IMPACT PROFILE
RESEARCH AT THE UNIVERSITY OF MARYLAND

JIANGHONG MENG

Detecting Food-Borne Pathogens

The Centers for Disease Control and Prevention estimates that pathogenic microorganisms in food kill 5,000 people in the United States each year and sicken as many as 76 million people.

Only a small portion of the food headed to market is tested for bacteria and viruses, yet food production practices, both domestically and among the increasing number of foreign producers, often aren't designed with a view to eliminating dangerous pathogens in food such as fresh fruits and vegetables.

Jianghong Meng, a professor of nutrition and food science at the University of Maryland, addresses the problem of food-borne pathogens from multiple angles. His research group develops technology to improve pathogen testing and studies the effects of agricultural practice on antibiotic resistance. In addition, Meng is helping

PHOTOGRAPHY BY
Edwin Remsberg

disseminate information about food safety worldwide as interim director of the Joint Institute for Food Safety and Applied Nutrition, or JIFSAN, a multidisciplinary center for research and education established by the Food and Drug Administration and the University of Maryland.

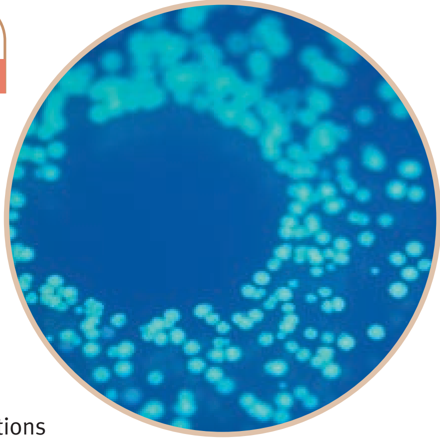
Meng's research group is developing a number of methods for detecting food-borne pathogens, whether viruses or bacteria, such as the famous strain of *E. coli* O157:H7 that has killed people through contaminated spinach and hamburger. One of the technologies Meng is applying to food safety is PCR, or the polymerase chain reaction, a very specific and sensitive method for amplifying tiny amounts of DNA. "PCR has become very mature now and is used in many different biomedical research fields. We're trying to improve, modify, increase the sensitivity, and reduce the time required for PCR," says Meng.

While PCR is a powerful method, it can be difficult to perform outside a laboratory because of the need to cycle specimens precisely among different temperatures. In collaboration with researchers at Mt. Sinai School of Medicine in New York, Meng and his research group are also developing tests that copy DNA at a single temperature. "You don't need a fancy machine. You just need a water bath to maintain a single temperature. It's more cost-effective," says Meng.

A startup company called Innovative Biosensor Company is already marketing a third strategy for detecting pathogens. Meng collaborated with the company to use genetically engineered immune cells that glow a fluorescent green when they recognize specific targets, such as *E. coli* O157:H7.

Besides developing technology for detecting pathogens, Meng studies antibiotic resistance resulting from agricultural practices. Antibiotics are not only given to livestock to treat infections but are routinely added to animal feed to promote growth. Antibiotics are even used routinely to grow produce.

"All these applications of antibiotics create problems by encouraging the development of drug-resistant bacteria," Meng says. To study the prevalence of such bacteria, members of Meng's laboratory tested bacteria on meat from grocery stores. "We found that many bacteria—*Salmonella*, *E. coli*, and *Campylobacter*—had developed resistance to antibiotics used to treat infections in people," says Meng.



Meng's group also found that bacteria are more common on organically grown meat, but that antibiotic-resistant bacteria are far more common on conventionally grown meat. Disturbingly, many isolates of *Campylobacter* from conventionally grown chicken were resistant to the important antibiotic Cipro, used to treat a wide range of human infections. It turned out that poultry producers were using a closely related antibiotic. This work, done in collaboration with scientists at FDA's Center for Veterinary Medicine, contributed to an FDA decision to ban the use of the sister antibiotic in the poultry industry.

Meng also studies the mechanisms that allow pathogens to survive and grow in the face of drugs and how genes conferring drug resistance spread. In addition, his group studies exactly how bacteria cause disease, for example how *Campylobacter* binds to and invades human intestinal cells. Meng receives funding for his research primarily from the U.S. Department of Agriculture, the FDA, and the state of Maryland.

Through JIFSAN, Meng contributes in a practical and immediate way to food safety. JIFSAN promotes collaborative research between the university and FDA, helps train food safety professionals, and plays an important role in promoting the safety of imported food. "There is no way to inspect every shipment from overseas. So how are we going to ensure the safety of imported food?" Meng asks.

JIFSAN strives to help with training programs. Between 2002 and spring 2007, JIFSAN led training programs in 13 countries on best practices for growing fruits and vegetables intended for import into the United States. With support from JohnsonDiversy Corporation, JIFSAN has also developed a program teaching best practices in producing seafood. "The incentive is less rejection in inspections for the exporting countries and a safer food supply to the U.S.," says Meng. In 2007, JIFSAN received an FDA Commissioner's Special Citation Award for this work. —*Karin Jegalian*

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Impact Profile is a supplement to *Impact*, a research digest from the University of Maryland. To learn more about research at Maryland, go to www.umresearch.umd.edu.

Produced by the Office of University Publications for the Vice President for Research, University of Maryland.