Researchers find new 'molecular motors' that bacteria use to transport proteins

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(PhysOrg.com) -- Joshua Shaevitz, an assistant professor from the Department of Physics and the Lewis-Sigler Institute for Integrative Genomics at Princeton University, along with Mingzhai Sun, a postdoctoral associate at Princeton, and scientists from the Universite Aix-Marseille in France, have discovered a new type of molecular machine used by bacteria for intracellular protein transport and gliding motility. The research involved the study of prokaryotes, single-celled organisms that lack a membrane-bound nucleus and are the most primitive form of life.

"These findings fundamentally change the way we understand intracellular organization in prokaryotes," the researchers said. Their results were published in May in the *Proceedings of the National Academy of Science*.

Sun and Shaevitz describe the findings as follows:

"In this paper, we show that bacteria possess molecular motors that are used for transporting proteins along the length of a cell. Until now, such motors were thought to exist only in higher organisms. Furthermore, we show that these motors can be used to facilitate cellular gliding over solid surfaces, thereby solving a long-standing mystery about how certain cells move in groups.

"Gliding locomotion is widespread throughout the bacterial kingdom and plays an important role in pathogenesis and biofilm formation. However,

unlike bacterial swimming, which is understood to occur by means of a helical propeller called the flagellum, the mechanism underlying bacterial gliding has long been enigmatic, mostly because this type of movement does not obviously involve extracellular organelles. We used a multidisciplinary approach to show that gliding is generated by coupling unidirectional intracellular transport with extracellular force generation. Moreover, we identified the molecular engine, a proton channel, that drives this transport.

"In addition to solving an old biological problem, these discoveries have important consequences for the field of prokaryotic biology. Intracellular transport had not been observed previously in bacteria and our results show that the class of molecular motors used for transport in higher organisms is conserved among bacteria. Moreover, we found that the motion of individual motors was tightly controlled by the cell, indicating that these new motors are likely to be highly sophisticated machines in both their regulation and degree of cooperativeness. We expect future research to uncover many more roles for these machines in bacterial cells."

Provided by Princeton University

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