Horizon
The EU Research
& Innovation Magazine

European Commission

Researchers zoom in on tiny life forms that could save our soils and our health

European researchers are developing new ways to preserve microscopic communities from soils, oceans and bodies, paving the way for sustainable farming, healthier ecosystems and personalised medicine.

30 July 2026 - By VITTORIA D'ALESSIO

No organism on Earth is sterile. All living systems, from soil and plants to water and humans, are teeming with bacteria, fungi, microalgae and other microscopic life forms. Together, they make up complex ecosystems known as microbiomes.

Thanks to advances in DNA sequencing and computing, scientists now have an impressive and growing catalogue of microbial species across all these environments.

Their importance to life is already clear. What is less understood is how they interact with one another, and what happens when the microbiome recipe changes – that is, when a species is removed or a new one introduced.

That gap in knowledge matters, because understanding and managing microbiomes could support more sustainable agriculture, healthier ecosystems and better human health.

For Dr Tanja Kostic, a microbiologist at the AIT Austrian Institute of Technology, understanding these hidden communities is one of biology's next great frontiers.

"The microbiome provides essential functions in every ecosystem," she said. "Most of the oxygen we breathe is produced by microbiomes in the oceans. Soil microbes help plants obtain nutrients. In our own bodies, gut microbes produce vitamins that we cannot make ourselves."

Kostic is leading an EU-funded research effort called MICROBE that runs from 2023 to 2027. Partners from Austria, France, Germany and the UK are developing the methods needed to preserve, compare and study entire microbiomes.

Preserving living communities

Over the past decade, scientists have catalogued thousands of previously unknown microorganisms. But that is only half the challenge.

DNA sequencing can reveal which organisms are present, but it cannot fully capture how they interact or how entire microbial communities function. To answer those questions, researchers need to preserve living microbiomes intact.

This is important because microbiomes are changing fast. Intensive farming, pollution, climate change and changing diets can all alter these delicate microbial ecosystems, potentially affecting everything from soil fertility to human health.

Preserving microbial diversity also supports the EU Biodiversity Strategy for 2030, which aims to halt the loss of biodiversity and restore degraded ecosystems.

“If we can preserve these communities exactly as they exist in nature, we will be in a much stronger position to understand how they work and how we might use them responsibly,” said Kostic.

The researchers hope to preserve microbiomes and identify the organisms responsible for key functions – and eventually recreate simplified microbial communities that keep those essential properties while being easier to study.

Beyond the single microbe

For decades, microbiologists have mainly collected and stored individual microbial species.

Dr Matthew Ryan, global lead for microbiology at CABI, a non-profit organisation specialising in agricultural and environmental research, believes that approach no longer reflects biological reality.

Microorganisms don’t live in isolation, he explained. They exist as complex communities whose members constantly interact with one another.

“The idea is to move beyond the single organism model and develop methods to preserve entire microbial communities,” he said.

Preserving an entire soil microbiome, for example, could retain far more of its biological potential than preserving a handful of isolated species. But these communities are far harder to collect, store and study.

To address this, the researchers are standardising methods for collecting, preserving and analysing microbiomes, alongside common approaches for sharing the data they generate. The aim is to ensure that microbiome samples collected in different laboratories or countries can be compared reliably.

Kostic and Ryan were both involved in an earlier EU-funded research initiative (MicrobiomeSupport), which helped identify many of the scientific and regulatory challenges now being addressed.

“Our vision is to harmonise how microbiomes are collected and preserved so researchers everywhere are working with comparable samples,” Kostic said. “At the moment, samples are often stored under different conditions, which can change the microbial community over time and make results difficult to reproduce.”

Rather than creating a completely new network of microbiome banks, the researchers are developing methods that existing European biobanks and culture collections can adopt, allowing microbiome collections to become part of Europe’s broader biological research infrastructure.

“We don’t want to establish a completely new biobank infrastructure. We want to establish new methods and technologies, and then tap into the existing infrastructure,” said Kostic.

Healthier soils, healthier people

The MICROBE research could also support wider European efforts to restore soil health under the EU Soil Strategy for 2030, which recognises healthy soils as essential for food security, biodiversity and climate resilience.

Healthy soils contain remarkably rich microbiomes that influence crop growth, nutrient cycling and resistance to pests and disease. Although microbial fertilisers and biopesticides already exist, their effectiveness often varies because every soil microbiome is different.

Instead of applying the same product everywhere, future farmers may be able to analyse the microbial community living around a crop’s roots before receiving tailored recommendations for restoring soil health.

A similar shift is beginning in medicine.

Rather than one-size-fits-all treatments, researchers are starting to explore approaches targeted at groups of people with similar microbiome characteristics. It is hoped that a better understanding of how gut microbes influence nutrition, immunity and disease will shape more personalised interventions, from diet to medication.

By preserving microbiomes consistently and linking them to high-quality data, researchers hope to understand not simply which microorganisms are present, but what they do together.

Building the foundations

Harnessing microbiomes requires careful safeguards. Introducing microorganisms into soils, crops or patients could disrupt existing microbial communities if not done responsibly.

The researchers are therefore working alongside experts in biosafety, ethics and regulation to help ensure future microbiome applications are safe and acceptable to society.

Another ethical issue the MICROBE team is considering is ownership. Who has the right to claim a microbiome as their own, particularly if it proves highly effective and commercially valuable?

EU funding is playing a crucial role in microbiome research, especially as national funding declines and competition at the European level intensifies. Expanding collaboration beyond Europe will be important for the future of this research.

It also feeds into Europe’s wider ambition to strengthen its leadership in biotechnology and life sciences through world-class research infrastructure and international collaboration.

Rather than producing a single new technology, the researchers are building the standards and infrastructure that could support microbiome research across Europe for years to come.

As Kostic puts it, the motivation for collaboration is simple: we all need to eat, so food must be produced sustainably and effectively, and we all want better health.

Research in this article was funded by the EU’s Horizon Programme. The views of the interviewees don’t necessarily reflect those of the European Commission. If you liked this article, please consider sharing it on social media.

More info

- MICROBE (CORDIS)
- MICROBE project website
- Biodiversity Strategy for 2030
- Soil Strategy for 2030
- One Health
- Strategy for European Life Sciences