

What is the microbiome?

& why does it matter for food and health?

Microorganisms (e.g., bacteria, archaea, fungi and viruses) are everywhere: in our bodies, our food, and the environment. A **microbiome** describes a community of microorganisms living in a particular environment, along with their interactions with each other and their surroundings.

Microbiomes are vital to **human and planetary health**. In the **body**, the gut microbiome aids digestion and immunity. In the **environment**, microbiomes shape ecosystems, drive nutrient cycles and help regulate the climate. In **agriculture**, soil microorganisms support plant growth by breaking down organic matter to make nutrients available for plants. In **food production**, microbes help shape and preserve fermented foods such as yoghurt, sauerkraut and kimchi, and can help reduce waste through composting and nutrient recovery. Some microorganisms, however, can have harmful effects and cause diseases of humans, animals and plants.



microorganisms

tiny organisms (e.g., bacteria, archaea, fungi and viruses) living in all kinds of environments: in our bodies, our food, and the environment



microbiota

a community of microorganisms in a specific environment



microbiome

describes a community of microorganisms living in a particular environment, along with their interactions with each other and their surroundings



Contact

Project coordinator:

Angela Sessitsch

Austrian Institute of Technology (AIT)

Communication contact:

Darya Silchenko

European Food Information Council (EUFIC)



info@microbiomes4soy.eu

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How microbiomes shape
our food systems from
soil to plate



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Microbiomes in the soil & plant

Plants need sufficient nutrients and healthy soils to enable healthy growth and increase resilience to key challenges like pests, droughts or floods. In MICROBIOMES4SOY, we aim to **boost soybean yields** by using natural soil microorganisms that **improve plant health and resilience**, while **reducing reliance on agrochemicals**.

Soils, plants and roots host diverse microbial communities, notably in the rhizosphere (the region around the roots). Our research team is exploring **which microorganisms can help soybean plants absorb nutrients, grow stronger and resist diseases**. From this, we will develop AI-based models to match microbial consortia to specific field conditions and agricultural management strategies, ensuring **effective use** to deliver:

- improved yields
- increased resilience to stressors
- reduced costs & increased profits for farmers
- more resilient & sustainable food systems



Microbiomes in the human & animal gut

The **gut microbiome** plays a vital role in immune function, metabolism, and overall health in humans and animals. MICROBIOMES4SOY is investigating how **replacing red meat with soy-based protein** affects the human gut microbiome, while also assessing whether **microbiome-improved crops** can improve the nutritional outcomes of soy-based products.

In parallel, the project will develop **fermented soybean-based feeds** for aquaculture. Novel bacteria will be applied to **improve soybean fermentation, reduce anti-nutritional factors, and create a sustainable alternative to fishmeal**. These optimised feeds will be tested for their effects on fish growth and health.

These research activities aim to provide:

- evidence to support plant-protein dietary recommendations
- improved understanding of microbiome-health interactions
- healthier fish through microbiome-enhanced nutrition
- reduced pressure on natural resources via sustainable protein alternatives

Integrating microbiomes in the “One Health” approach

Healthy microbiomes are essential to **healthy ecosystems, crops, animals and people**. This interconnectedness is the core of the **One Health** approach.

Microbiomes in the gut, in and on plants, and in soil, water and animals all influence one another. By understanding these connections, researchers can develop microbiome-based innovations that support **sustainable food production, improve health, reduce reliance on chemicals, and make better use of natural resources**.

MICROBIOMES4SOY applies this concept from **soil to gut**: healthy soils support beneficial microorganisms that improve crop performance and food quality, and these benefits ripple through the food chain – shaping animal and human microbiomes and contributing to healthier, more resilient food systems.

