

Bioeconomy 101: Making Microbial Connections

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Did you know that the tiniest parts of an ecosystem play massive roles in driving the economy? In fact, microbes are at the heart of energizing agriculture, transportation and pharmaceutical development worldwide.

This collective system—a cog in the global economic machine—is known as the bioeconomy. But what is the bioeconomy? What is the relationship between microbiology and the bioeconomy? And why is the bioeconomy relevant to [One Health](#)?



The bioeconomy is a facet of the global economy that uses biological resources to produce goods or services across a diverse network of industries. Source: American Society for Microbiology.

WHAT IS THE BIOECONOMY?

Capturing a single definition of the bioeconomy is challenging, [and the U.S. has yet to adopt an official definition](#). In general, the bioeconomy is a facet of the global economy that uses biological resources to produce goods or services across a diverse network of industries. This encompasses a variety of fields, from food production to the development of biofuels. This often involves reusing or repurposing existing materials and products to reduce waste and minimize environmental impacts (i.e., contributing to an economy that is circular). The bioeconomy yields economic benefits by creating new jobs, advancing capital toward sustainable systems and more. Although defining the bioeconomy is complex, illustrating the importance and impact is imperative, and [microbiologists—and the field of microbiology at large—will play a key role](#).

WHAT IS THE ROLE OF MICROBIOLOGY IN THE BIOECONOMY?

Microbes have many features that make them integral to the bioeconomy. In addition to being a renewable resource, they have varied metabolic capabilities and physiologic traits that can be harnessed to generate high-value, sustainable products.

Food Security

For example: fermentation is a microbial process critical to [crafting dairy products like cheese and beverages, including wine and kombucha](#). The capabilities of [lactic acid bacteria](#) not only support the overall making of fermented foods and drinks, but also prolong a product's shelf life and bolster food security in the long run.

Agricultural processes, too, benefit from microbial functions. Soil-dwelling microbes [produce compounds that improve plant growth](#), which promotes the growth of healthy crops and contributes to feeding a growing population.

Biofuel Development and Electricity

Beyond food and agriculture, microbes can be employed to generate electricity. For instance, the [emerging industry of bioelectrochemical systems](#) leans on electrogenic bacteria that produce and sustain an electrical current. The production of [biofuels, like biodiesel and biogas](#), similarly leverages the metabolic functions of microbes to power cars, heating and cooling systems, farming equipment and more.

Antimicrobial and Pharmaceutical Production

Pharmaceutical development is another microbiology-driven sector vital to global public health and economic growth. With the [rising threat of antimicrobial resistance \(AMR\)](#), microbiologists are using biological resources to design and test novel therapeutics that ultimately will prevent the overuse of antimicrobial drugs. This includes genetically engineering microbes to produce new antimicrobial compounds, as well as developing vaccines to combat diverse pathogens. New therapeutics will benefit patients worldwide, and, by improving [health outcomes, lower health care spending overall](#).

Waste Management

Across sectors, the ability of microbes to degrade and transform pollutants and waste into useable products is groundbreaking. Reflecting circular economic practices, microbial processes continue to be relied on to reduce waste—for example, when used to [help us reclaim our wastewater, remove radioactive waste](#) and [transform waste into products like bioplastics](#) (i.e., bioremediation).

WHY IS THE BIOECONOMY IMPORTANT?

Advancing the bioeconomy is key for addressing some of the most pressing challenges of our time, like climate change and food security. Bioeconomic development eases our reliance on fossil fuels, reduces environmental pollution, informs development of drugs to improve human and animal health, promotes sustainable agricultural practices and expands the number of jobs available across diverse sectors. Ultimately, by leveraging bioeconomic processes, we can maintain and enhance the collective well-being of people, animals and the planet (i.e., support One Health)—now and in the future.

Interested in learning more about the role of microbiology in the bioeconomy?
Attend a session from the [Bioeconomy Curated Itinerary](#) at ASM Microbe 2024.

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