PhD Studentship: Development of an *E. coli-based* Biosensor system for real time Anaerobic Digestion monitoring & control

University College/ Management Unit	UCD College of Engineering & Architecture
University School/ Unit	School of Biosystems & Food Engineering
Project Title	Development of an *E. coli*-based Biosensor system for real time Anaerobic Digestion monitoring & control
Post Duration	4 Years
Supervisors/ Mentors	Dr. Joseph Sweeney
Main Location for project	UCD
Funding source	BiOrbic
Provisional start date	1/9/2024 or 1/1/2025
BiOrbic Challenge alignment	Digitalising the Bioeconomy
Salary	€22,000 tax free per annum plus university fees

Summary

The optimal and as such sustainable operation of many bioprocesses, requires that the concentrations of important analytes within the process be monitored and controlled accurately and in real-time. At present, the control of many bioprocesses is hampered by the lack of cost-effective, accurate and rapid monitoring of individual analytes. Consequently, many bioprocesses operate inefficiently without any monitoring, or use inferences from inaccurate observations in determining a control strategy.

To address this industry wide issue, a biosensor platform technology is being developed in UCD that consists of a range of cost-effective biosensors each of which is specific to a single analyte. These sensors are being designed to enable multiple analytes to be simultaneously monitored in real time.

As Ireland's National Renewable Energy Action plan has committed to Ireland producing 5.7 TWh of indigenous biomethane by 2030, which will require towards 200 20 GWh AD units the need for real time monitoring and control systems is evident. The focus of this PhD studentship will be towards developing UCD's biosensor platform towards providing a real time monitoring and control system for Anaerobic Digestion.

To achieve this goal the PhD student will be required to apply extensive genetic and protein engineering techniques to develop and test a suite of analyte detecting *E. coli* biosensor strains. The candidate will then process, interpret apply statistical analysis and develop control algorithms from the large biosensor datasets. Finally, the PhD student will operate and assess the biosensor monitoring and control system's performance on AD influents and effluents.

Objectives

1. Optimise UCD's biosensor platform technology to quantify key analytes within anaerobic digestor leachate samples off-line and benchmark the results against chemical analysis.
2. Apply suites of genetic engineering techniques including Crispr Cas9 to
   a. Optimise current biosensor *E. coli* strains

b. Develop new analyte detecting biosensor *E. coli* strains.
3. Apply statistical analysis and develop computer programming algorithms to process and interpret large biosensor datasets, towards developing a control system for different lab scale AD bioreactor configurations.
4. Engage with AD industry partners and contribute to IP generation and technology commercialisation
5. Publish 2-3 high impact peer reviewed articles

Requirements

A 2.1 or 1.1 degree at undergraduate level in Microbiology, Biochemistry, Biotechnology or a related discipline that has relevance to the aforementioned activities is essential. A relevant masters degree is desirable.

Knowledge, skills, experience

The successful candidate will be self-motivated with experience in working on research projects and will have: -

- Expertise in genetic engineering techniques, in particular Crispr Cas9 but also protein engineering
- Experience in cell cultivation, designing or operating bioreactors
- An interest in anaerobic digestion and biological treatment technologies
- Experience/knowledge in one or more computer programming languages (R, Python, Java, C++, C etc.)
- Excellent written and oral communication and interpersonal skills
- Excellent qualitative and quantitative research skills
- Innovation and entrepreneurship experience

Application Procedure

Applicants should submit in one document: a cover letter setting out your motivation for applying for the role and how your skills meet the requirements set out in this document and can contribute to achieving listed key objectives AND a full Curriculum Vitae to include the names and contact details of 2 referees (including email addresses), by August 9th 2024 17:00 (GMT) to:
Dr Joseph Sweeney Email: joseph.sweeney@ucd.ie

BiOrbic

 "This project is funded by BiOrbic, Ireland's National Bioeconomy Research Centre. BiOrbic is a national collaboration of researchers, focused on the development of a sustainable, circular economy. Encompassing 100+ researchers from twelve institutions in Ireland, along with International collaborators, BiOrbic is focused on training and developing the next generation of Bioeconomy leaders."