Researchers developing nanoscale optical fibers to detect bioterrorist agents

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(PhysOrg.com) -- In an age when bacterial agents may be intentionally released as method of terrorist attack, there is an increased need for quick diagnostic methods that require limited resources and personnel. Thomas Inzana, the Tyler J. and Frances F. Young Chair of Bacteriology in the Virginia-Maryland Regional College of Veterinary Medicine at Virginia Tech, has been awarded a grant from the National Institutes of Health to develop such a diagnostic test.

He and his co-investigators, James “Randy” Heflin, a professor in the Department of Physics in the university’s College of Science, and Abey Bandera, a research assistant professor in the veterinary college, are working to develop nanoscale optical fiber biosensor tests, or assays, for detection of *Francisella tularensis*, *Burkholderia mallei*, and *B. pseudomallei*.

Currently, testing involves either the use of cultures in Biosecurity Level-3 (BSL-3) laboratories, or -- since facilities do not have BSL-3 capabilities -- serology or antibody-based testing. Both require extensive materials and training, and the results can take days or weeks.

“This assay will be rugged, portable, inexpensive, and rapid,” said Inzana, who is also the associate vice president for research programs at the university. “All of these are critical to minimizing the affect on an intentionally introduced biological weapon.”

The increased speed of detection allowed by this new, optical fiber assay

will also increase the speed of treatment for those affected, according to Inzana.

The optical fiber is coated with antibodies or DNA that will bind to antigens or DNA in the specimen. When this happens, the light that normally passes through the fiber will be decreased, indicating the presence of a biological agent.

According to Inzana, there are advantages and disadvantages to both. Antigens are more abundant and closer to the surface of the agent, but aren't always very specific. DNA, however, is very specific, but is less plentiful and resides deep within the cell.

Inzana and his co-investigators are currently developing assays using both, with the plan to increase their sensitivity and specificity to make them viable options for detection of a variety of biological agents. They have had previous experiences using a similar assay to detect the presence of Methicillin-resistant Staphylococcus aureus (MRSA), which received a seed grant from the Virginia Tech Carilion School of Medicine and Research Institute to support collaborative research between Virginia Tech and Carilion Clinic researchers on medical challenges.

"This is very much an interdisciplinary project," said Inzana, "with each of us reliant upon the other."

Inzana earned his bachelor and master's degrees from the University of Georgia, his Ph.D. in microbiology from the University of Rochester School of Medicine, and was a post doctoral fellow at the Baylor College of Medicine.

His current research focuses on understanding the role of bacterial virulence factors in pathogenesis and host response, and the development

of subunit and live vaccines to prevent tularemia and glanders due to the select agents Francisella tularensis and Burkholderia mallei, respectively. His research group is investigating the in vivo development and function of Histophilus somni biofilm formation in the bovine host during pneumonia, myocarditis, and other systemic infections to develop new treatments to prevent biofilm formation, and as a model to study human biofilm infections.

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