Microbes: Marvels and Miscreants

Millions of different kinds of microbes live on our planet—in the air, in water, on the ground—and, of course, inside us and other living things. Some—like the microbes that live inside the gut and help us digest our food—enable us to live life to the fullest.

Others prefer us dead.

In this issue of *Agricultural Research,* you'll get a look at leading-edge ARS research on several microbes involved in everything from anthrax to zoonoses—diseases that can spread from animals to people.

Today, one such zoonotic disease, Rift Valley fever—the work of a *Phlebovirus* microbe (see page 11)—is still a half a world away, a scourge in Africa and some parts of the Middle East.

In contrast, the deadly *Clostridium botulinum* microbe—the cause of botulism food poisoning and the subject of a feature beginning on page 4, could actually be as close as your kitchen. That's especially true if you tend to let leftovers linger, instead of promptly refrigerating or freezing them, or if your pantry has food in dented, swollen, or rusted cans.

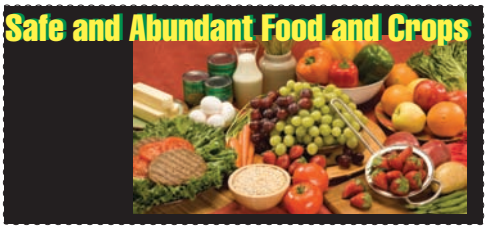
At the ARS Western Regional Research Center in Albany, California, near San Francisco, we are developing new, faster, and less expensive ways to detect botulinum toxin in foods and beverages. The illustration on this page shows how one new assay efficiently determines whether the toxin is present in a food sample and, if so, whether it is active and harmful or merely inactive and harmless.

The botulism research here in Albany has attracted attention from federal inspection and regulatory agencies as well as from scientists at two of the world's leading medical research institutions: the University of California-San Francisco and the southern California-based Beckman Research Institute at City of Hope, in Duarte.

The Beckman researchers are developing a new and improved diagnostic test that hospital emergency room doctors and other medical professionals could use to quickly and correctly diagnose botulism as the cause of a patient's symptoms.

The San Francisco scientists' focus is on designing a treatment to speed patients' recovery.

Meanwhile, studies by food safety scientists at the Eastern Regional Research Center in Wyndmoor, Pennsylvania, near Philadelphia, have resulted in new techniques to protect milk and liquid egg whites—the kind used for making angel food cake—against *Salmonella enteritidis* and the organism responsible for anthrax, *Bacillus anthracis* (see page 12). Other work at Wyndmoor has yielded a new test that, according to preliminary results, can detect *Yersinia pestis,* the causal agent of bubonic plague, in milk inoculated with this pathogen for laboratory tests.



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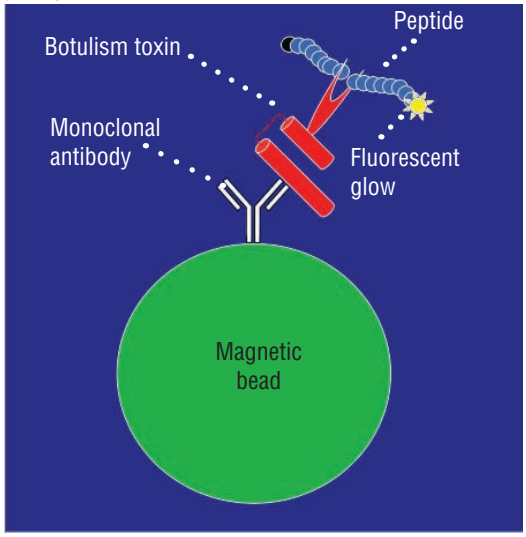

A new assay from ARS researchers reveals whether foods and beverages contain active botulism toxin (see story, page 4). Tiny magnetic beads are coated with an ARS-developed protein known as a "monoclonal antibody" and then exposed to the suspect food or beverage. With the botulism toxin clinging to the antibody, the beads are removed and exposed to a peptide (protein fragment). If active, the toxin can cut the peptide, yielding a detectable fluorescent glow.

Studies by researchers at the ARS National Animal Disease Center in Ames, Iowa, about 30 miles north of Des Moines, may produce a powerful new vaccine to protect cattle from bovine tuberculosis, caused by the microbe *Mycobacterium bovis.* The bacterium not only kills cattle but can also cause tuberculosis in humans who drink milk produced by diseased cows. Details are in an article on page 8.

Of course the harmful microbes described on the following pages continue to evolve. But the cutting-edge science and technology emerging from ARS laboratories outpaces that evolution. In this way ARS research helps ensure that America's food supply is among the world's safest.

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