



The Role of Microorganisms In Industrial Research

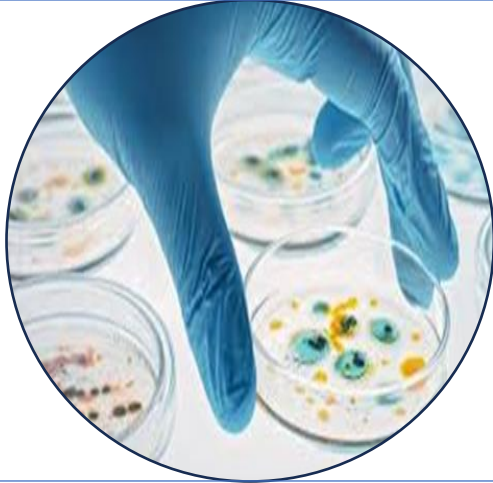
Presented in:

**Microorganisms:
Natural Allies for a Green and
Sustainable Future**

August 17, 2024

Mehrdad Azin

Main areas of industrial microbiology



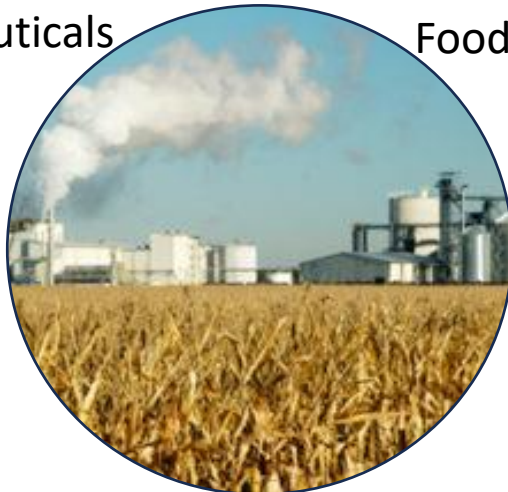
Biopharmaceuticals



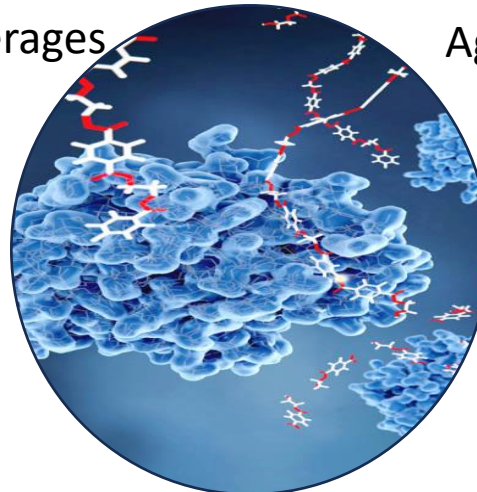
Food and beverages



Agriculture



Biofuels



Industrial enzymes

Industrial Microbial Metabolites

The global market for these bioproducts is substantial and growing:

1.Amino Acids: The market was valued at approximately **\$27.2 billion in 2023** and is expected to grow at a CAGR of 8.5% from 2024 to 2030.

2.Organic Acids: This market is driven by their use in food, pharmaceuticals, and industrial applications, with significant growth expected due to increasing demand for sustainable products. The current market size is about **\$12 million**.

3.Polysaccharides: With a market of **\$610 million**, used in food, pharmaceuticals, and cosmetics, this market is expanding due to their functional properties and natural origin.

4.Bioplastics: The market is growing rapidly (CAGR of 18.8%) as industries seek sustainable alternatives to conventional plastics, driven by environmental concerns and regulatory support.

These markets are integral to various industries, reflecting the increasing shift towards sustainable and bio-based products. The current market size is **\$12 million**.



Industrial microorganisms

Key Characteristics

1. High Productivity
2. Rapid Growth
3. Genetic Manipulability
4. Robustness
5. Specificity
6. Versatility
7. Safety



High- performing companies

Several companies are leading contributors in the field of industrial microbiology, leveraging microbial processes for various applications. Here are some of the main commercial contributors:

- | | |
|----------------------|----------------|
| 1. Novozymes | \$2.2 billion |
| 2. DSM | \$10 billion |
| 3. DuPont | \$12 billion |
| 4. BASF | \$75 billion |
| 5. Amyris | \$270 million |
| 6. Ginkgo Bioworks | \$251 million |
| 7. Evonik Industries | \$18.5 billion |

These companies are at the forefront of integrating microbial technologies into their production processes, contributing significantly to advancements in biotechnology and industrial microbiology.



Biorefineries as most wanted new-era biotechnology plants

The Concept of Biorefineries

The key points about the concept of biorefineries are:

1. Biorefineries are integrated facilities that utilize biomass feedstocks to produce a diverse range of biobased products, including fuels, chemicals, and materials.
2. The concept is inspired by traditional petroleum refineries, with the aim of maximizing the utilization of biomass and producing multiple valuable products.
3. The three key principles of biorefineries are biomass utilization, integrated production, and sustainability.
4. The advantages of the biorefinery concept include a diversified product portfolio, efficient resource utilization, environmental benefits, and economic development.
5. Biorefineries are a crucial step towards a more sustainable and circular economy, enabling the transition from a fossil-based to a biobased economy.



BIOREFINERIES

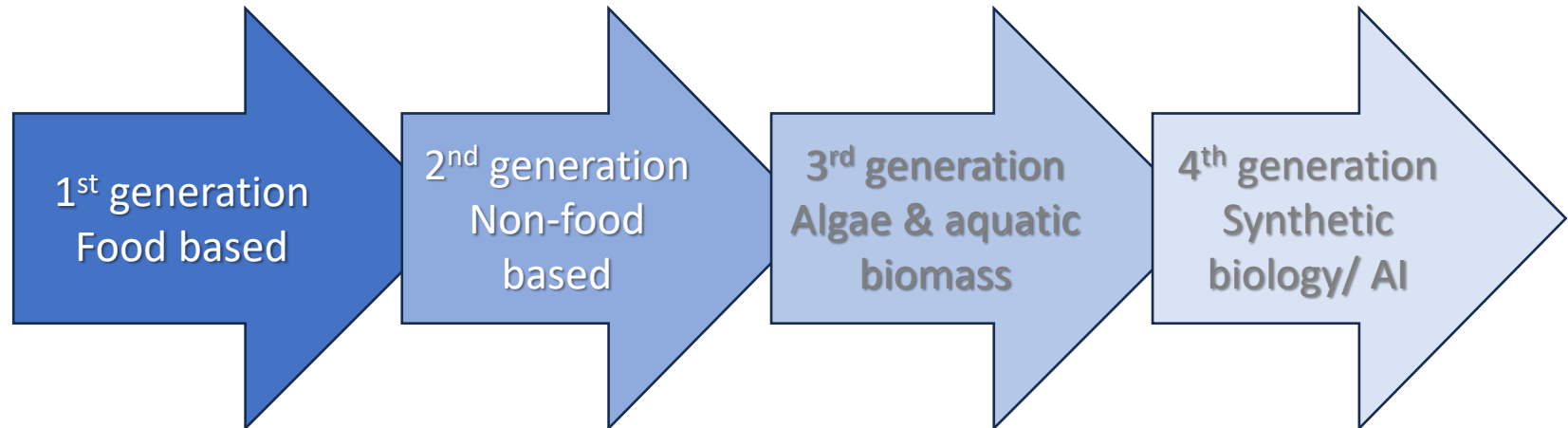
The Role of Microorganisms in Biorefineries

In summary, the key roles of microorganisms in biorefineries include:

1. Biomass conversion and biofuel production
2. Biochemical and biomaterial production
3. Waste treatment and valorization
4. Pretreatment and hydrolysis of biomass
5. Wastewater treatment
6. Bioremediation of environmental contamination

What are present and future biorefineries?

Biorefineries can be categorized into present and future types based on their current state of development and the technologies they employ. Here's an overview of present and future biorefineries:





Present challenges in industrial microbiology

1. Strain Optimization
2. Bioprocess Optimization
3. Microbial Contamination
4. Regulatory Compliance
5. Sustainability and Environmental Impact
6. Technological Advancements
7. Talent and Skill Development



Future challenges in industrial microbiology

1. Sustainable Bioprocessing
2. Personalized and Precision Microbiology
3. Integrating Emerging Technologies
4. Microbiome Engineering
5. Regulatory Adaptability
6. Workforce Transformation
7. Societal Acceptance and Ethical Considerations



Far future challenges in industrial microbiology

1. Terraforming and Planetary Engineering
2. Interstellar Microbial Exploration
3. Microbial-Based Nano-factories
4. Microbial-Driven Quantum Computing
5. Microbial Consciousness and Intelligence
6. Microbial-Enabled Human Enhancement



Thank you for
your attention!