

Researchers survey microbes that influence plant health

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Assoc. Prof. Jack Gilbert (foreground) and Sparkling Pointe winemaker Gilles Martin take samples of the microbes living on the leaves, flowers, soil and roots of grapevines as part of a study on how microbes affect plant health. Credit: Kristin West/FMC Corporation and Jack Gilbert

When driving past a sunlit field of grapes, we miss the frenzy of activity

that is invisible to the human eye. Vines and roots teem with bacteria, and viruses and fungi all impact how those grapes will grow.

Researchers from Argonne National Laboratory led a new study of the microbes growing among grapevines, surveying microbes on the plants and their influence on the plants' health. The study is part of a larger push to understand the roles microbes play in agriculture.

Scientists are hard at work cataloguing the microbes that live in and around us and influence everything from oceans, rivers and the atmosphere to human homes. While a few known strains of [bacteria](#) can destroy plants, it's likely that hundreds to thousands of other species actually help them—living in a complex, interwoven community that, when working at its best, can help the plant survive tough times.

A team led by Assoc. Prof. Jack Gilbert, a microbial ecologist at Argonne and the University of Chicago, wanted to explore these communities. Gilbert's team, in collaboration with researchers at FMC Agricultural Solutions and Sparkling Pointe Winery, led research that may help farmers encourage healthier plants without pesticides. They sampled microbes in the soil, roots, leaves, flowers and grapes from the plants in five New York vineyards over every season in the span of two years.

"One of our key findings was that the vast majority of the bacteria come from the soil," said Argonne researcher Sarah Owens. "The leaves, roots, flowers and grapes all had the same bacteria but in different abundances, which may suggest that different parts of the vine are recruiting different species."

For example, plants can encourage certain microbes to grow by producing chemicals or nutrients that those microbes like, she said.

However, each vineyard had its own unique microbial signature, Owens said, "even when the vineyards were just half a mile down the road from one another."

They also tracked differences associated with the soil's pH and its proportions of carbon and nitrogen. "The type and content of soil, the climate, the plant varieties and how the vineyard is managed—these are all expressed in the microbiome, and we have to understand them if we want to translate this knowledge into practical applications," Owens said.

"The next step," Gilbert said, "would be to see if we can find microbes that would help farmers specifically manipulate the properties of a crop—more fruit or more drought-tolerant, for example."

To do so, they need to first predict which bacteria might be helping the crop, based on just the genomic data. Argonne postdoctoral researcher Pamela Weisenhorn, also a study author, is working with Argonne computational biologist Christopher Henry to develop methods to tease out community metabolic models from metagenomic data. By feeding the data through software that flags genes with known functions, Weisenhorn can pick out organisms that appear beneficial and build simulations of how they might interact with the plant and what they're producing. This narrows the list of potential bacterial partners for field trials.

"Ultimately," Gilbert said, "we hope to give farmers more information on the invisible—how [plants](#) use [microbes](#) to respond to climate and conditions."

And perhaps in the process they could also give winemakers more clues to pin down exactly what makes up the elusive terroir—the taste of a wine from grapes grown in a particular region—a mystery that has tantalized oenophiles since winemaking began.

More information: "The Soil Microbiome Influences Grapevine-Associated Microbiota." *mBio* 6(2):e02527-14. [DOI: 10.1128/mBio.02527-14](https://doi.org/10.1128/mBio.02527-14)

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