UC-Led Team Shows How Bacterial Community Evolves

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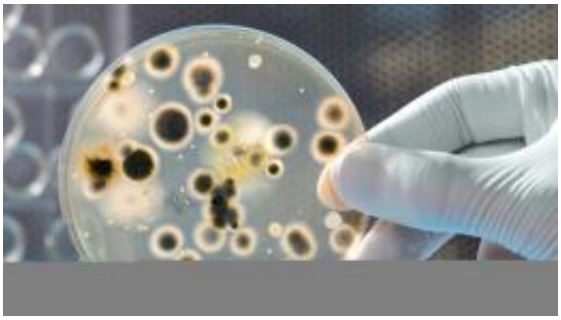

(PhysOrg.com) -- An international team led by a University of Cincinnati researcher has shown how a bacterial community evolves to survive hostile host defenses in the body.

The team, led by Malak Kotb, PhD, chair of UC's of molecular genetics, biochemistry and microbiology department, analyzed the evolution over time of the community structure of Group A streptococcus (also known as GAS or Strep A), a bacterium often found in the throat or on the skin. It can cause many human diseases, ranging from strep throat to debilitating and often deadly diseases of the heart, skin, kidney and brain.

In the 1980s, hypervirulent strains of the Strep A bacteria emerged, including necrotizing fasciitis (commonly known as the flesh-eating

disease), an invasive GAS that is an infection of the deeper layers of skin and subcutaneous tissue. About 9,000 to 11,500 cases of invasive GAS disease—in which bacteria get into parts of the body where bacteria usually are not found—occur each year in the United States, resulting in 1,000 to 1,800 deaths annually, according to the Centers for Disease Control and Prevention (CDC). In Greater Cincinnati, there have been several highly publicized cases associated with death or amputation.

The research team's findings appear in PLoS ONE, an open-access online journal of peer-reviewed articles.

"This is the first organized attempt to capture the dynamics of bacterial evolution in live species and to discover molecular events that are associated with stark changes in the demographics of the bacterial community as they sacrifice the majority of their members and select the fittest ones to survive host defenses," says Kotb, who is also director of the Midwest Center for Emerging Infectious Diseases (MI-CEID).

Researchers found that as dominant members of the population surrendered to host immune defenses, they were replaced by a hyperaggressive, mutant minority population that thrived and took over the abandoned community to become the new majority.

Using a mouse model, the team monitored evolutionary changes in the bacterial community as it faced different environmental factors and attempted to adapt to different host niches. The data confirmed that the bacterial community is mixed and that under certain conditions different populations can take over the community.

"What we perceive as a single bacterial colony is in fact a mixture of subpopulations whose members play different roles to achieve virulence," says study author Ramy Aziz, PhD, of Cairo University's department of microbiology and immunology. "The survivors, it turns

out, have the final word."

Authors call the study a first step toward exploring the sociomicrobiology of invasive Group A streptococci within a living organism. They plan to follow with single cell studies of bacteria associated with immune cells to further dissect the different roles played by members of the same bacterial community.

More information: Plos ONE paper: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0009798

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