

More than 100 years ago, 2 pioneering scientists figured out how to keep canned food safe

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In this photo taken in the 1920s, Samuel Cate Prescott, left, and William Lyman Underwood discuss their canning research. Image courtesy of the MIT Museum

In the late 18th century, French emperor Napoleon Bonaparte offered a cash reward to anyone who could develop a reliable method to preserve food — and keep Napoleon’s armies fed. Fifteen years later, French confectioner Nicholas Appert won the prize with his method of heating food and sealing it in an airtight container.

For nearly 50 years, no one was sure why this technique worked, until Louis Pasteur demonstrated that food spoilage is caused by microorganisms such as bacteria, which are killed by heat.

By the late 1800s, many companies were selling canned goods, but the canning process was far from perfect. In 1895, William Lyman Underwood, grandson of the founder of the William Underwood Company of Boston, America's first canning company, approached MIT Professor William Thompson Sedgwick for help with a critical problem: Some of the company's cans swelled even after heat treatment, indicating the food inside had spoiled.

Sedgwick suggested that Underwood work with Samuel Cate Prescott, then an instructor in MIT's Department of Biology. Prescott and Underwood got together every afternoon to work on the spoilage problem. They began by looking at canned clams, and their studies, conducted over several years, established a scientific approach to canning and food preservation that is still used today.

Their efforts also laid the groundwork for the formation of MIT's Department of Food Technology in 1945 (the department was disbanded in 1988). Prescott, who later studied topics such as the chemistry of coffee and diseases of the banana plant, is known as the founder of modern food technology at MIT and went on to become the first dean of MIT's School of Science.

Preventing spoilage

Underwood and Prescott took a rigorous approach to their canning studies, and found that the source of spoilage in canned clams was a type of bacteria that formed very heat-resistant spores, able to survive standard processing. Furthermore, they discovered that such spores could be killed easily by raising the temperature to 250 degrees Fahrenheit for 10 minutes.

They went on to study other canned products, including peas, corn, spinach, tomatoes, sardines and other canned fish. The pair identified

several types of bacteria that can spoil food, and they developed successful methods for preventing such spoilage, tailored to the contents and size of the container.

Prescott and Underwood discovered that in order to have a successful canning process, every point in the can had to be raised to the necessary temperature for the required length of time. To solve that problem, they incorporated engineering principles of heat transfer into their research. By carefully placing thermometers in different parts of the can, and mapping the temperature rise over time for different foods, they were able to establish a general approach to safe canning.

Neither of the scientists, nor the William Underwood Company, filed for patents on their methods, which they hoped would improve food safety for all consumers.

The work was especially groundbreaking considering that the term “microbe” had been coined only 20 years earlier, according to Samuel A. Goldblith, MIT professor emeritus of food science. At first, Underwood and Prescott had trouble convincing canners that their spoilage problems were caused by microorganisms invisible to the naked eye, Goldblith wrote in his history of food technology research at MIT, *Of Microbes and Molecules* ([Food](#) & Nutrition Press, 1995). It also introduced an engineering concept into scientific research.

Their work eventually succeeded in transforming canning from “an art based on experience to a technology based on science,” according to Goldblith. “The results and conclusions are as valid today as they were when the work was done.”

“From MIT’s perspective their collaboration was a seminal event,” says Steven Tannenbaum, an MIT professor of toxicology and chemistry who holds a chair named for Prescott and Underwood. “It reinforced the MIT

motto of ‘mens et manus’ and established that industry and academia could be partners in discovery and development.”

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