Biofilms: Even stickier than suspected

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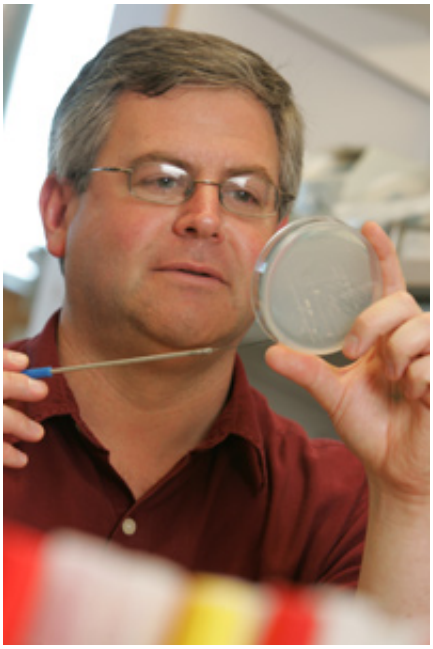

USC College associate professor of molecular biology Steven Finkel. Photo credit Philip Channing

(PhysOrg.com) -- Biofilms are everywhere - in dental plaque and ear canals, on contact lenses and in water pipelines - and the bacteria that make them get more resilient with age, finds a new study in *FEMS Microbiology Letters*.

Because bacteria in biofilms resist antibiotics, the study may have long-term implications for medical researchers seeking to develop better drugs and less infection-prone devices.

Biofilms are bacterial cities clinging to a surface. In addition to aiding infections, they can hamper industrial processes by clogging pipelines and gumming up machinery.

And as the study shows, biofilms may hold lessons for scholars of evolution.

Authors Steven Finkel and Alison Kraigsley of USC College found evidence of natural selection in a single-species bacterial biofilm. Finkel is associate professor of molecular biology. Kraigsley is a graduate student in Finkel's group.

"The bacteria that originally formed the biofilm are not the same as the bacteria that we harvest from that same biofilm later," Finkel said. "The mutants we find are more fit than the original founding strain."

A 2007 paper by Hansen et al. in the journal Science had found evidence of natural selection in bacterial biofilms, but only in response to competition between species.

The new study shows directly that bacteria in biofilms can evolve as a result of starvation or other external pressures.

"We demonstrate here for the first time that a single species of biofilm-forming bacteria can evolve in response to changing environmental conditions," the authors wrote.

Finkel and Kraigsley incubated biofilms of E. coli bacteria for as long as 33 days, representing potentially hundreds of generations of growth. They then removed bacteria from old biofilms and pitted them against bacteria from very young biofilms.

The goal was to see which group would become dominant through sheer

numbers of offspring.

"We never observed one-day-old biofilm-harvested cells outcompeting older cells at any time point," the authors stated.

To guard against the possibility that the older populations might simply be more accustomed to the biofilm environment, rather than genetically different, the researchers placed the cells in a neutral culture for 20 generations before starting the competition.

The cells from the older biofilms still outgrew their competitors, suggesting that the advantage was rooted in their genes.

The microbes' ability to multiply through multiple generations very quickly makes them ideal model systems for the study of natural selection.

The biofilm experiment is a variation on the Finkel group's best-known work: their studies of how starvation of microbes in a closed environment leads to the emergence of a dominant type of cells known as GASP mutants, for Growth Advantage in Stationary Phase.

GASPers, as Finkel calls them, outcompete bacteria from younger cultures. The key is not the age of individual microbes but the age of the culture they come from: young offspring of GASPers exhibit the same dominance as their parents.

Source: University of Southern California (news : web)