Microbial Forensics and Ag Biosecurity: 
A National Priority
terrorist attacks of September 11, 2001, elevated national security to an all time high at the federal, state and local levels. Efforts emerged in the scientific community to address U.S. preparedness and capabilities in response to intentional events related to agricultural biosecurity. Jacque Fletcher, Sarkeys Distinguished Professor in the Department of Entomology & Plant Pathology, at Oklahoma State University, was engaged by the president of the American Phytopathological Society (APS) to take the lead in determining that organization’s response to Washington’s needs in agricultural biosecurity.

The area was completely new to Fletcher and not one that she knew much about at the time. But in that role, she spent a lot of time working in Washington, meeting with agency administrators from the U.S. Department of Agriculture (USDA) and the Department of Homeland Security (DHS). She prepared a Congressional briefing and gave a number of informational presentations to various stakeholder groups, including commodity groups.

The following year when Fletcher took over as president of the APS and had to design a plenary session for an upcoming meeting, she invited some experts to speak about biosecurity and agriculture.

One of those experts was Randall Murch, a retired Federal Bureau of Investigation (FBI) agent, who had started the field of microbial forensics. At the time, he was working for the

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Fletcher will direct the Institute that will establish the university as a nationally-recognized leader in the area of microbial forensics and agriculture biosecurity.
The team realized that the discipline of plant pathology already had much information, technology and expertise that could be applied to the discipline of plant pathogen forensics. But, this had rarely been done before and most plant pathology methods had not been developed with the rigor and validation necessary for forensic purposes. New research and technology will be necessary for defending a position in a court of law. “We have to understand the limits of our tests,” says Fletcher. “We have to know how likely it is that we will have a false positive because a witness in court is going to be aggressively challenged by the other side.”

The group put together a report of capabilities, identified the gaps and determined the need to increase U.S. capabilities to trace back, for purpose of attribution, something that was done to products or crops. The group began a prioritization effort. “As this happened,” says Fletcher, “I began to understand this was a niche—an area of research that was not being addressed in this country. Oklahoma—a state rooted in agriculture—where agriculture is a major component of our economy, has all the right elements to support such an initiative. We have the Advanced Center for Genome Technology in Norman, the OSU Oklahoma Food and Agriculture Product Center, the Oklahoma City Memorial Institute for the Prevention of Terrorism and the MesoNet system, among other strengths.”

“We ... are in a position to make a real contribution to the nation.” — Fletcher

The MesoNet system, for example, plays into the epidemiology side of forensics. Plant pathologists usually use epidemiology to predict where a plant disease is going in the future. In forensics, you see where the disease is and try to trace it back to the source. “The MesoNet allows us to do that,” says Fletcher. “We have all these capabilities, so we are in a position to make a real contribution to the nation. And, it’s not being done anywhere else in the country.” Fletcher proposed a new initiative that has resulted in the creation of the National Institute for Microbial Forensics and Food & Agricultural BioSecurity (NIMFFAB) within the OSU system.

Clarence E. Watson, associate director, Oklahoma Agriculture Experiment Station (OAES), supports the formation of the Institute as proposed by Fletcher. “Recent events in our country, such as ‘mad cow’ disease, the E. coli outbreaks in the spinach and lettuce crops, and the anthrax contamination of federal mail in our nation’s capital clearly indicate the relevance of this topic. These incidents all had marked effects upon our agricultural economy and food security, and it is critical that we be able to quickly and accurately identify the source and/or perpetrators of these outbreaks.”

Watson went on to say there are few institutions with the expertise to deal with this growing problem. Fletcher has a wealth of experience in the field and is widely recognized by her peers as a leader in the area of biosecurity. “The research of the Institute is of critical importance to the mission of the OAES, and we strongly endorse the establishment of the Institute,” said Watson. The Division of Agriculture Sciences and Natural Resources (DASNR) provided some funding for the initiative.

Steph W.S. McKeever, vice president for research and technology transfer, says the effort is in direct support of OSU’s research efforts in sensing and homeland security, and is also in support of the university’s strategic planning objectives. Fletcher was the only ‘plant person’ on the national level FBI’s Scientific Working Group on Microbial Genomics and Forensics. One outcome is that the director of the National Biosecurity Forensics and Countermeasures Center, a subset of DHS, wrote a letter of support for the USDA National Needs Fellowship grant that Fletcher and her colleagues Robert Allen and Ulrich Melcher received for student support in this area of research.

John Fernandez, president, OSU Center for Health Sciences (CHS), and dean, College of Osteopathic Medicine, congratulated Fletcher on securing...
fellowship support for graduate students working in the emerging area of forensic science. He went on to say, “The Center for Health Sciences fully supports Fletcher and Robert W. Allen’s efforts in the creation of NIMFFAB. Through this, Oklahoma can take the lead in agricultural forensics.”

Allen, who is chair of the Department of Forensic Sciences at OSU’s CHS, also endorsed the concept. “As collaborators we have already experienced the success that synergy between two different areas, plant pathology and forensic science, can have on funding requests in this newly emerging area of forensic science. Creating the proposed Institute will only further enhance the potential for future funding and, more importantly, ensure that our university establishes itself as a nationally recognized leader in the agricultural biosecurity initiative.”

News of the Institute based in Stillwater was well received within the Oklahoma City FBI office, where the responsibility to protect Oklahoma’s vital agricultural infrastructure is taken very seriously. “I feel the creation of NIMFFAB will allow OSU to be a leader in the nation’s efforts to prevent an agroterrorism event. Such a role is very much supported by the Oklahoma City office of the FBI,” said Samuel Macaluso, acting special agent in charge.

The OKC Division of the FBI helped form the Oklahoma Agroterrorism Working Group (AWG), which now includes 41 organizations representing industry, law enforcement, government and academia. OSU has a strong presence on the Oklahoma AWG, with active members and personnel in leadership roles on the AWG Steering Committee. As a public-private alliance, the AWG focuses on establishing pre-crisis liaison and two-way communication flow while training and preparing to deal with the potential threat of agroterrorism.

A workshop on microbial forensics and agricultural biosecurity, funded by DASNR, was held in Oklahoma City, Oklahoma in January 2007 to look at possible scenarios, something that could be a real situation, leading to the development of a decision tree for law enforcement individuals assigned to investigate an agricultural crime scene. These may be FBI agents or other security personnel who are not experienced in agricultural or crop-related issues. They need to understand what kind of questions to ask, what information they would look for or what would be useful to them, such as patterns of disease in the field or particular symptoms they see.

The workshop discussions may be expanded in the future into a full-fledged field exercise in which security personnel would go through the steps as if in a ‘real’ scenario. “You can do this approach with plant pathogens, but not with humans or animals,” Fletcher explained. “Plant pathologists must be able to inoculate plants in the field as long as the pathogen is already common in the state every year. Thus, we have the ability to create a man-made event that can be compared with a natural situation. Then you create a decision tree for someone coming on to the scene, test it against a real situation, modify the tree and test it again. This way, you get a sense of the real issues that you are faced with.”

Fletcher says she will work to establish the Institute and to attract funding for research projects that support development of capability in this area. Research will include projects that would help identify more rigorous methodology, more portable methodology and quicker methods to enhance the capability to respond before evidence is destroyed or the disease gets out of hand or to identify perpetrators and bring them to attribution. This could be research in disease diagnosis, pathogen identification and best ways to collect evidence, store it, save it and test it. Or, it could be research in epidemiology or food safety.

Fletcher, who will direct the Institute says she hopes as time goes on the Institute will expand to include new faculty positions, but existing OSU faculty can work in affiliation with the Institute or take on a partial appointment. In addition to research, Fletcher also envisions the Institute playing a role in the other elements of the land grant university—education, training and extension.

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