

Implications of Nanoscale Agrochemicals in Microbiome Evolution in Agri-Food Systems

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INTRODUCTION

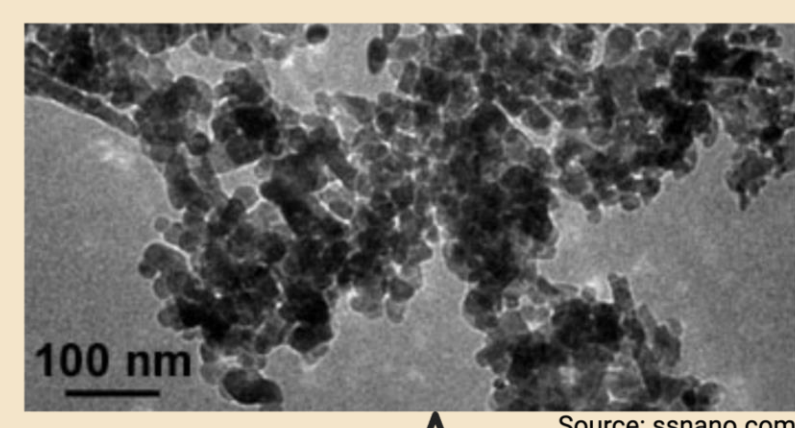
- Global agriculture faces escalating pressure due to climate change, depreciating arable land, and deteriorating soil, air, and water quality. Microorganisms display promise in addressing these challenges by facilitating nutrient cycling, nitrogen fixation, and more. Environmental stressors like nanomaterials, owing to their migration and prolonged persistence, threaten the agri-food microbiome with potential unforeseen consequences, given their increasing use in agriculture.
- The current research investigates these effects of nanomaterials on microbiome structure and pathogen persistence in the agri-food environments.

OBJECTIVES

- Characterization of commonly used nanomaterials in agrochemicals.
- Impact assessment of nanomaterials on the microbiome in given environmental conditions.
- Evaluation of the evolution in pathogens and their adaptation post the introduction of nanomaterials in the environment.

PROSPECTS

- Providing information about the long- and short-term effects of nanomaterials on:



- Microorganisms
- Food safety
- Persistence of pathogens in the environment
- Safe end-of-life disposal of nanomaterials.

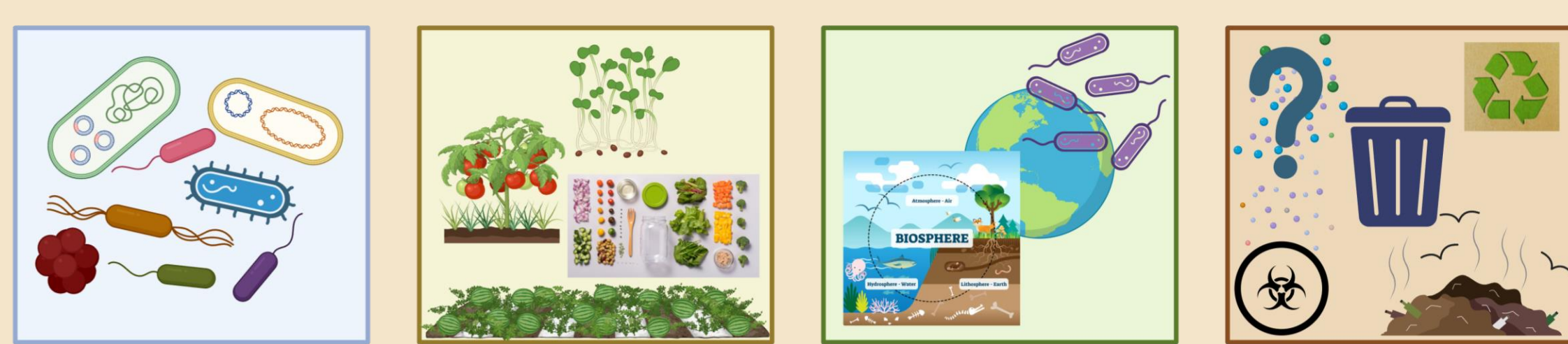


Fig. 1 Graphical illustration of the research's prospects (created using Biorender.com)

METHODS

- Synthesis and procurement of commonly used carbon, metallic, polymeric, and complex nanomaterials.
- Determination of critical nanoscale design parameters using different spectroscopic and microscopic techniques.
- Testing of soil and irrigation water samples with nanomaterials against native microflora, sterile controls, and selected foodborne pathogens in elevated CO₂ and temperature conditions.
- Investigation of possible anti-microbial resistance in the microbes using plasmids as the model.
- Analysis of the multi-omics (genomics, transcriptomics, and metabolomics) data using different machine learning tools.

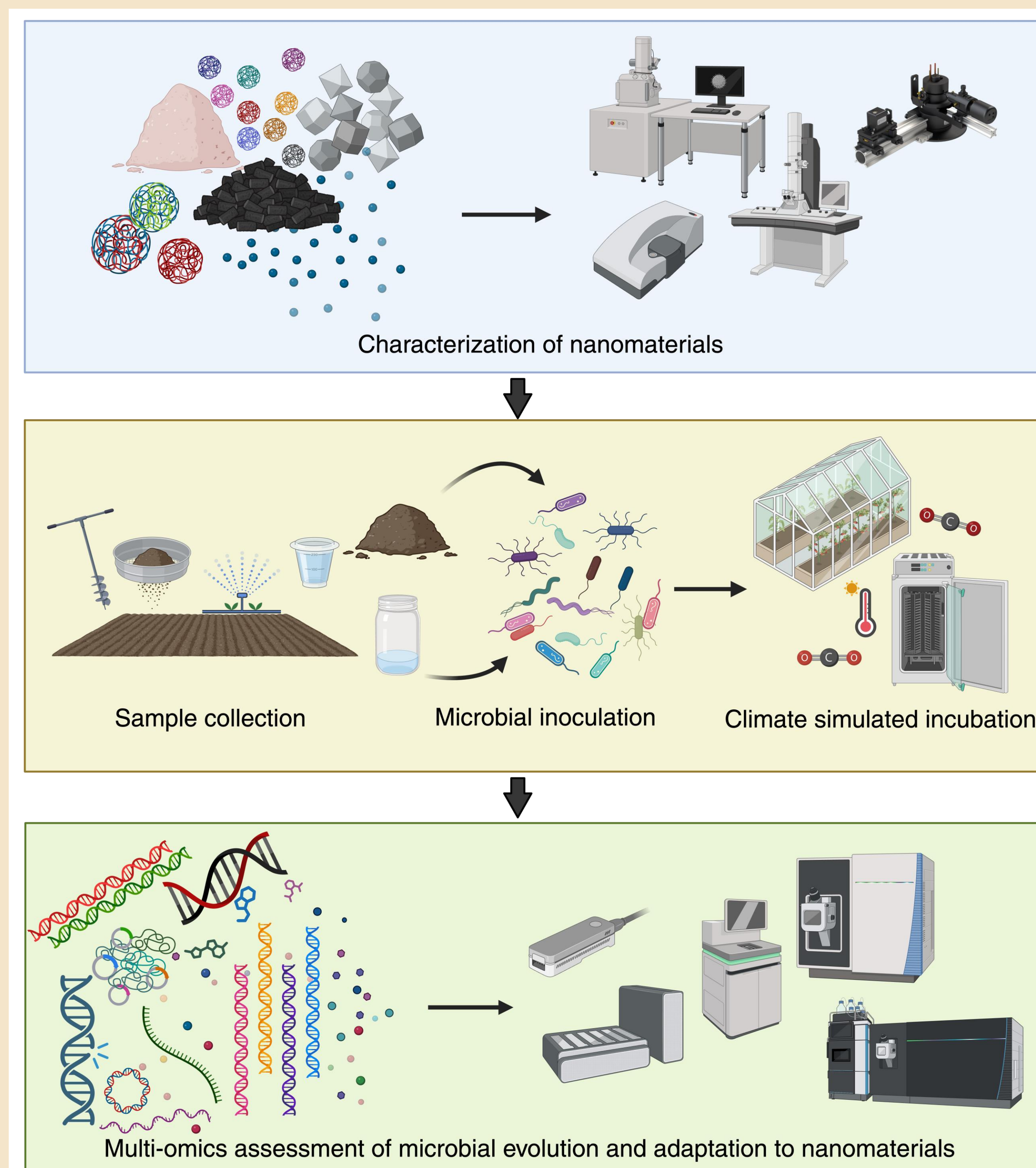


Fig.2 Graphic illustration of methodology (created using Biorender.com)

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