Researchers use gold nanoparticles to diagnose flu in minutes

August 4 2011

Arriving at a rapid and accurate diagnosis is critical during flu outbreaks, but until now, physicians and public health officials have had to choose between a highly accurate yet time-consuming test or a rapid but error-prone test.

A new detection method developed at the University of Georgia and detailed in the August edition of the journal *Analyst,* however, offers the best of both worlds. By coating gold nanoparticles with antibodies that bind to specific strains of the flu virus and then measuring how the particles scatter laser light, the technology can detect influenza in minutes at a cost of only a fraction of a penny per exam.

"We've known for a long time that you can use antibodies to capture viruses and that nanoparticles have different traits based on their size," said study co-author Ralph Tripp, Georgia Research Alliance Eminent Scholar in Vaccine Development in the UGA College of Veterinary Medicine. "What we've done is combine the two to create a diagnostic test that is rapid and highly sensitive."

Working in the UGA Nanoscale Science and Engineering Center, Tripp and co-author Jeremy Driskell linked immune system proteins known as antibodies with gold nanoparticles. The gold nanoparticle-antibody complex aggregates with any virus present in a sample, and a commercially available device measures the intensity with which the solution scatters light.

Driskell explained that gold nanoparticles, which are roughly a tenth of the width of a human hair, are extremely efficient at scattering light. Biological molecules such as viruses, on the other hand, are intrinsically weak light scatterers. The clustering of the virus with the gold nanoparticles causes the scattered light to fluctuate in a predictable and measurable pattern.

"The test is something that can be done literally at the point-of-care," said Driskell, who worked on the technology as an assistant research scientist in Tripp's lab. "You take your sample, put it in the instrument, hit a button and get your results."

Gold is often thought of as a costly metal, but the new diagnostic test uses such a small amount—less than what would fit on the head of the pin—that the cost is one-hundredth of a cent per test.

The researchers noted that the current standard for definitively diagnosing flu is a test known as PCR, for polymerase chain reaction. PCR can only be done in highly specialized labs and requires that specially trained personnel incubate the sample for three days, extract the DNA and then amplify it many times. The entire process, from sample collection to result, takes about a week and is too costly for routine testing.

The alternative is a rapid test known as a lateral flow assay. The test is cost effective and can be used at the point-of-care, but it can't identify the specific viral strain. It also misses up to 50 percent of infections and is especially error-prone when small quantities of virus are present, Driskell added.

By overcoming the weaknesses of existing diagnostic tests, the researchers hope to enable more timely diagnoses that can help halt the spread of flu by accurately identifying infections and allowing

physicians to begin treatment early, when antiviral drugs, such as Tamiflu, are most effective.

Tripp and Driskell are planning to compare the new diagnostic test with another that Tripp and his colleagues developed that measures the change in frequency of a laser as it scatters off viral DNA or RNA. Tripp also is working to adapt the new technique so that poultry producers can rapidly detect levels of salmonella in bath water during processing. Poultry is the largest agricultural industry in Georgia, he pointed out, so the technology could have a significant impact on the state's economy.

"This test offers tremendous advantages for influenza, but we really don't want to stop there," Tripp said. "Theoretically, all we have to do is exchange our anti-influenza antibody out with an antibody for another pathogen that may be of interest, and we can do the same test for any number of infectious agents."

Provided by University of Georgia