New technology sheds light on viruses

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ARS scientists are using surface-enhanced Raman scattering with gold nanoparticles to design tests for identifying viruses that cause West Nile fever and Rift Valley fever (RVF). RVF is spread by mosquitoes to humans and to sheep, cattle, and some other livestock in Africa and the Middle East. Credit: Keith Weller

(Phys.org) -- Diagnostic tests that rapidly detect disease-causing viruses in animals and humans are being developed by U.S. Department of Agriculture (USDA) scientists using a new technology called "surface-enhanced Raman scattering," or SERS.

With SERS, molecules give off their own unique signals or wavelengths that can be detected with a spectroscope. Viral molecules are labeled with a dye that makes them detectable when a laser is shone on them. Moving a metal such as gold or silver close to the labeled molecules greatly enhances the detection signal.

Microbiologist William Wilson at the Agricultural Research Service (ARS) Center for Grain and Animal Health Research in Manhattan, Kan., used this technology to identify viruses that can cause West Nile fever and Rift Valley fever, both of which are spread by infected mosquitoes. ARS is USDA's chief intramural scientific research agency.

Wilson and his collaborators at the University of Wyoming designed a nucleic acid diagnostic assay to bring molecules close to gold nanoparticles in solution. The gold nanoparticles boost the spectroscopic signal from the indicator molecule, making it easier to detect viral nucleic acid from infected cells. They also developed an immunoassay that rapidly detects antibody responses to viruses.

Scientists hope to eventually adapt the assay to field-based bedside or pen-side diagnostic tools. For example, an instrument similar to a dipstick could be used to rapidly determine areas where a disease outbreak is occurring. Veterinarians could take blood samples from animals on farms, put the samples in small vials and read them with a hand-held device to determine if a virus is present.

Another advantage of the assay is that it can be used to test for multiple pathogens, whereas current pen-side tests are generally agent-specific. The sensitivity of the new diagnostic assay is also greater than the current pen-side system and potentially as good as widely used polymerase chain reaction-based tests.

Findings from this research were published in Biosensors and

Bioelectronics and Analytical Chemistry.

More information: Read more about this research in the April 2012 issue of Agricultural Research magazine.

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