Biodegradable nanoparticles slip through mucus

July 5 2012

(Phys.org) -- Researchers at Johns Hopkins University (JHU) have created biodegradable, ultra tiny, nanosized particles that can easily slip through the body's sticky and viscous mucus secretions to deliver a sustained-release medication cargo. The interdisciplinary team of researchers, led by Justin Hanes of the JHU Center for Nanomedicine, developed the nanoparticles so that they not only penetrate mucus but degrade over time into harmless components. The team believes these nanoparticles have potential for delivering chemotherapeutic agents to tumors in mucus-coated tissues such as the lung and cervix.

Reporting its work in the journal *Science Translational Medicine*, the Johns Hopkins team describes its development of a mucus-penetrating nanoparticle for achieving vaginal delivery of a drug that could prevent herpes simplex virus infection. However, the authors note that the same design principles would apply to a nanoparticle that would deliver anticancer agents to cervical tumors or cut through the mucus in the lungs.

The new biodegradable particles are made of two polymers routinely used in existing medications: poly(lactic-co-glycolic acid), known as PLGA, and poly(ethylene glycol), commonly called PEG. An inner core traps therapeutic agents inside the nanoparticle, while a dense outer coating allows a particle to move through mucus nearly as easily as if it were moving through water and permits the drug to remain in contact with affected tissues for an extended period of time. Tests in mice showed that these mucus-penetrating nanoparticles were able to

uniformly coat the vaginal tissue, penetrat through mucus to reach the vaginal folds within minutes, and remain in the target tissue for 24 hours. In contrast, conventional nanoparticles were aggregated and did not distribute along the vaginal tissue uniformly, remained trapped in the mucosal layer, and were unable to reach the tissue below.

"The major advance here is that we were able make biodegradable nanoparticles that can rapidly penetrate thick and sticky mucus secretions, and that these particles can transport a wide range of therapeutic molecules, from small molecules, such as chemotherapeutics and steroids, to macromolecules, such as proteins and nucleic acids," said Dr. Hanes, who is also a member of the Johns Hopkins Center for Cancer Nanotechnology Excellence. "Previously, we could not get these kinds of sustained-release treatments through the body's sticky mucus layers effectively."

This work, which was funded in part by the National Cancer Institute, is detailed in a paper titled, "Mucus-penetrating nanoparticles for vaginal drug delivery protect against herpes simplex virus." An abstract of this paper is available at the journal's website.

Provided by National Cancer Institute