MSU team developing new way to fight influenza

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Abby Leary and Jim Wiley work with an aerosolization chamber used to innoculate the lung. (MSU photo by Kelly Gorham).

(PhysOrg.com) -- Montana State University scientists are researching the use of nanomaterials to develop a new way of fighting influenza and other respiratory infections caused by viruses.

If it works in humans the way it does in mice, people will prepare for a respiratory viral assault by inhaling an aerosol spray containing tiny protein cages that will activate an immune response in their lungs. This activated immune state will be good against any respiratory virus and last more than a month. People won't have to wait for scientists to analyze new viruses, develop vaccines against them, then distribute and administer the vaccine.

"It's like having a fire department at your house before the fire. If a fire starts, you don't have to call them and wait for them to arrive. They are already there," said Jim Wiley, assistant research professor in the Department of Veterinary Molecular Biology in MSU's College of Agriculture.

Wiley has been working on the protein cage nanomaterial approach for more than 2 1/2 years. A recent $275,000 grant from the National Institutes of Allergy and Infectious Diseases will allow his research team to continue another two years. The grant was made possible through the American Recovery and Reinvestment Act of 2009.

The hollow protein cages he uses in his research are prepared in MSU's Center for Bio-Inspired Nanomaterials, Wiley said. These protein cages are made by a heat-loving bacterium, and they are similar to one which the Center for Bio-Inspired Nanomaterials recently isolated from a bacterium that thrives in the thermal features of Yellowstone National Park. The cages are hollow spheres that carry nothing on the outside. They are so small that they have to be magnified 50,000 times to be seen under an electron microscope. A human hair is 7,000 to 10,000 times wider than these cages.

The cages alone are enough to set off an immune response in the lungs, Wiley said. If the approach works in humans, people who have prepared their lungs with nanomaterials might sniffle for a couple of days instead of being hospitalized. Rather than missing work for a few days with an influenza infection, they may only need to sleep a few extra hours at night.

"You would be able to prepare an entire population for an imminent respiratory viral infection, like the swine influenza infections that we just experienced," Wiley said.

Wiley and 10 co-authors from MSU, Utah State University and the University of Rochester Medical Center have already published a scientific paper on the nanomaterial approach, which is based upon activating "inducible Bronchus-Associated Lymphoid Tissue," or iBALT, in the lung. This iBALT is a naturally occurring tissue that is made in the lung as part of the normal immune response to an infection. The paper showed that the presence of iBALT accelerated the recovery of infected mice without causing lung damage or other harmful side effects. The acceleration effect of the treatment disappeared gradually after one month. The paper about it ran in the September 2009 edition of PLoS One, an online scientific journal from the Public Library of Science.

MSU co-authors of the paper were Laura Richert, Steve Swain, Ann Harmsen, Mark Jutila and Allen Harmsen in the Department of Veterinary Molecular Biology; Trevor Douglas, Chris Broomell and Mark Young in the Center for Bio-Inspired Nanomaterials. Douglas and Broomell are also in the Department of Chemistry and Biochemistry. Young is also in the Department of Plant Sciences and Plant Pathology.

In the current project, Wiley said he and his team are testing this iBALT-based therapy in animal models, whose response to influenza infection is close to that seen in humans. He doesn't know when this iBALT-based approach will be tested in humans, but said, "It certainly is promising as a treatment right at the moment."

He added that nanomaterials could be generated much faster than vaccines.

Wiley's current research team consists of Richert and four lab technicians: Abby Leary, Rebecca Pulman, Soo Han and Mark McAlpine. Richert is a doctoral student from Idaho.

"I have been excited to work on it," Richert said about the project. "It has been interesting from a non-traditional immunological standpoint."

Wiley said if iBALT-based therapies had been in place last year, people would have been better prepared for H1N1.

"If we had been able to develop a state of immune preparedness in the lungs or a partial activation state in the lungs, we could have at least given people some degree of protection," Wiley said.

Provided by Montana State University