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Rapid test for pathogens developed by K-State researchers

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Dangerous disease often spreads faster than it takes to diagnose it in the lab. To remedy that, researchers at Kansas State University have developed a test to bring that time from days down to hours.

Sanjeev Narayanan, assistant professor, and Greg Peterson, research microbiologist, both in the department of diagnostic medicine and pathobiology, use a device called a DNA spotted microarray to seek out the specific genetic markers that set one pathogen apart from another and determine antibiotic resistance.

Traditionally, it takes days and multiple lab workers to screen a sample of soil, water or feces for just one pathogen. Additional time is then needed to look for resistance to antibiotics. The new test developed at K-State simultaneously looks for multiple diseases and antibiotic resistance, reducing the time it takes from sampling to diagnosis to about 24 hours.

"We needed a mass, high through-put system," Narayanan said. "The longer a serious disease goes undiagnosed, the harder it is to treat and the further it can spread."

Narayanan and Peterson have analyzed DNA of hundreds of pathogens and synthesized DNA probes for the specific genetic sequences that set each pathogen apart. So far they can detect as many as 557 genes, making it possible for them to screen for 40 different species of bacteria, 1,200 serotypes of *Salmonella*, five common serotypes of *E. coli*, and resistance to the 45 most common antibiotics used to treat

human and animal illnesses caused by these pathogens.

When a sample is submitted, technicians extract and fluorescently label total DNA, and run a microarray to check whether a particular gene is present. Narayanan said the next step will be to develop a test that indicates how much of a pathogen is present, or rather how bad an infection is.

Narayanan said that he and Peterson developed the test because most human and animal infections are caused by a mixture of pathogens.

Under the current practice, it literally takes days to isolate and identify each individual pathogen and generate their antimicrobial resistance profiles. This means physicians and veterinarians often start antibiotic treatment before knowing exactly what they're up against.

"This new test will eliminate a lot of the guesswork," Narayanan said. It will tell the doctor how many different kinds of pathogens are in a sample and which antibiotics won't work, all in a shorter time frame. The test's efficiencies also translate into lower cost, he said.

Should the U.S. ever be attacked with biological weapons, Narayanan said the new test also will help in quickly identifying all of the bacterial pathogens used.

"Being able to get such quick results for so many pathogens at once will become critical in case of bioterrorism," he said. "Under that scenario, every minute counts in providing treatment or preventing disease spread."

Also, such pathogens would likely be engineered for resistance to common drug treatment and the new test would determine such resistance rapidly, Narayanan said.

The test is currently being used in research labs at K-State's College of Veterinary Medicine to detect animal and zoonotic pathogens; zoonotic pathogens can be transmitted between humans and animals. The test also is being used to monitor the flow of genetic elements in food production systems, such as feedlots. However, Narayanan hopes the test one day will be used to enhance the clinical diagnosis of animal and human infections.

Source: Kansas State University