Researchers discover 'acquired' DNA key to certain bacterial infection

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Researchers announced this week the discovery of a mechanism by which Mycobacterium avium – a bacterium which can result in serious lung infections and is prevalent in emphysema and AIDS patients among others – infects tissue cells or “macrophages” and thus compromises the body’s immunity.

Results of the study, led by researchers at Oregon State University, will be published online this week in the *Proceedings of the National Academy of Sciences*. Other co-authors were from the University of Nebraska.

The key to the bacterium’s ability to enter environmental amoebas – and ultimately humans – is an “island” of genetic material acquired through evolution from another bacterium, according to Luiz E. Bermudez, a professor of biomedical sciences in OSU’s College of Veterinary Medicine and an author of the study.

“Without these acquired genes, the bacterium is very inefficient in infecting environmental amoeba, which is the environmental host,” Bermudez said. “In fact, its efficiency is close to zero. But with this ‘island’ of acquired genetic material, the bacterium finds a way to get inside the cells and it takes control, not the phagocyte.”

Phagocytes are cells that engulf and digest pathogens and cellular debris, and in humans serve as the body’s initial immune response.

The researchers did not find a similar island of acquired genetic material in two similar bacteria, Mycobacterium tuberculosis and Mycobacterium paratuberculosis, which causes Johne's disease.

M. avium exists in the environment and is thought to infect humans when the infected environmental hosts – amoebas – are inhaled or swallowed.

Incidence of M. avium as a cause of syndromes may be decreasing because of changes in treatment for HIV-infected patients, according to the Centers for Disease Control and Prevention, which estimates that 1 out of 100,000 persons may be affected. However, CDC also notes that the bacterium's resistance to antibiotics – already a problem – may be increasing. In contrast, the incidence of lung infection in patients with chronic lung diseases and cystic fibrosis is increasing.

Understanding the mechanism by how M. avium penetrates the macrophage and infects humans may eventually lead to interventions that can prevent, or at least, reduce the chance of infections, though Bermudez cautioned that it is early in the process.

"We still don't know what most of the individual genes do," he said, "and none of the DNA sequences match those in known databases."

The researchers did discover that one of the genes provides coding for a protein that targets action in the host cell, which may help the bacterium survive in the macrophage.

Bermudez said the researchers learned the genetic "island" was acquired from another bacterium because of its unique nucleotide structure, which differs from its Mycobacterium cousins. Such evolution likely took place over thousands of years, he pointed out, and may have come from a pathogen which also has the ability to infect environmental

amoeba.

Source: Oregon State University