Understanding and Using Biofilm Microenvironments: Multidisciplinary Goals, Gaps, Required Support, and Critical Skills Inventories

EXECUTIVE SUMMARY

Hosted by the Environmental Biotechnology Network and facilitated by Newcastle University

Copthorne Hotel, Newcastle 17-18 March 2025

Workshop Participants	
James Chong	University of York
Thomas P. Curtis	Newcastle University
Emily Gracie	Newcastle University
Jack Jennings	University of Sheffield
Ciara Keating	Durham University
Yongqiang Liu	University of Southampton
Benedek Plosz	University of Bath and Oslo Metropolitan University
Davide Poggio	University of Sheffield
Bartlomiej Waclaw	University of Edinburgh
Joseph Earl Weaver	Newcastle University and Durham University
Dongda Zhang	University of Manchester

Supported By	
Joseph Earl Weaver	Newcastle University and Durham University
Sonia Heaven for EBNet	EBNet / University of Southampton

Contact:

Dr Joseph Earl Weaver, Durham University, joseph.e.weaver@durham.ac.uk

Environmental Biotechnology Network, ebnet@ebnet.ac.uk

Prof Sonia Heaven, University of Southampton, S.Heaven@soton.ac.uk

Cite as: Executive summary from the EBNet workshop on biofilm microenvironments. Hosted by Environmental Biotechnology Network and Newcastle University, UK. Ed: Weaver, J.E. EBNet, 2026. Available from: https://ebnet.ac.uk/resources

EXECUTIVE SUMMARY

This workshop brought together experts from diverse disciplines to examine the role of microbial microenvironments in environmental biotechnology and to identify pathways for advancing research and application. Through structured discussions participants developed a shared conceptual framework, articulated aspirational goals, and highlighted critical gaps in knowledge and capability.

Progress hinges on two interconnected priorities: improving system insight and control and strengthening interdisciplinary integration. While technological advances remain essential, participants emphasized that the most immediate gains will come from enabling skill development, collaborative design, and streamlined institutional support.

Reflections on institutional support underscored the need for proactive matchmaking, flexible funding mechanisms for cross-disciplinary projects, and reduced administrative burden. Recruitment processes and recognition of non-traditional outputs, such as software and experimental infrastructure, were also identified as areas for improvement.

A skills inventory exercise exposed both strengths and gaps across the community. Expertise clustered around modelling, wetlab techniques, and microbial ecology, while capabilities in industry engagement, policy, and communication were notably absent yet widely desired. Correlation analysis suggests participants aim to deepen current expertise, broaden capabilities by recruiting collaborators with complementary capabilities, and selectively expanding into data science, infrastructure, and process engineering, areas critical for bridging theory and application. Overall, realising goals of microenvironment understanding and control will require not only technical innovation but also cultural and structural shifts that enable collaboration, broaden impact, and accelerate translation from concept to practice. The promise of, challenges regarding, and way forward to achieving those goals are presented in Appendix I.

Box 1: Microenvironments in Practice

Microenvironments occur in many different practical contexts. Concrete examples from participant's and other activities include:

- Wastewater treatment, anaerobic digestion and biogas production
- Bio-electrochemical systems, including microbial fuel cells
- Industrial biotechnology, including engineering biology and synthetic biology
- Biofouling of medical and industrial equipment
- Experimental model systems of mass transport and reactions
- Natural and engineered systems contributing to biogeochemical cycling of materials, including nitrogen
- Plant root ecosystems and soil health