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Rapid Diagnostic Test for Common Type of Pneumonia Developed

University of Georgia researchers have developed a technique that can diagnose a common type of pneumonia within minutes, potentially replacing existing tests that can take several days for results.

The researchers, whose findings are detailed online in the journal PLoS ONE, detected Mycoplasma pneumoniae, which causes atypical or "walking pneumonia," in true clinical samples with over 97 percent accuracy using a recently-developed nanotechnology-based platform.

"If you can make a positive identification from a 10-minute test, then appropriate antibiotics can be prescribed, limiting both the consequences in that patient and the likelihood that it will spread to others," said lead-author Duncan Krause, a Professor in the Department of Microbiology in the UGA Franklin College of Arts and Sciences.

Krause and his colleagues built upon an existing technology called surface-enhanced Raman spectroscopy, which works by detecting spectral signatures of a near-infrared laser as it scatters off a biological specimen. They were able to enhance the Raman signal by using silver nanorod arrays to detect the tiny bacteria in throat swab specimens.

Krause, who also directs the interdisciplinary UGA Faculty of Infectious Diseases, compared the nanorod array developed by collaborator Yiping Zhao, Director of the UGA Nanoscale Science and Engineering Center, to a brush with densely packed bristles, where each of the tiny silver rods extends out at a specific angle. The sample, such as bacteria from a throat swab, penetrates among the bristles, where the spectral signature produced by the laser is amplified and then analyzed by a computer program.

Krause noted that infections due to M. pneumoniae are very common yet difficult to diagnose. The bacterium is a major cause of respiratory disease in humans and the leading cause of pneumonia in older children and young adults.

"Walking pneumonia feels like a bad chest cold that will not go away," he explained. "It can persist for weeks and even months and can cause permanent damage to the lungs if not diagnosed promptly. A delay in diagnosis extends the likelihood for complications as well as continued transmission of the infection to others."

Krause said the device can be reduced to a size that could fit in a briefcase, although their testing is currently done only in a laboratory setting. "Our hope is that when we begin to explore the capabilities of this technology, it can be applied in point-of-care testing," he added. "Then the impact becomes truly significant."

Krause hopes the combined efforts of the research specialists in nanotechnology and infectious disease will eventually be able to determine if the technique is effective in detecting other pathogens in clinical samples. "We need to do a thorough job with mycoplasmas first," said Krause. "Then we can go to other clinical samples and ask the same questions with other infectious agents."

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Suzanne L. Hennigan, Jeremy D. Driskell, Richard A. Dluhy, Yiping Zhao, Ralph A. Tripp, Ken B. Waites, Duncan C. Krause, Olivier Neyrolles. Detection of Mycoplasma pneumoniae in Simulated and True Clinical Throat Swab Specimens by Nanorod Array-Surface-Enhanced Raman Spectroscopy. PLoS ONE, 2010; 5 (10): e13633 DOI: 10.1371/journal.pone.0013633