

Air-driven food protein production

BCSP 2026 PhD Studentships - Prof Sonja Billerbeck

PhD Program Overview

The Bezos Centre for Sustainable Protein at Imperial College London is offering a fully funded PhD opportunity focused on gas precision fermentation and the development of engineering biology tools for sustainable protein production. The project focuses on engineering hydrogen-oxidising bacteria of the genus *Xanthobacter* into programmable cell factories for recombinant food protein production, while also developing accessible laboratory-scale gas fermentation systems to support research and scale-up. The goal of this research is to accelerate the development of air-driven biomanufacturing systems that could contribute to a carbon-neutral or carbon-negative food chain.

Bezoes Centre for Sustainable Protein Doctoral Program

This PhD program is part of the **Bezoes Centre for Sustainable Protein's** broader initiative to advance knowledge and accelerate innovation in sustainable proteins, to make the food system more sustainable, equitable, resilient, efficient and healthy. The centre will do this through five pillars of work, namely research, translation, education, network and advocacy.

Research Focus

This interdisciplinary PhD will combine engineering biology, bacterial physiology, and bioprocess engineering to develop *Xanthobacter* species into programmable cell factories for recombinant food protein production, while simultaneously creating accessible laboratory-scale gas fermentation systems for autotrophic cultivation under production-relevant conditions. The project will focus on developing advanced genetic tools, including inducible promoters and multiplex CRISPR systems, alongside validating miniaturised gas fermentation platforms suitable for laboratory research and scale translation. The research will also explore the production of recombinant food proteins beyond beta-lactoglobulin, including casein, mollenin, and enzymes, while contributing open-access hardware and protocols that reduce barriers to entry for gas precision fermentation research and accelerate the development of air-driven biomanufacturing systems.

Supervisory Team

- **Principal Investigator:** Prof Sonja Billerbeck, Department of Bioengineering - Faculty of Engineering, Imperial College London
- **Industry Supervisor:** Dr Martin Currie DIC FICChemE FRSB, Founder, AMYBO

Program Details

- **Funding:** Fully funded for UK home students
- **Location:** The research will be based at the Bezos Centre for Sustainable Protein and the Bioengineering Department at Imperial College London

How This PhD Will Contribute

This project sits at the intersection of sustainable food systems, engineering biology, and gas precision fermentation. By developing both advanced genetic engineering capabilities and accessible laboratory-scale gas fermentation systems, the student will contribute to accelerating research and development in air-driven biomanufacturing. The project will support the broader development of carbon-neutral food production systems while strengthening capabilities across academia and industry.

Your Profile

We are looking for an enthusiastic and highly motivated PhD candidate with:

- A background in molecular biology, synthetic biology or bioprocess engineering
- An affinity for hardware design and gas-fed bioreactor development
- An interest in engineering biology with non-model organisms
- An interest in gas fermentation and sustainable protein production
- Strong analytical and communication skills
- The ability to work independently and collaboratively in an interdisciplinary environment

Candidate Development Opportunities

The student will have the opportunity to:

- Gain training in engineering biology with non-model organisms
- Develop expertise in gas fermentation and small-scale bioreactor development
- Work within the Air2Food consortium (a multi-stakeholder European Commission-funded innovation hub for gas precision fermentation) and engage with leading companies and academic groups in gas precision fermentation
- Develop understanding of techno-economic, regulatory, consumer acceptance, and responsible innovation considerations related to sustainable protein production
- Build experience across academia, industry, entrepreneurship, and open-access technology development