Unmasking anthrax for immune destruction

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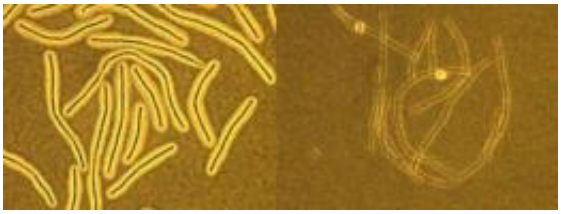

Overexpression of CapD results in a smaller capsule in *Bacillus anthracis*. Capsule is indicated as the clear area around the bacillus. Wild-type strain is shown on the left and the strain over-expressing CapD is shown on the right. Credit: Arthur Friedlander

Anthrax-causing bacteria can be engineered to shed their invisibility cloaks, making it easier for the immune system to eradicate it, according to a new study published in *Microbiology*. The work could lead to new measures to treat anthrax infection in the event of a biological warfare attack.

Bacillus anthracis is a particularly lethal pathogen because it manages to escape recognition by the host's immune system by coating itself with a protective capsule around its surface. A key bacterial enzyme called capsule depolymerase (CapD) anchors the capsule to the cell surface. CapD can also cut and release some of the capsule into small fragments that are thought to interfere with specific parts of the immune system, offering further protection to the bacterium.

Scientists at the U.S. Army Medical Research Institute of Infectious

Diseases discovered that by engineering *B. anthracis* to produce higher-than-normal amounts of CapD, the protective capsule is chopped up and released as tiny fragments. The bacterium is left nearly completely unmasked and therefore vulnerable to immediate detection and destruction by the macrophage and neutrophil cells of the immune system. "By engineering *B. anthracis* to over-produce CapD, we are effectively turning the bacterium's own weapon on itself," explained Dr. Arthur Friedlander, one of the principal investigators in the study.

B. anthracis is the most commonly mentioned pathogen associated with biological warfare. This bacterium can form resilient spores that survive dormant in the environment for long periods of time. When these spores are aerosolised the bacterium can be very effectively distributed. After human inhalation the spores reactivate and cause severe infection that is usually fatal if left untreated.

Dr Friedlander believes his groups' findings could have significant clinical impact. "Many pathogenic bacteria, including *B. anthracis*, produce a capsule surrounding them that prevents the infected host from killing them, improving their chances of causing disease," he explained. "Understanding the mechanisms of virulence used by the anthrax bacterium is vital to developing medical countermeasures against it in the event of a biological attack."

Finding a way to encourage *B. anthracis* to unwittingly unmask itself, using the bacterium's own machinery would be a novel approach to eradicating the pathogen. "What is more, these measures may also be effective against strains of *B. anthracis* that have been genetically engineered to be resistant to antibiotics and/or existing vaccines," suggested Dr. Friedlander.

More information: doi:10.1099/mic.0.035857-0

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