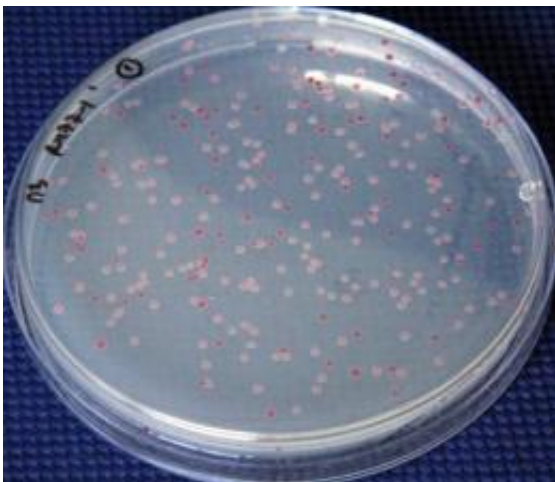


Frontal attack or stealth? How subverting the immune system shapes the arms race between bacteria and hosts

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This photo shows bacterial colonies in a culture in the laboratory. Credit: João Gama & Francisco Dionísio, IGC & Univ. Lisbon

Why is it that *Mycobacterium tuberculosis* can cause tuberculosis with as little as 10 cells, whereas *Vibrio cholerae* requires the host to ingest up to tens of millions of cells to cause cholera? This is the question that two research teams, from the Pasteur Institute, in France, and the Instituto Gulbenkian de Ciencia and the University of Lisbon, in Portugal, answer in the latest issue of the journal *PLoS Pathogens*. The researchers show that bacteria that are able to invade and/or destroy cells of the host's immune system have higher infectivity, whereas those that are more

motile, multiply faster and communicate with each other are less infectious, that is, it takes more bacterial cells to trigger an infection. These findings help understand the patterns that shape infectivity of bacteria, and contribute to more accurate predictions of how emerging pathogens may evolve, with implications for public health.

Despite the multitude of mechanisms that pathogens use to exploit its [human host](#), the research teams of Eduardo Rocha, in France, and Francisco Dionísio, in Portugal, set out to find common themes in the mechanisms used by distantly related bacteria. The researchers trawled through scientific literature on 48 bacterial pathogens. They related several bacterial features (motility, interactions with the immune system, growth rate) with their value of ID50 – the minimum number of [bacterial cells](#) that is required to trigger an infection in 50% of infected hosts.

The teams found that bacteria that are able to destroy or subvert phagocytes – the cells of the immune system that engulf bacteria – have ID50 of around 250 cells. The remaining bacteria, meanwhile, have ID50 values of around 30 million – they are much less infectious. These bacteria rely on high turnover (or growth), are very motile, and are capable of communicating with other bacteria, through the mechanism of quorum-sensing.

Says Joao Gama, first author of the paper, "In the "arms race" between disease-causing bacteria and the hosts they infect, some bacteria act through frontal attack, whereas others operate through stealth, manipulating the host's immune system. Many others are somewhere in between. Our findings suggest that the low ID50 (more infectious) bacteria be classed as working by stealth; the high ID50 bacteria are those that resort to frontal attacks".

Provided by Instituto Gulbenkian de Ciencia

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