FORUM

*Who Knows What Lurks?*

# Microbial Collections Key to Unlocking New Discoveries

In 2005, Cargill, Inc., of Minneapolis, Minnesota, debuted a low-glycemic syrup known as "Xtend Sucromalt." It was the product of a 4-year cooperative research and development agreement involving a team of scientists and support personnel at ARS's National Center for Agricultural Utilization Research (NCAUR), Peoria, Illinois.

Sucromalt—which digests slowly in the body, providing sustained energy—exemplifies ARS's fruitful history of collaboration with private industry to develop new products benefiting consumers and agricultural providers alike. It is also an example of the broad—and sometimes unexpected—uses to which microbes maintained in ARS's extensive collections at Peoria are being put.

The ARS-Cargill team was recognized in 2008 for scientific excellence and creativity in lifting the Sucromalt concept from the laboratory bench to consumers' hands. But credit should also have gone to strains of *Leuconostoc* bacteria whose fermentation of two sugars—maltose from corn and sucrose from sugar beets or sugarcane—enabled creation of Cargill's final Sucromalt product.

Those *Leuconostoc* bacteria were chosen from among 80,000 microbial strains that make up NCAUR's Culture Collection. Many of the microbes are historically significant, like NRRL 1951. This strain of *Penicillium chrysogenum,* originally isolated from a rotting cantaloupe, is best known as the blue-green mold responsible for the antibiotic penicillin, which saved thousands of Allied soldiers' lives during World War II and continues to save lives to this day. Other important products derived with the help of microbes from the collection include dextran blood extender and xanthan gum. The latter is widely used in food products and for industrial processes.

The Peoria collection—together with its 10,000 strains of bacteria; 45,000 filamentous fungi; 10,000 actinomycetes; and 15,000 yeasts—began in 1940. That's when Kenneth B. Raper, a new mycologist at the Northern Regional Research Laboratory (NRRL, as NCAUR was then known), acquired about 2,000 mold cultures from his USDA mentor, Charles Thom, and Thom's associate, Margaret B. Church. Other strains soon joined the collection, including citric-acid-producing yeasts from NRRL colleague Lynferd J. Wickerham.

These are but a few of the many private collections that the ARS Culture Collection at Peoria has absorbed during its 68-year history. And it's a good thing it has, too, considering that some of the collections might otherwise have been lost to retirement or transfer of key curators or even to loss of funding.

Early USDA curators like Raper and Wickerham set in motion a tradition of excellence in microbial stewardship, documentation, global collaboration, and technological innovation—from lyophilization (freeze-drying) techniques developed in the 1940s to, more recently, multigene analysis and integration of microbial data into a searchable online catalog.

Continuing that tradition today is a seven-member curatorial team in NCAUR's Microbial Genomics and Bioprocessing Research Unit, where the collection is maintained inside an access-controlled room. A subgroup of 6,000 strains there, known as the "ARS Patent Culture Collection," is 1 of only 33 International Depository Authorities (IDAs) worldwide. Each is entrusted with acquiring, storing, and distributing patented microbes, cell lines, or other biological materials in accordance with the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedure, ratified by the United States in 1980. Aside from Peoria, the American Type Culture Collection in Manassas, Virginia, is the only other IDA based in the United States.

The curatorial team's responsibilities are wide ranging, from freeze-drying new acquisitions and periodically reviving cultures to ensure genetic integrity to developing new techniques in molecular genetics to detect, identify, and classify microbial accessions from around the world. These diagnostic gene-sequence databases are widely used for identification of *Listeria, Fusarium, Penicillium,* and yeasts.

Demand is high for microbes kept at Peoria, with annual distributions totaling about 4,000 strains. This includes species necessary for plant pathology and mycotoxin studies, biological pest control, host-pathogen genetics, food processing, food safety, biotechnological applications, and germplasm enhancement. Demand for yeasts and bacteria remains especially high because of interest in developing biobased alternatives to petroleum products, including fuel and plastics.

Scientists at several ARS sites around the country currently maintain microbial collections, typically specific to particular research needs. These include:

- *Puccinia* rust and other wheat pathogens (Pullman, Washington).
- *Rhizobium* and *Bradyrhizobium* bacteria, mycoplasmas, spiroplasmas, and fungi of the order Hypocreales (Beltsville, Maryland).
- Insect-infecting, or entomopathogenic, fungi (Ithaca, New York). (See related article on page 4.)

ARS recently completed a survey of these and other in-house collections—their locales, sizes, types, and so forth—to explore ways of standardizing how they're maintained, funded, and distributed. It is hoped this, in turn, will ensure the collections' availability to researchers everywhere for years to come.

After all, the dormant microbe of today might just be the modern marvel of tomorrow.

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