We cannot stop now: A call for urgent action in Environmental Biotechnology Research in Europe

To all EU decision makers and stakeholders with a say in Environmental Research, from member projects of the EU bioremediation cluster

June 2024

• This document is the result of collaborative efforts of a coalition of 5 EU projects that focus on bioremediation: MIBIREM (Grant Agreement ID: 101059260), EDAPHOS (Grant Agreement ID: 101112768), BIOSYSMO (Grant Agreement ID: 101060211), SYMBIOREM (Grant Agreement ID: 101060361) and NYMPHE (Grant Agreement ID: 101060625).

• Environmental Biotechnology, which was in its infancy in the late XX century, has evolved thanks to the revolution brought about by Molecular Biology, Systems Biology and Synthetic Biology. Multiple successes in the biological cleanup of municipal and industrial wastewater and of hydrocarbon soil pollution demonstrate the vast power of clean technologies. In addition, the buildup of information on the activities of microorganisms as biocatalysts in all sorts of natural, industrial and agricultural environments has flourished. There is a continuing realization of the critical role of microbial processes in biological, ecological, industrial and geological systems.

• Since environmental biotechnology has matured, it is ready to tackle bigger challenges: the scaling up of many bioremediation systems is still in progress, the search for novel biocatalysts for industrial applications, the continuing effort against common human life-threatening processes such as antibiotic resistance, the accumulation of hormone-mimicking substances (endocrine disrupters), the deposition of air-borne pesticides in the environment. Many environmental biotechnology trials achieved the degradation of recalcitrant contaminants and the containment of metallic (non-degradable) contaminants. All these environmental burdens in the background of climate change are generated to a large extent by industrial, farming and urban activities. Environmental biotechnology has the potential of preventing the contamination of food chains, protecting life and allowing for human activity and economic development that do not compromise sustainability.

• However, given that environmental biotechnology must deal with challenges such as the immense variety of compounds to be degraded or contained, the varying physical and chemical characteristics of environments to be treated and the multitude of organisms with potential bioremediation activities, one more conclusion is clear. We must develop a *fully integrated knowledge basis* to tap into the full potential of microbes as instruments for environmental management. Advancements from the nanotechnologies and genomics sector should be compiled into common platforms and databases. This would then facilitate the easy retrieval of information or data integration, as and when required to develop interdisciplinary solutions/synergistic systems for bioremediation.

• Furthermore, it is imperative to develop expert systems and models for the prediction of metabolic processes under various conditions. And most importantly, we need to integrate these databases with such expert systems into a cohesive information system. Such integration will produce a true 21st century tool for both management and research purposes. Managed data becomes information, and information fed to modeling and predictive systems becomes knowledge. This knowledge supports decision-making and is critical for policy makers, scientists and industry. Most importantly, it allows them to work together.

• Apart from scientists and policy makers, the public has everything to gain from environmental biotechnology research, since there is growing evidence that human health is directly dependent on the environment, motivating a *One Health* approach. In addition to the prevention of diseases that plague both industrialized and developing nations and that are related to environmental degradation, environmental biotechnology can help to prevent the spread of diffuse pollution, a threat that knows no frontiers and is a key challenge to address, due to its reduced traceability. Indeed, large discharges of industrial and agricultural chemicals, pharmaceutical compounds and extremely recalcitrant molecules (e.g. per- and polyfluoroalkyl substances), constitute a public health threat as much as the loss of environmental integrity. Finally, in addition to its contributions to human health, environmental biotechnology holds promises of economic importance such as the development of clean technologies with competitive advantages in a global economy and, the remediation of contaminated sites for either public or private benefits.

• Therefore, it is the duty of industrialized societies and their political leadership to fund and encourage science that deals with the roots of problems created by the process of industrialization itself. Environmental biotechnology is one of the pillars of such mission-oriented science, the realm of which is far beyond the borders of states and nations. Previous Framework Programs of the EU planted the seed for the booming of this new field. Unfortunately, the new Programs of the EU assign only a very minor role to environmental biotechnology and bioremediation—in favor of biomanufacturing— despite the decision to support the vision of a knowledge-based, highly competitive and sustainable economy.

• Whether this absence is due to the lack of vision of Member States, to the anti-GMO sentiment and sometimes misinformation regarding the value of DNA technologies amongst the public in the European Union, or to deliberate omissions in the preparatory panels, the situation must change. Recurrent environmental crises are not only very grave European pollution problems, but also have serious political consequences. Even considering only short-term returns, the European Commission should have a vital interest in funding this type of research, given the social and economic costs associated with such environmental problems. Highlighting bioremediation research in future programs would provide an opportunity for more favorable public perception of European Commission policies.

• Europe has an opportunity to be at the forefront of research in environmental biotechnology, and leading transatlantic partnerships, let alone competing in this vital area. It is essential to prevent a brain drain into other scientific areas and failing to grab the opportunities of economic development and jobs creation brought about by the environmental remediation sector.

• Europe cannot stop now. Because of its relevance to human health and green technologies, environmental biotechnology at large can make a huge difference in the quality of life of our future generations. We need a major European-funded environmental biotechnology research initiative for the benefit of European research leadership, international collaborations and ultimately, all of society.

For more information on the EU bioremediation cluster member projects:

- MIBIREM: https://www.mibirem.eu/
- EDAPHOS: https://edaphos.eu/
- BIOSYSMO: https://www.biosysmo.eu/
- SYMBIOREM: https://symbiorem.eu/
- NYMPHE: https://www.nympheproject.eu/

Disclaimer:
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [the European Research Executive Agency and the European Health and Digital Executive Agency]. Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union