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For Gastronomists, a Go-To Microbiologist

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JIM LAHEY, the founder of Sullivan Street Bakery in New York, wanted to find out which organisms inhabited his sourdough and produced its tantalizing sulfuric aroma.

Meanwhile, in the East Village test kitchen of the Momofuku restaurants, David Chang and Dan Felder were fermenting pork tenderloins, pistachio misos and fish sauces, and trying to understand what microbes made the process work. And in San Francisco, Harold McGee, author of the food-science book “On Food and Cooking,” began to wonder what bacterial species made his particularly long-lived yogurt culture so hardy. They all turned to the same expert: Rachel Dutton, an ebullient young Harvard microbiologist who, almost by accident, has become the go-to source for chefs and food artisans seeking to unravel the mysteries of microorganisms.

At a time when cooks are increasingly delving into the science of food, there is no shortage of resources, including a forthcoming sequel to the book “Modernist Cuisine” for home cooks; the Cook’s Illustrated “Science of Good Cooking;” and a continuing lecture series at Harvard and the University of California, Los Angeles.

But some chefs want to dig even deeper. “I would consider myself a cellular gastronomist, not a molecular gastronomist,” Mr. Lahey said. “I’m always thinking in terms of microbes and populations of microbes.”

For those who have made their way to her, Ms. Dutton is an exceptional find: a scientist who can explain arcane concepts in laymen’s terms, who dispenses her expertise pro bono, and who shares their fascination with good food.

“There really is no one else doing what she is doing,” said Mr. McGee, a contributor to the New York Times Dining section. “Academic microbiologists have not taken an interest in fermentation, focusing on [food safety](#) rather than food quality. There is really a gap at the moment.”



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Inside Harvard's gleaming Northwest Science Building here, Ms. Dutton and two postdoctoral researchers, Benjamin Wolfe and Julie Button, have been culturing **cheese** samples for scientific scrutiny. In a large, open laboratory filled with beakers and centrifuges, the three work on isolating bacteria and fungi from cheese rinds, storing them in petri dishes in a modified refrigerator they call the cave.

Ms. Dutton, 32, started out as neither a cheesemaker nor a turophile (cheese lover). Her first love is science.

After finishing doctoral work on tuberculosis and *E. coli*, she began searching for a guinea pig to study the microcosmos. She needed a village of microbes that could help scientists understand how more-complex populations communicate and build microscopic societies that we macrobes depend upon. (After all, microbes take up residence in our homes, the soil, oceans and even within our guts, where they outnumber body cells nine to one and often prove essential to health.)

Her model organism had to be complex, but not so complex that it couldn't be replicated in a lab. That's when Ms. Dutton came across the cheese section in "On Food and Cooking," and said to herself, "This is the community I have been looking for."

In 2010, she began an ambitious five-year project to sequence, analyze and map the DNA of organisms found on 160 different cheese rinds from around the world. Viewed under a scanning electron microscope, these microbial villages can look very simple or highly diverse — as different as the ecology of Lincoln Center's well-manicured lawn and that of the High Line before its flourishing weeds were tamed.

As word about the lab's work spread, first among microbiologists, then among cheesemakers, Ms. Dutton's in-box filled with requests from nonscientists, including chefs, bakers and even a pickle maker in Berkeley, Calif. Packages started showing up at her office, containing food samples for her to analyze.

The activities of these microbial communities lend distinctive flavors and aromas to fermented foods, and appear to vary from region to region.

"You can imagine certain microbes are found in certain places," Ms. Dutton said. "That's interesting in terms of cheesemaking, but that's also interesting in terms of microbiology and in manipulating microbial ecosystems."

Chefs also suspect that by harnessing the actions of these unseen native inhabitants, they can create an indigenous taste of place: a "microbial terroir." Mr. Chang said he hoped to find

signature flavors unique to the East Village that could give “locally grown” a whole new meaning.

“How can we make New York taste New York?” he said. “What makes terroir is the microbes. It’s literally what’s in the air.”

Yet the same food made in two different parts of the world may end up with a similar village of microbes. That’s what Ms. Dutton found when she sequenced Mr. Lahey’s sourdough, which started with flour, water and a culture he found on a cabbage leaf in Tuscany in 1992. (He said he looked there because he thought the leaves resembled the skins of wine grapes, which he had been picking for weeks.)

As in 90 percent of the world’s sourdough, Ms. Dutton discovered, the culture contained a single species of bacteria: *Lactobacillus sanfranciscensis*. Now, Mr. Lahey said, “I have a name for the community of microbes that make up my starter. It’s a good thing, as Martha Stewart would say.”

He also learned that all sourdough starters have to perform in a similar way, which explains why the ancient recipe for bread has remained so consistent, and replicable. While bakers made sourdoughs successfully for millennia without any of this technical knowledge, Mr. Lahey said new scientific analysis could soon herald a “golden age of fermentation.”

For now, Ms. Dutton said, her work with chefs can be time consuming, especially as she is overwhelmed with cheese, but the interactions have fueled a newfound curiosity for her, as well as for the chefs. One of her colleagues did a nonscientific side-by-side comparison between his sourdough and Mr. Lahey’s sample. Ms. Dutton has also been able to taste-test Momofuku’s miso at the restaurants’ laboratory. (After all, eating is not permitted at their workbenches in Harvard’s pristine lab.)

“I had no idea how delicious the fresh koji was, when you ferment the rice with *Aspergillus*,” she said. “It goes from tasting like plain rice to tasting like this incredibly sweet, almost dessertlike food. There’s nowhere you can taste that, unless you make it yourself.”

As for Mr. McGee’s yogurt, the sample revealed a remarkably stable, if not all that surprising, community of *Lactobacillus* and *Streptococcus*. Still, the collaboration might make the treat even longer-lived. It has been shared around the lab; as Ms. Dutton said, “We’re all making Harold’s yogurt.”

