

## **Biotechnological processes toward environmental sustainability: prospects and challenges**

Barabara Menin

*Institute of Agricultural Biology and Biotechnology of the CNR (IBBA-CNR)*

The impact of climate change due to global warming is becoming increasingly evident. Thus, the development of environmentally and energy sustainable technologies has become a worldwide priority, with the climate neutrality targets set to accomplish the ambitious goal of achieving zero carbon emissions by 2050.

Biotechnological processes are emerging as the current trend in production process, offering innovative tools to promote sustainability, opposed to conventional chemical synthesis, which causes increased pollutants and waste to the environment. As research advances and supportive policies are developed, biotechnology can play a crucial role in the transition to a more sustainable and environmentally friendly future.

The potential of biotechnology lies in the extraordinary plasticity and metabolic flexibility and adaptability of microorganisms, which make them ideal catalysts to perform Carbon Capture and Utilization (CCU) techniques and promising platforms for the production of a wide range of commodities, including biofuels, building blocks, and high-value metabolites. In this view, process engineering and metabolic engineering play a key role in making bioprocesses more stable and efficient and thus ultimately economically viable.

Indeed, despite these promising prospects, there are several challenges that need to be addressed for large-scale implementation of biotechnological processes. A major challenge is the need for significant investment in research and development to make these technologies economically competitive. In fact, at present, many biotechnological processes are hampered by expensive running costs because of insufficient production and levated downstream costs for separation and purification of target products. In addition, regulation and public perception of biotechnologies, especially those involving genetically modified organisms, can be major obstacles.

The objective of the talk is to provide an up-to-date overview of recent developments in biotechnological processes and critically discuss perspectives and challenges. Application cases will focus on the use of wild-type and metabolically engineered strains of microorganisms for the production of high-value molecules coupled with wastewater valorization from the dairy sector.