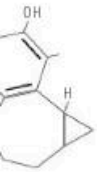
TARGETING A KILLER

Simple test may diagnose deadly global illness

By Cindy Tumiel



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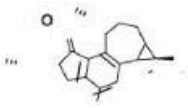
>
> Shannon Weigum, Ph.D.,
> ASSISTANT PROFESSOR OF BIOLOGY



Here is a glimpse into the future of global public health: a credit-card sized piece of paper, dunked into a liquid sample in a Third World health clinic that quickly tells a doctor or nurse whether a malnourished child with diarrhea is infected with a virus, a bacteria, or a parasitic protozoan.

Gastrointestinal ailments may sound like a small matter in the industrialized world, but in millions of remote villages in undeveloped nations, food and water-borne illnesses are potentially deadly matters. Worldwide, diarrheal diseases are among the top 10 causes of death; according to the World Health Organization, and they are the second biggest killer of children under the age of three.

Rapid diagnosis can mean fast, appropriate treatment. This is the quest of Shannon Weigum, Ph.D., an assistant professor of biology at Texas State University. Her laboratory is merging principles of biochemistry and materials science in the develop-ment of a miniature, highly portable, rapid-detection tool for diarrheal illnesses that could someday make a major impact on global health.

"In healthy people, diarrheal illnesses often resolve themselves without treatment," says Weigum, an interdisciplinary researcher. "When a person is malnourished, immune compromised, or suffering from chronic illness, the consequences can become very serious. This is especially true in malnourished children."

Weigum's first diagnostic targets are noroviruses, a type of virus that causes more than half of the food-borne illnesses in the United States. Noroviruses have been in the news in the last few years for sickening hundreds of cruise ship passengers. Health data show that noroviruses are the most common cause of diarrhea in adults and the second most common cause in children.

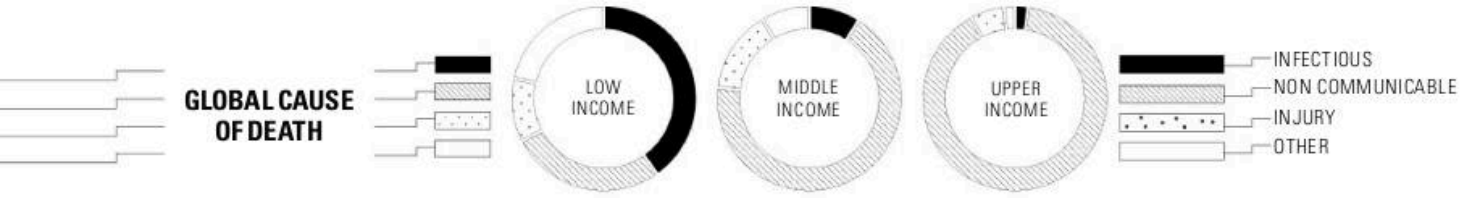
To be practical for remote clinics in undeveloped areas, though, laboratory tools have to be inexpensive as well as highly portable. Poor countries lack medical infrastructure and skilled personnel to operate the sophisticated diagnostic tools found in large urban medical centers.

The team at Texas State is working on a two-step process that utilizes technology from the emerging fields of nanotechnology and microfluidics. The first step uses specialized magnetic nanoparticles that can be coated with antibodies to attract a pathogen [an agent that causes disease]. In the lab, the nanoparticles are added to a test tube with the biological sample, and then magnetic energy is applied to separate the infectious material away from the rest of the sample.

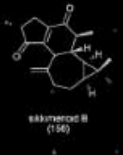
The second step involves use of a special patterned piece of paper that has been treated with a chemical that Weigum's lab developed to attract norovirus organisms. When the lab sample is added, the clinic worker can determine by the colors and patterns it makes whether a patient is infected with a norovirus.

"If someone is infected with a norovirus, then obviously, treating them with an antibiotic is not going to help," says Weigum. While antibiotics work against bacterial infections, they don't do any good against viral infections.

jatrophalone A (157) R_1= Me, R_2= H
158 R_1=Me, R_2=OH
jatrophalone B (159) R_1=H, R_2=Me
160 R_1=OH, R_2=Me



Noroviruses are just the first phase of the project.



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Weigum also is working on making the paper tool sensitive to *Cryptosporidium* and *Giardia*, protozoan parasites that also cause diarrheal illness. She envisions developing the tool so it can even detect bacteria such as *Salmonella*, *Campylobacter* and other food or water-borne bugs. "The idea here is to use the technology as a platform that can detect different infectious agents," Weigum says.

Her solution is taking shape with the help of a Career Development grant from the Western Regional Center for Excellence in Biodefense and Emerging Infectious Disease Research, which is centered at The University of Texas Medical Branch in Galveston. The center is supported by an 11-year, $105 million grant from the National Institutes of Health and is drawing researchers from five states together in the search for newer, faster ways to detect emerging infections, including agents that could potentially be deployed as terrorist weapons. The WREC's Career Development program supports scientists at the early stages of their careers that have promising ideas for improved detection or treatments for potential bioterrorism threats.

Weigum began her science career as a high school teacher in San Antonio, and then returned to the classroom as a student to pursue advanced degrees at The University of Texas in Austin. After earning master's and doctorate degrees in biochemistry, she moved to a postdoctoral fellowship in bioengineering at Rice University, where her love of biology began to merge with materials science and opened the door to cutting-edge engineering innovations in developing diagnostics. Now at Texas State, her diverse training is taking shape in the development of an innovative tool with tremendous potential impact, says David Walker, M.D., executive director of the WREC.

"Dr. Shannon Weigum embodies the perfect example of a talented young scientist who made the transition from a postdoctoral fellow to an assistant professor by successfully competing for research funding while meeting her teaching obligations," says Walker, the chairman of pathology at UTMB.

"In addition to the development of a new platform for detection of clinically-relevant noroviruses that could improve diagnosis and monitoring of diarrheal illness, Weigum's project establishes an important collaboration among The University of Texas Medical Branch, Texas State University and Baylor College of Medicine," Walker adds. "Her paper-based microfluidic assay is being developed for use in resource-poor countries, and should lead to better diagnosis of diarrheal diseases that are often deadly in young children."

It is not hard to imagine the illnesses and potential deaths that could result from terrorists' release of infectious agents into the food supply, whether in food processing plants, community water supplies or even sprayed across a food buffet. But food- and water-borne illnesses also are a real world problem that public health providers face every day in restaurants, hospitals, daycare centers and even luxury cruise ships. Those arenas provide potential markets that could make her diagnostic tool a commercially viable product.

Weigum says her diagnostic tool is a few years away from the market. "We need more funding to refine and expand the platform, then maybe a commercial partner to collaborate in the manufacturing and distribution," she says.