New model sheds light on secondary bacterial pneumonia

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August 9, 2016 - For years, researchers have known that the bacteria *Staphylococcus aureus* (*S. aureus*) can trigger severe, sometimes deadly secondary bacterial pneumonia, in some people who are subsequently infected with influenza A virus, but scientists have not known exactly how this happens. Now, scientists have developed a new model for studying this phenomenon, which could lead to new treatments designed to prevent secondary bacterial infections. The findings were published this week in *mBio*, an online open-access journal of the American Society for Microbiology.

"This study has established a physiologically relevant model, so we can now more carefully evaluate the actual events involved after colonization with *S. aureus* and identify the primary factors that can lead to secondary bacterial pneumonia," said principal study investigator Anthony Campagnari, PhD, Professor of Microbiology/Immunology and Medicine at the University at Buffalo, State University of New York.

S. aureus is one of the most common causes of secondary bacterial pneumonia in cases of seasonal influenza. Scientists have been studying this phenomenon by introducing *S. aureus* directly into the lungs of mice. However, this does not mimic the natural pathogenesis of infection. In the new model, Ryan Reddinger, a senior doctoral student in the Campagnari Laboratory, developed a technique where *S. aureus* stably colonizes the nares of mice and these animals are subsequently infected with influenza A virus to see what would happen.

"Ryan's work demonstrated that influenza A virus infection leads to the dissemination of *S. aureus* from the nasal cavity into the lungs, resulting in the development of secondary bacterial pneumonia in these mice," said Dr. Campagnari. "The model is very relevant to the current physiologic state in humans where individuals are colonized by *S. aureus* in the nares and subsequently acquire a viral infection. The fascinating thing about this model is when we colonize mice with *S. aureus* it remains in the nares for up to 7 days, without obvious signs of disease and does not appear to move to the lungs on its own. The bacteria only disseminates to the lungs in response to the subsequent viral infection."

It has been well known that when a person gets a viral infection, there are certain physiologic changes that occur in the nasopharynx that are related to damage of host cells and host responses, including increased body temperature and release of ATP, glucose, and norepinephrine. With their model, the researchers discovered that a combination of these factors, in the absence of influenza A virus, will cause *S. aureus* to leave the nasopharynx and travel to the lungs.

"We don't know why the viral infection induces the bacteria to disseminate to the lung, but now we can evaluate potential mechanisms more closely because of this model," said Dr. Campagnari. "In addition this model could be adapted to study other virus-bacterial interactions."

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