protein4impact

Newsletter No. 2

Insights from the PROTEIN4IMPACT project on sustainable and alternative protein sources

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PROTEIN4IMPACT IN NUTSHELL

Project description **Project website**

- **Research & Innovation** project
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- **Coordinator:** Pedro E. D. Augusto, CentraleSupélec, (Université Paris-Saclay, France)

Content

EDITORIAL

WELCOME TO THE SECOND EDITION OF THE PROTEIN4IMPACT NEWSLETTER!

Thank you for joining us for the second edition of the Protein4Impact Newsletter. Over the past months, our teams have been deeply engaged in hands-on research – from producing new protein sources to improving their nutritional and sensory qualities.

Researchers have been advancing the production of alternative proteins, exploring mycoprotein cultivation, insect rearing, algae and bacterial growth, aquaculture by-products, and innovative ways to recover proteins from food waste and present these results to food industry managers and investors. These activities are helping us understand how different sources perform, how they can be scaled, and what potential they hold for future food applications.

At the same time, we have focused on what happens once these proteins are produced. Our team has been working on improving their texture, flavour, and nutritional value, developing new formulations, assessing quality, and even designing early concepts for fish feeds based on alternative proteins.

In this edition, we share highlights from these activities, together with a selection of upcoming events and calls shaping the alternative protein landscape.

We hope you enjoy reading and continue following our progress as Protein4Impact moves forward.

Protein4Impact Team

ADVANCING PROTEIN PRODUCTION

Our teams have continued advancing the production of alternative proteins using a diverse set of biological and upcycling approaches. Recent work includes new trials in mycoprotein cultivation, early results from insect rearing and algae growth, and ongoing assessments of aquaculture by-products. Researchers have also been developing innovative methods to recover proteins from the food industry side streams, including promising extrusion-based processes for brewery by-products or valorization of fish waste into bacterial protein. Several of these materials have already been passed on for nutritional and functional testing, while others are moving toward production in the coming months.

MYCOPROTEIN ON THE RISE

Researchers have been cultivating *Pleurotus ostreatus* – a well-known oyster mushroom – using brewer's spent grain (BSG) as a nutrient source. BSG is the most abundant by-product of the brewing industry, rich in fibre and residual nutrients, yet often underused. By growing edible fungi on this material under submerged conditions, the team is transforming a low-value side stream into nutritious fungal biomass, a promising form of mycoprotein. The process has already been successfully scaled to a 3-litre stirred-tank bioreactor, and the next step is transferring the cultivation to a larger air-lift system to support more efficient operation and assess economic viability. The resulting mycoprotein will then be evaluated across the consortium for its nutritional, sensory, functional and environmental performance.

RECOVERING PROTEINS FROM BREWER'S SPENT GRAIN THROUGH EXTRUSION

Alongside fungal cultivation, another team has been working on how to unlock the protein potential of BSG using extrusion-based processing. The goal is to design a method that maximises protein recovery and concentration while keeping solvent use to a minimum. Several extraction strategies have already been tested – from direct extrusion to combinations with pre- and post-processing – allowing researchers to compare yield, efficiency and the structural quality of the recovered proteins. The first samples have been delivered for nutritional and functional assessment. Moreover, the obtained secondary by-product, poor in proteins but rich in cellulose, is being upcycled to produce bio-based materials.

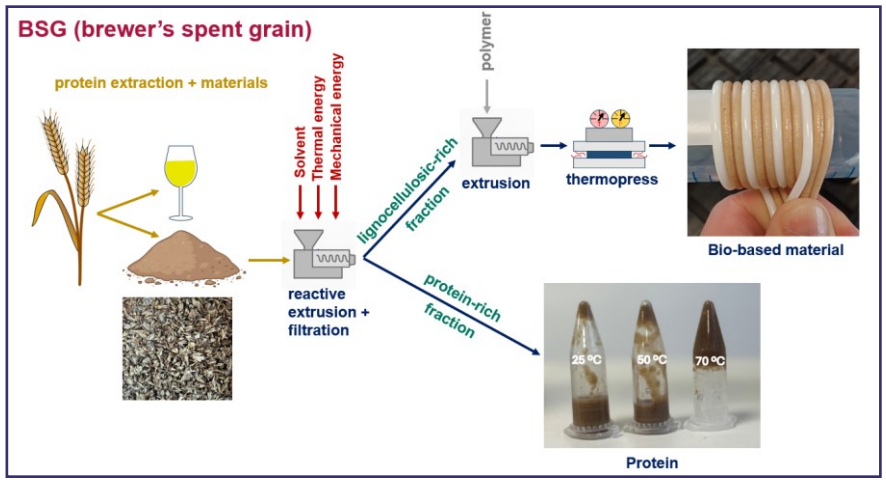


Figure 1: Illustration of protein recovery from brewer's spent grain.

INSECT REARING ON UPCYCLED DIETS

Another focus of research is comparing how insects grow when with fed diets supplemented with banana waste, brewer's spent grain (BSG), or cocoa shells. These materials are abundant food-industry side streams, and the goal is to identify which of them can best support insect growth and protein production. By monitoring growth performance across the different diets, researchers are determining which combinations lead to the most efficient and nutritionally valuable insect meal.

The team is also analysing *Tenebrio molitor* growth when reared on diets enriched with different food-industry side streams, including banana waste, brewer's spent grain (BSG), cocoa shells and wheat bran. Each substrate supports growth differently, and the researchers are comparing performance across all diets to identify which one leads to the most efficient biomass production. Early analyses show clear differences in the nutritional profile of the resulting insect meal, with the diet based on cacao and BSG yielding the highest protein content. This work helps determine how insects can be raised more sustainably while turning low-value by-products into high-quality protein ingredients.

RENEWABLE ENERGY TO PRODUCE BACTERIAL PROTEIN

After protein extraction, fish residues still have a high nitrogen content. Through anaerobic digestion, nitrogen is released into the digestate as ammonia, while bioenergy in the form of methane is recovered. Protein4impact investigates how to upgrade those nutrients into bacterial protein by hydrogen oxydizing bacteria, proposing a new Power-to-Protein value chain. The process relies on hydrogen and oxygen from water electrolysis and consumes carbon dioxide from biogas or combustion, ensuring its sustainability. The team has analyzed the impact of different flue

gas toxicants on microbial growth, showing that biomass productivity is not compromised due microbial culture adaptation, but high levels of CO may inhibit protein production. Nevertheless, bacteria synthesise all essential amino acids, becoming nutritious alternatives to conventional proteins. Current work focuses on upscaling productivity on innovative membrane bioreactors for safe gas fermentation.

EXPLORING THE FUTURE OF PROTEIN PRODUCTION

Our teams have continued to work on the development of alternative proteins, focusing on improving their functional, nutritional, and sensory properties. Recent activities include progress in protein modification, early results from flavour optimisation and digestibility testing, and the first applications of novel proteins in food and aquafeed prototypes. Several materials have already moved into evaluation, while others are entering more advanced testing stages.

TRANSFORMING RAW MATERIALS INTO FUNCTIONAL INGREDIENTS

Researchers have been refining enzymatic and bio-processing methods to enhance the performance of proteins from legumes, algae, mycoproteins and agro-industrial by-products. These improvements support the development of high-quality vegan protein alternatives with better texture, solubility and overall usability in food applications.

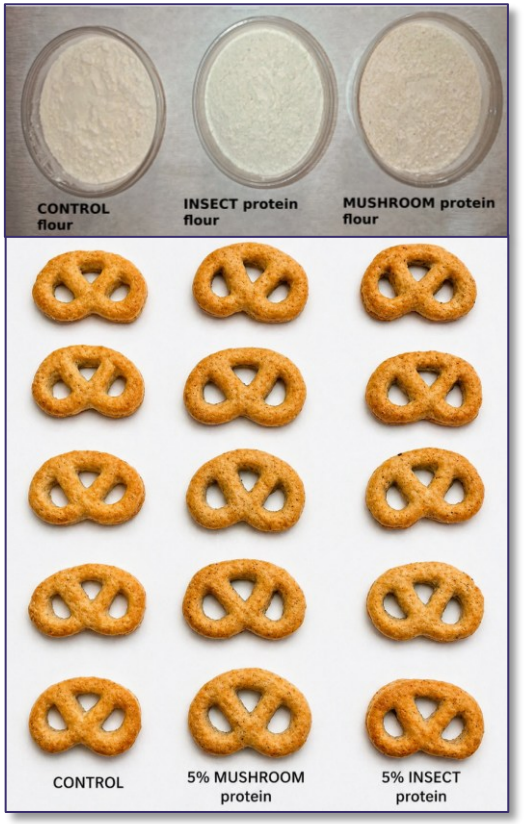


Figure 2: Prototype examples of innovative protein-enriched foods (provided by the VenusRoses Labsolutions Ltd).

FROM EXTRACTION TO PROTOTYPING

Work progressed on producing an encapsulated hydrolysate from *Tenebrio molitor* protein, accompanied by detailed characterisation of its properties. Teams also advanced green extraction of proteins from additional raw materials and developed early prototypes of protein-enriched food products. These prototypes are now undergoing rheological, nutritional, microscopic, structural and sensory testing.

QUALITY, DIGESTIBILITY AND FLAVOUR

Alkaline-extracted *T. molitor* protein entered digestibility trials. Flavour research continued with quantitative profiling of aroma-active compounds in pulse protein and *Dunaliella salina* before and after fermentation, with further analyses and human acceptability studies underway.

ALTERNATIVE PROTEINS FOR AQUAFEEDS

Progress also continued in aquafeed development using microbial ingredients, particularly fungal mycoprotein produced from agrifood side streams. This ingredient offers high protein quality and beneficial bioactive compounds. Current trials are assessing its impact on growth, physiology and disease resistance in two economically important European aquaculture species.

Figure 3: Illustration of trout feed (provided by the AQUABIOTECH LIMITED).

SIMULATING INDUSTRIAL PROTEIN PRODUCTION

Our teams have made steady progress in developing simulation tools for modelling industrial-scale protein production. Recent work focused on gathering detailed process information from research partners, analysing their feedback and translating it into clear checklists to support high-quality modelling.

Researchers have been describing and modelling the technological steps involved in protein production and building a unified model framework that captures the key operations, inputs and performance indicators. The first data elements have already been integrated into the system, forming the basis for realistic process simulations.

Next steps include linking the production models with other typical enterprise processes, followed by data entry and initial test runs of the full enterprise-level simulation.

MOTIVATIONS BEHIND SELECTING ALTERNATIVE PROTEIN

Introducing alternative proteins into European diets requires more than just new food options; it depends on understanding the psychological and behavioural factors that shape people's eating habits. Without this insight, even innovative protein sources may struggle to achieve widespread adoption.

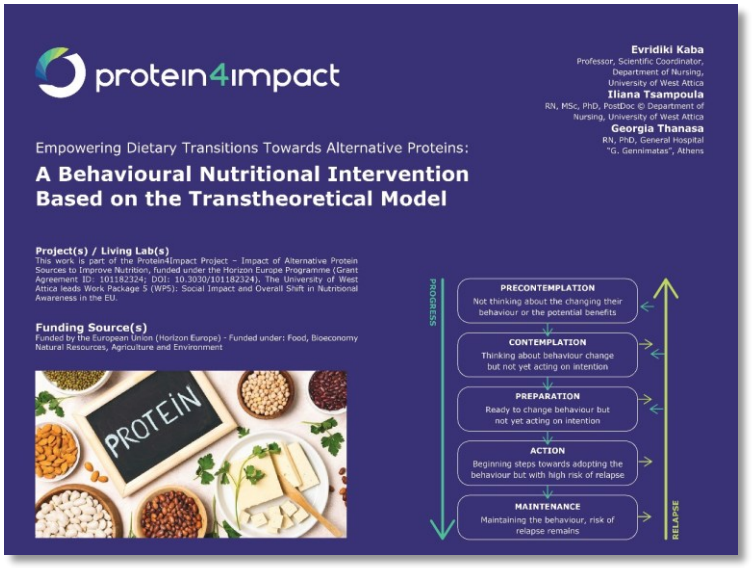


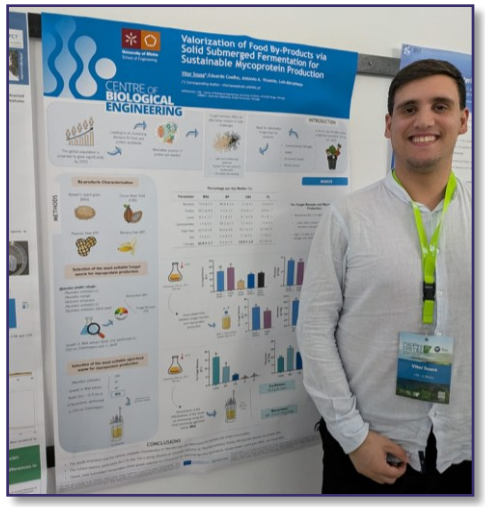
Figure 4: Poster Preview (provided by UNIWA).

We therefore focus on identifying the drivers behind food choices, including attitudes, intentions and everyday behavioural patterns. The research team is conducting a behavioural nutrition intervention consisting of a 12-week programme designed to explore these factors in depth. The study begins with a series of informational meetings to present the research framework and recruit participants. The programme aims to involve 140 participants and uses a quantitative quasi-experimental design informed by the Transtheoretical Model (TTM) and Motivational Interviewing (MI). By combining behavioural theory with applied nutrition research, the Protein4Impact seeks to identify key psychological and social determinants that influence the acceptance and long-term adoption of alternative proteins in everyday diets.

For more information on the Transtheoretical Model and the behavioural nutrition intervention, see our poster HERE.

HIGHLIGHTS FROM EVENTS AND MEDIA

VALORIZATION OF FOOD BY-PRODUCTS VIA SOLID SUBMERGED FERMENTATION



At *the MicroBiotec '25 conference*, **Vítor Sousa** from **UMINHO** presented new results on fermentation-based production of mycoprotein using food-industry by-products, including brewer's spent grain, banana peels, peanut shells and cocoa bean shells. The work demonstrates how these low-cost, widely available residues can serve as effective substrates for fungal cultivation, supporting both biomass growth and protein enrichment while reducing reliance on conventional feedstocks. **Read the abstract** HERE.

ADVANCED TREATMENT OF FISH INDUSTRY WASTEWATER

At the *Danish Water Forum* **Pietro Postacchini** and **Borja Valverde Pérez** from **DTU** shared promising insights into producing microbial proteins using hydrogen-oxidizing bacteria grown on nitrogen- and carbon-rich waste streams, demonstrating how advanced treatment can simultaneously recover resources and reduce environmental impact. Their work highlights a pathway where wastewater becomes a feedstock for bioenergy and protein-rich microbial biomass, reinforcing the role of circular approaches in sustainable protein production. **Read the abstract** HERE.

VALORIZING FISH INDUSTRY WASTEWATER

At the *YWPDK conference* in Denmark, **Pietro Postacchini** from **DTU** presented new results on a topic with strong relevance for both the water and bioresource sectors: how fish-processing wastewater can be transformed into bioenergy and microbial proteins. The work shows that these nutrient-rich side streams, typically treated as waste, can instead serve as valuable feedstocks for microbial cultivation. By converting dissolved organic matter into biogas and protein-rich microbial biomass, the approach reduces environmental impact while creating new resource pathways for sustainable protein production. **Read the abstract** HERE.

CONNECTING WITH BRAZIL'S RESEARCH COMMUNITY

At the *JP–FAPESP Workshop* on EU–Brazil collaboration in sustainable research, **Pedro Augusto** from **CS** joined researchers to explore opportunities for deeper cooperation in bioeconomy, food systems and environmental sustainability. The event highlighted shared priorities between Europe and Brazil, including circular use of biomass, low-impact protein production and innovation pathways that connect science with societal needs. **Read more details** HERE.

ADVANCES IN MARINE BY-PRODUCT VALORIZATION

The Protein4Impact team, represented by **CNR** and **ENEA,** presented on microwave-assisted extraction of proteins from fishery residues, supercritical CO_2 extraction of lipids and omega-3 from fish waste, and a circular-economy approach to recovering lipids and proteins from shrimp-processing side streams.

MEDIA SPOTLIGHT: INTERVIEW WITH LUÍS ABRUNHOSA

Protein4Impact gained visibility in Portugal, where the *Perspectiva Atual* magazine published an interview with **Luís Abrunhosa** from **UMINHO,** highlighting our work on sustainable protein innovation. For our community, we prepared an **English summary — available** HERE.

UPCOMING EVENTS

WHICH EXCITING EVENTS ARE COMING UP SOON? HERE ARE SOME KEY EVENTS WE'VE CHOSEN FOR YOU.

VITAFOODS EUROPE

Date: 5-7 May 2026

Place: Barcelona, Spain

Vitafoods Europe is a major international event for the nutraceutical industry. It connects professionals across the global health and nutrition supply chain, including manufacturers, ingredient suppliers, researchers and brands. The 2026 edition will highlight developments in dietary supplements, functional food and beverages, innovative ingredients, and contract manufacturing solutions. The event serves as a key hub for business networking, product discovery and knowledge exchange, supporting innovation in health, nutrition and the wider functional food sector.

More information about the event HERE.

IBIC 2026

Date: 10-13 May 2026

Place: Palermo, Italy

Organised by AIDIC (Italian Association of Chemical Engineering), this conference brings together researchers, industry professionals, and innovators in industrial biotechnology. The 2026 event focuses on bioprocess engineering, biorefineries, sustainable production, environmental biotechnology, and cross-sector applications for a circular bioeconomy. IBIC offers a platform for scientific exchange, collaboration, and showcasing industrially relevant biotech solutions.

More information about the event HERE.

ISEKIFOOD26 – 8TH INTERNATIONAL ISEKI-FOOD CONFERENCE

Date: 1-3 June 2026

Place: University of Algarve, Faro, Portugal

Organised by the ISEKI-Food Association, this conference brings together national and international researchers, educators, and industry stakeholders. The 2026 edition, held in Faro, Portugal, will focus on innovation in research and education for the transition to sustainable food systems, providing a platform for collaboration, networking, and knowledge exchange across food science and technology.

More information about the event HERE.

AD19 – 19TH IWA WORLD CONFERENCE ON ANAEROBIC DIGESTION

Date: 9-13 June 2026

Place: Valencia, Spain

As one of the premier international gatherings dedicated to anaerobic technologies, IWA AD19 will showcase the latest advancements in the field. Anaerobic technology has evolved from a cost-effective solution for waste treatment into a comprehensive approach for transforming waste into valuable resources.

The conference theme, "*Fueling Sustainability*," underscores the pivotal role anaerobic digestion plays in achieving environmental resilience. IWA AD19 will bring together academics, researchers, practitioners, policymakers, and industry representatives, helping to shape the future of anaerobic digestion. **More information about the event** HERE.

WASTEENG 2026 CONFERENCE

Date: 7-10 July 2026

Place: A Coruña, Spain

WasteEng 2026 is the 11th International Conference on Engineering for Waste and Biomass Valorisation, bringing together researchers, engineers, and industry professionals focused on sustainable waste management and circular economy solutions. Marking 20 years of research and innovation in the field, the conference is led by founder and chair Prof. Ange Nzihou, with Prof. Maria C. Veiga and Prof. Christian Kennes as co-chairs. The event will include scientific sessions and keynote lectures covering topics such as sustainable materials from waste and by-products, including their properties, durability, and environmental assessment, as well as broader circular economy themes addressing life cycle assessment, policy, health and risk assessment, and links between research, innovation, and industry.

More information about the event HERE.

IDS 2026 – 2026 INTERNATIONAL DRYING SYMPOSIUM

Date: 25-28 August 2026

Place: Paris-Saclay, France

This event is co-organised by our project coordinator, **CentraleSupélec**, and AgroParisTech, two prestigious French engineering schools of Université Paris-Saclay. The symposium will focus on strategies to reduce the carbon footprint of drying processes in a resource-constrained world, addressing current and emerging challenges in drying and dewatering technologies.

It will provide a platform for researchers, industry professionals, and educators to share knowledge, exchange ideas, and foster collaboration.

More information about the event HERE.

FUNDING OPPORTUNITIES

EXPLORE THESE CALLS THAT COULD SUPPORT YOUR RESEARCH AND INNOVATION ACTIVITIES.

BALANCING FOOD SECURITY, BIOECONOMY, CLIMATE AND BIODIVERSITY OBJECTIVES TO UNLOCK SUSTAINABLE VALUE CHAINS

Topic ID: HORIZON-CL6-2026-01-CIRCBIO-09
Indicative contribution: 6,000,000 EUR
Deadline: 17 September 2026

This call supports research on balancing food security with emerging bioeconomy markets (e.g., carbon and biodiversity credits). Projects should analyse sustainable business models, natural capital accounting and land-use trade-offs, while identifying diversification options for farmers that do not compromise food supply. A multi-actor approach and alignment with EU initiatives are required.

More information about the call HERE.

BOOSTING AGROBIODIVERSITY FOR FOOD SECURITY AND SUSTAINABLE COMPETITIVENESS

Topic ID: HORIZON-CL6-2026-01-BIODIV-06
Indicative contribution: 6,000,000 EUR
Deadline: 17 September 2026

This call aims to strengthen agrobiodiversity to improve food security, farm resilience and long-term competitiveness. Projects should quantify benefits of diversified agroecosystems, develop scaling strategies, and assess economic and environmental impacts. A multi-actor approach involving farmers, land managers and agribusinesses is required.

More information about the call HERE.

ADVANCING THE EUROPEAN BIO-BASED INNOVATION ENABLED BY BIOTECHNOLOGY AND BIOMANUFACTURING CONCEPTS

Topic ID: HORIZON-CL6-2026-01-CIRCBIO-07
Indicative contribution: 4,000,000 EUR
Deadline: 17 September 2026

This topic supports the development of key biotechnologies and biomanufacturing concepts to strengthen Europe's sustainable bio-based economy. Projects should advance technologies such as synthetic biology, metabolic engineering or microbiome-based approaches, integrate digital tools, and ensure early assessment of environmental and safety impacts.

More information about the call HERE.

Thank you for joining us on this journey. Stay connected as we share key insights, progress, and perspectives from across the consortium and beyond.

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