New Technologies:
Trickle-Down Technology

By Pam Erickson
Contributing Editor

Technological discoveries of great import seldom remain bound to their original purpose. The day fire went from keeping fierce cave bears at bay to cooking them for dinner could well be the day trickle-down technology — the transfer of a concept from one objective to another — was born.

Modern food science is rife with examples of technologies "borrowed" from outside the industry: canning and bottling were pioneered by scientists in Napoleon Bonaparte's camp. The French emperor offered a prize of 12,000 francs to the first person who could create a new way of preserving food; after a means of thermal processing was developed, it didn't take long for the idea to move from the military to the common sector.

Waves of the future

Moving to the 20th century, the microwave energy, once thought only to have communications applications, ended up revolutionizing food preparation techniques. In a more contemporary vein, irradiation technology, widely used in the medical and aerospace fields, is now being applied to various types of food.

Photos: TJ Hine Photography

One potential improvement to Meals Ready to Eat is the addition of the Flameless Ration Heater (FRH). This may eventually lead to self-heating consumer entrees.

Dr. Ken Lee, food science department chair at Ohio State University, Columbus, OH, draws a parallel between the initial opposition encountered by microwaves and the current rumblings being directed at irradiation.

"Irradiation possesses a great potential in the food industry because it kills microorganisms without cooking the food," Lee says. "Yet because the general public is very wary of radiation, consumer acceptance of the process has been very slow. Remember when people were afraid to stand near microwave ovens while they were cooking? That's the stage irradiation is at today."

On the other hand, Lee says, the nearly universal acceptance of microwave cooking has led to the development of many technologically advanced products and processes; many would still be mere pipe dreams were it not for the flow of information between industries.

"The microwave susceptor was developed as a result of Stealth bomber research," Lee says. "The substance was originally designed to dissipate radar imaging. It was then found to have the same effect on microwaves, creating a high level of heat. Susceptors have made a lot of consumer products acceptable — microwavable pizzas and popcorn, for instance."

Photo: Fiber Sales and Development Corp.

Microwave susceptors evolved from Stealth bomber research on materials that dissipate radar waves.

Sweet serendipity

For another example of trickle-down technology, Lee points to the field of pharmaceuticals. Aspartame, commercially marketed under its registered trademark NutraSweet, was discovered by researchers at G.D. Searle in the early 1970s. The popular sweetening agent, composed of aspartic acid and phenylalanine, was discovered during routine screening of antacids to be used for the treatment of ulcers. Searle sought U.S. Food and Drug Administration approval in 1973; after extensive testing, approval was granted in 1981.

"Sweeteners seem to develop by serendipity," Lee notes. "I don't know why the scientist at Searle decided to taste the antacid, but because he did, one of the country's most popular sugar substitutes was discovered."

But for all the food products and processes that have been enabled by trickle-down technology, there are also those that have fizzled. George Bookwalter, a former food research technologist with the U.S. Department of Agriculture's Peoria, IL, laboratory, recalls the rise and fall of spun-fiber soy products.

"General Mills developed a whole series of products using spun-fiber technology, which originally was used in the textile industry. The process is very similar to that used to spin nylon," Bookwalter says. "Bacos, simulated bacon bits, were the major product to survive research. However, General Mills eventually moved away from the process. Bacos are still on the market, but they are manufactured by extrusion, by another company."

The high cost of spinning, coupled with the fact that the simulated products' properties were still rather far removed from those of actual meat, resulted in the process's downfall.

"The technology still exists, but I don't know of any widely available commercial products using it today," Bookwalter says.

Foodservice in the service

The military sector of industry, with its unique requirements for palatable food products for use under extreme conditions, is responsible for a wide range of commercially marketed foods. Jerry Darsch, chief of the food technology division at the Natick Research, Development and Engineering Center, Natick, MA, says

23% of today's total food expenditures can be traced back to Natick's military-directed research.

For example, the Army's Meals Ready to Eat (MREs) are packaged in trilaminate flexible, or retort, pouches that are able to withstand the high heat associated with cooking. Many food companies have expressed an interest in the concept, Darsch says, although he notes that the material is not in wide use yet. He points to My Own Meals of Deerfield, IL, as one company that has successfully implemented use of the packaging.

"The bar has many applications in warmer climates, and in areas where air conditioning might not be prevalent," Darsch says of the product's future.

Another food product developed initially for the military is shelf-stable bread.

"The main ingredients in this product are no different from what you'd find in Wonder Bread," Darsch says. "The only difference is an emulsifier that has been added; it helps maintain a sufficient moisture content for a considerable period of time."

Photo: My Own Meals

When Operation Desert Shield and the subsequent Desert Storm erupted, Darsch says, Natick was able to accelerate research on high-heat stable chocolate bars.

"There was a need for a chocolate bar that wouldn't melt, yet also didn't taste like candle wax," he says. The resulting product, which can withstand temperatures as high as 120°F without compromising quality, arrived in the Persian Gulf prior to the end of the conflict; Hershey Foods introduced the Desert Bar to consumers Memorial Day weekend 1991.

Many food companies are expressing interest in trilaminate flexible packagings originally developed for the Army's Meals Ready to Eat (MRE's).

When left in its original packaging and kept no warmer than 80°F, shelf-stable bread maintains its freshness for three years. The NutriSystem diet program uses the product in some of its prepackaged meals.

Heat out of the kitchen

Developed within the last two years, the Flameless Ration Heater (FRH) is another military product Darsch foresees a future for in the commercial market.

"Despite the vast improvements that have been made in the foods contained in MREs, the food items always taste better if they can be warmed," he says. "The FRH was developed in response to a need for a heat source that did not have to remain stationary when in use. That same need can be found among campers and outdoors men."

The FRH consists of a plastic bag that contains a fiberboard pad impregnated with a chemical compound. When 2 ounces of water are added, the compound produces an exothermic reaction; the heat generated increases the temperature of the MRE entree by 100°F. This temperature can be maintained as long as one hour, Darsch says, and adds that the entire package can be contained in the pocket of a battle-dress uniform.

"The Japanese and Europeans have already experienced some degree of success with these products," Darsch says. "Self-heating meals could find a comfortable niche in the U.S. marketplace."

Ah, but what idea is so great that it cannot be improved upon? Darsch says future research could be directed at taking the FRH one step further.

"We might explore air activation as opposed to catalytic reactions, thus eliminating the need for water and making the product that much more convenient," he says.

Biodegradable food-product and packaging materials are on the research agenda at Natick.

"Soon the Navy will not be able to dump any plastics at sea, unless those items can biodegrade,"

Darsch says. "We are working with the commercial sector to develop environmentally safe plastic cutlery. The objective, of course, is to make sure it doesn't degrade before its time."

Some field testing has been completed; however, Darsch declined to speculate on when a product might hit the commercial market.

Another program at Natick revolves around Dental Liquid Rations — menus for people unable to chew solid foods. According to Darsch, roughly 56 products have been developed so far, with flavors such as barbecued chicken, corn and chocolate-mocha cake.

"These products have generated a lot of interest in the commercial sector," Darsch says. "Dentists and dietitians at hospitals, who so far have only been able to offer liquid nutrients with vanilla, chocolate or strawberry flavors, are particularly excited about these developments."

Two-way transfer

For all the innovations produced through military-directed research, Darsch notes that trickle-down technology is actually a two-way street.

"Many times, we have taken technology from the food industry's commercial sector, then adapted for various other needs," he says.

Ohio State's Lee confirms Darsch's assessment. "Quite a bit of our food-science research is directed at developing products and processes for use by other industries," he says. As an example, he cites current experiments using whey salts.

"Whey salts are a common by-product that could have many applications," he says. "Our goal has been to create value-added technology. Would you want to take whey salts and use them as road salt? No, it's not practical — rock salt and sand are dirt cheap, and do the job quite well.

"But if you take the whey and use it in particle board, or use it to create a new insulating material, then you have value-added technology. Those are ways that food science research can help benefit other industries."

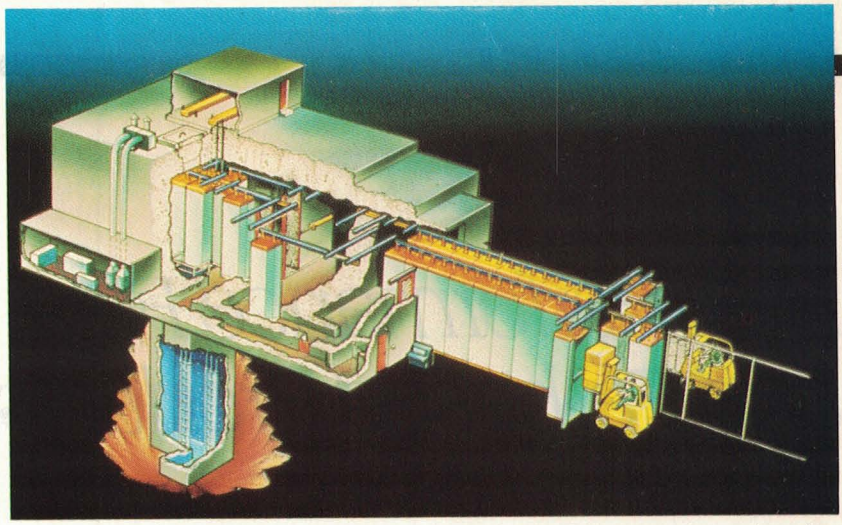

Photo: Nordion International

Technology from other industries often encounters consumer resistance. Current rumblings directed at irradiation are similar to the opposition once encountered by microwaving.

The idea of taking the concept for a new product or process, then applying it to a completely different discipline, is by no means new. But some food scientists say it is an approach that often is overlooked.

"Sometimes there are things going on just around the corner that could revolutionize our research, but we don't know about them because we're too busy to look," says Dr. Swamy Anantheswaran, assistant professor of food science at Penn State University, State College, PA.

Anantheswaran says he has been taking a look at the development of slow-release drugs, in hopes of one day applying those principles to preservatives used in food products; another project involves using electrostatic spray drying to control particle distribution in food.

Anantheswaran says he tries to attend at least one seminar a week on topics outside of the food science field, although he admits that schedules and deadlines sometimes get in the way.

"I'm as guilty as the next person when it comes to being too focused on the project at hand," he says, "but I try to keep a broad-minded approach. You don't know — maybe a topic discussed at a physics seminar will lead to a solution in your own research."

To encourage this approach outside of academia, Anantheswaran suggests food scientists attend conferences sponsored by other industries. "Going to a chemical engineering meeting might prove just as enlightening as attending a food technologists meeting," he notes. "The fine lines that we used to have around our fields are fast disappearing. We would be smart to open our minds a little more; meeting occasionally with people from other industries might ultimately make our jobs that much easier." ■

Pam Erickson is an Evanston, IL-based contributing editor specializing in topics relating to the food industry.