Engineers track bacteria's kayak paddle-like motion for first time

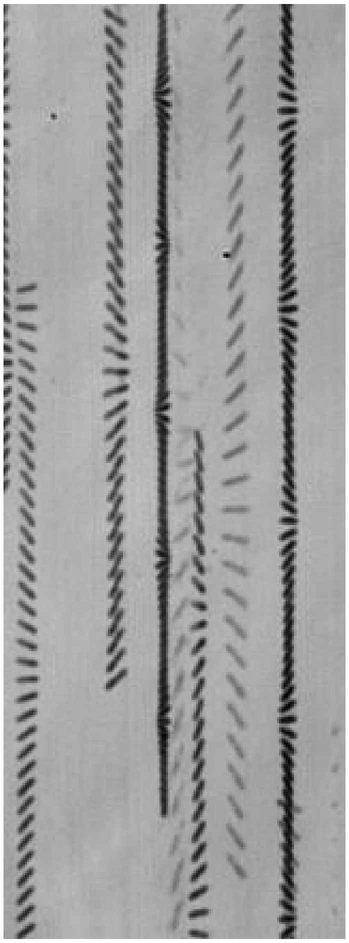
September 25 2009

Yale engineers have for the first time observed and tracked *E. coli* bacteria moving in a liquid medium with a motion similar to that of a kayak paddle.

Their findings, which appear online September 29 in the journal *Physical Review Letters*, will help lead to a better understanding of how bacteria move from place to place and, potentially, how to keep them from spreading.

Scientists have long theorized that the cigar-shaped cell bodies of *E. coli* and other microorganisms would follow periodic orbits that resemble the motion of a kayak paddle as they drift downstream in a current. Until now, no one had managed to directly observe or track those movements.

Hur Koser, associate professor at Yale's School of Engineering & Applied Science, previously discovered that hydrodynamic interactions between the bacteria and the current align the bacteria in a way that allows them to swim upstream. "They find the most efficient route to migrate upstream, and we ultimately want to understand the mechanism that allows them to do that," Koser said.



The team took sequential images of the *E. coli* bacteria to track their movements, which resemble the motion of a kayak paddle, through a liquid medium. Credit: Hur Koser/Yale University

In the new study, Koser, along with postdoctoral associate and lead author of the paper, Tolga Kaya, devised a method to see this motion in progress. They used advanced computer and imaging technology, along with sophisticated new algorithms, that allowed them to take millions of high-resolution images of tens of thousands of individual, non-flagellated *E. coli* drifting in a water and glycerin solution, which amplified the bacteria's paddle-like movements.

The team characterized the bacteria's motion as a function of both their length and distance from the surface. The team found that the longer and closer to the surface they were, the slower the *E. coli* "paddled."

It took the engineers months to perfect the intricate camera and computer system that allowed them to take 60 to 100 sequential images per second, then automatically and efficiently analyze the huge amount of resulting data.

E. coli and other bacteria can colonize wherever there is water and sufficient nutrients, including the human digestive tract. They encounter currents in many settings, from riverbeds to home plumbing to irrigation systems for large-scale agriculture.

"Understanding the physics of bacterial movement could potentially lead to breakthroughs in the prevention of bacterial migration and sickness," Koser said. "This might be possible through mechanical means that make it more difficult for bacteria to swim upstream and contaminate water supplies, without resorting to antibiotics or other chemicals."

Source: Yale University (news : web)

Citation: Engineers track bacteria's kayak paddle-like motion for first time (2009, September 25) retrieved 2 May 2024 from
https://phys.org/news/2009-09-track-bacteria-kayak-paddle-like-motion.html