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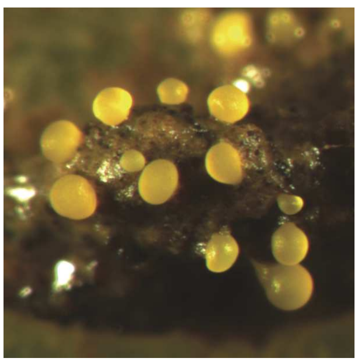
Slip sliding away

Vivienne Baillie Gerritsen

Like us, bacteria have to move if they want to get somewhere. Or away from something. We take the bus, hop into a car, use our legs or climb onto a bicycle. Different bacteria have different means of locomotion that they have had ample time to perfect since their first appearance on earth millions of years ago. Some squirt slime to propel themselves forward. Or use flagella to swim in water. While others hitch a ride on a fellow cell, or project pili with which they heave themselves forward. Recently, researchers discovered yet another mechanism: gliding by way of minute anchors. Such motility systems always involve complex protein assemblies but one individual sticks out among the others: the adventurous gliding Z protein. AglZ is an essential part of the gliding mechanism some bacteria use to skim across solid surfaces.



Thousands of *Myxococcus xanthus* cells amassed into a fruiting body with spores, ready to glide…

Photo by Michel Vos, 2005
Source: wikipedia

The Dutch merchant Anton van Leeuwenhoek was the first to observe bacteria in the 17th century, under a microscope of his own design. He called the creatures he described, animalcules. Over 100 years later, the German naturalist Gottfried Ehrenberg renamed them ‘bacteria’ from the Greek ‘bacterion’ meaning ‘small staff’. It took a further century before the renowned French microbiologist Louis Pasteur and his contemporary, Robert Koch, demonstrated that although bacteria were essential in a number of vital daily processes, they could also be the carriers of fatal diseases.

The tiniest drop of water shelters over a million bacterial cells. A teaspoon of soil can be a home to 40 billion. Needless to say, there are a lot of bacteria around. They were amongst the first organisms to populate our planet, and have never stopped multiplying and evolving since. They live in earth’s every nook and cranny, in the deepest depths of oceans, and at temperatures none of us could stand. Minuscule though they may be, many of them carry out tasks we couldn’t do without, while others can ground us and leave us at death’s door.

Bacteria have to move in all kinds of media, and they have thought up as many ways as they need to do so. With time, they have devised two ways of gliding across hard substrates: either on their own or with one – or more – of their kind. The two mechanisms have been named adventurous gliding motility and social gliding motility, respectively. Bacteria can use either mechanism, or indeed both. *Myxococcus xanthus* uses the two means of locomotion, and is the bacterium in which aglZ was identified. Researchers had been observing *Myxococcus xanthus* for years; when it wasn’t hitching a ride, it seemed to be moving on its own within a film of slime. Consequently, many believed that there was something in the slime that helped the micro-organism move forward. What they could not see were the tiny clumps that riddled the creature’s “belly” along its length, at regular intervals. These clumps were finally observed thanks to the use of fluorescence techniques, and aglZ turned out to be a major protein in their formation.

AglZ is a coiled-coil protein, reminiscent of myosin. In its absence, *Myxococcus xanthus* cannot adhere to substrate and, as a result, cannot move on its own. AglZ is part of a Lilliputian anchor that spans the bacterium's membranes, and forms a gangway between its cytoskeleton and the surface along which it is gliding. If you could have a look at the bacterium's underside, you would see a neat row of these anchors. While, to the naked eye, they appear to be immobile with regard to the surface, they are in fact moving along a helical runway in the opposite direction to that of the bacterium. This runway is in fact part of the organism's cytoskeleton and its helical structure – combined with the 'walking' anchor – causes the bacterium to spin around its long axis. The whole mechanism seems very close to the myosin/actin motor system used in muscle contraction, for instance.

Because they are so ubiquitous, nowadays almost any discovery regarding bacteria is significant one way or another. Bacteria are used in the preparation of fermented foods and beverages such as cheese, bread, pickles, yoghurt, wine and beer, not to mention waste processing and bioremediation. They are used to replace pesticides and produce chemicals that are of pharmaceutical or agrichemical importance. Bio-engineered bacteria know how to synthesize therapeutic proteins, such as insulin, growth factors and antibodies, which have made a huge difference in our society in the past years. In short, without bacteria, research in molecular biology, genetics and biochemistry would not have taken such great leaps forward in the past decades. Yes, but their means of locomotion you're thinking… The way – and the speed at which – bacteria move is paramount since their virulence depends on it. Consequently, aglZ is a great candidate to tinker when designing novel therapies which could counter adventurous gliding. And what better way to stop the troops from advancing than to tamper with their means of locomotion?

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