic health. It responds to two linked challenges in the food sector: the need to make better use of processing by-products and the need to develop foods that offer added nutritional and health value. Recent work in the marine field shows that side-streams (e.g. fish heads) can provide useful compounds, including functional omega-3 fatty acids and other lipids, that may be incorporated into marine products to improve nutritional quality while supporting more sustainable production systems.

The study will focus on side-streams from selected marine processing systems with good potential for fish industry's applications. These materials will be chosen based on availability, safety, sustainability value, compositional potential, and relevance to industrial use. Particular attention will be given to side-streams that can yield bioactive-rich fractions suitable for use in marine matrices and relevant to cardiometabolic health. This direction builds on published work from the host group, which has shown that side-stream-derived ingredients can support the design of more sustainable and potentially functional marine foods and nutraceuticals within a circular food system approach.

The work will be organized in four stages. First, a set of promising side-streams will be identified and prioritised. Second, appropriate green or food-compatible extraction methods will be applied to recover the target bioactive fractions, followed by chemical characterisation and assessment of their stability and suitability for food use. Third, the recovered fractions will be evaluated using relevant in vitro assays to assess functional potential and basic safety-related properties. Fourth, the most promising ingredient will be incorporated into a prototype marine food model or nutraceutical, where its effects on composition, shelf life, sensory quality, and functional value will be examined. This follows the translational route described in the host paper, moving from ingredient recovery and characterisation through testing and product development.

The project brings together sustainable food production, food bioactive research, and translational nutrition. Its main contribution is to treat side-streams not as waste, but as useful raw materials for the development of healthier marine foods. It also offers a strong fit between the host's expertise in marine innovation and side-stream valorisation and my own background in underutilised food resources, phytochemical characterisation, molecular nutrition, and cardiometabolic health. The expected outputs include new knowledge on side-stream-derived bioactives suitable for marine applications, a prototype functional marine product and/or a nutraceutical and a clearer route for linking food valorisation with nutrition and health.

Ioannis Zabetakis, PhD, MEd

Ioannis Zabetakis, after having obtained his **B.Sc. in Chemistry** in the University of Athens, he spent 8 years in UK where he studied for a **PhD in Food Science** in the University of Leeds, did post-doctoral research on alkaloids in the University of Durham and worked as a Lecturer of Food Chemistry in the University of Leeds. During his lectureship in Leeds, he studied towards a **MEd in Food Science**.

In Greece, he held Academic positions as a Lecturer, Assistant and Associate Professor of Food Chemistry in the University of Athens (2003-2015). He developed an independent research stream on the cardioprotective properties of food lipids and on ways to create novel feeds and functional food with improved activities against inflammation and cardiovascular diseases. In 2015, he joined University of Limerick (UL) as a Lecturer in Food Lipids and he was the Head of the department (HoD) of Biological Sciences in UL (September 2018-August 2023: 5 year term). Since 2020, he is a Senior Lecturer (Associate Professor) in Food Chemistry.

Ioannis holds also *two patents* on valorising side stream of olive oil industry to produce novel and functional, against inflammation, fish feeds for the aquaculture sector.

<https://patents.google.com/patent/WO2014122571A1/en>

<https://patents.google.com/patent/EP2953478A1/en>

Ioannis has published **>115 peer-reviewed articles (Scopus h-index 41)** and also four books (two as editor) on marine oils, cardiovascular diseases and functional foods, including marine. In addition to these, Ioannis has published 7 books in Greek, covering all aspects of Food Chemistry, Food Technology, Food Safety and Crisis management in the food chain. <https://izab.net/books/>

Summary of research activity

Cardiovascular diseases (CVD) and related diseases (e.g. stroke and chronic obstructive pulmonary disease) are the leading causes of death in the world. CVD alone cause 18M deaths in the world and 10k in Ireland, respectively, on an annual basis. Statins do not lower the cardiovascular risk and also, they have strong negative side-effects, i.e, 50% of people on statins develop diabetes type-2 after 5 years of being on statins.

Ioannis is passionate on developing novel functional feeds, foods and nutraceuticals to help prevent or tackle CVD. This is the underlying reason why Ioannis has dedicated his research since 2000 on the impact of foods against CVD. Since 2016, in Ireland, he has developed strong collaborations with food and nutraceutical companies and through them, he has developed a nutraceutical supplement derived from salmon fillets with TRL 7. This product is against CVD, using organic salmon, sourced in Ireland, in collaboration with Life's2good (with the generous support of EI).

Relevant publication:

Lordan R, Tsoupras A, Jakeman P, Zabetakis I (2025)

Encapsulated Salmon Polar Lipids Modestly Reduce Postprandial Platelet Sensitivity to PAF and Thrombin in Healthy Adults: A Pilot Study

<https://doi.org/10.64898/2025.12.02.25341455>

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