

# Biologists discover an extra layer of protection for bacterial spores

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Bacterial spores, the most resistant organisms on earth, carry an extra coating of protection previously undetected, a team of microbiologists reports in the latest issue of the journal *Current Biology*. Their findings offer additional insight into why spores of the bacteria that cause botulism, tetanus, and anthrax survive methods to eradicate them.

The study was conducted by researchers at New York University's Center for Genomics and Systems Biology, Loyola (Ill.) University's Medical Center, and Princeton University's Department of [Molecular Biology](#).

The researchers studied the spores of a non-pathogenic bacterium, [Bacillus subtilis](#), which is commonly found in soil. Although non-pathogenic, *B. subtilis* spores exhibit many of the same structural features of the spore-forming pathogens. In this study, the scientists examined the proteins that comprise spores' protective layers. Previous research has shown that 70 different proteins make up these layers. Less understood is how these proteins interact to form the spores' protective coats.

To do this, the researchers examined coat formation of both normal and mutant spores. In the latter case, they removed genes for selected coat proteins, allowing them to determine which proteins were necessary in—and extraneous to—the formation of the spores' coats.

To observe proteins' behavior in living cells, the researchers fused the

genes encoding the spores' coat proteins to a marker, a Green Fluorescent Protein (GFP). This procedure allowed them to monitor how the proteins localized to form spores' protective coats. A combination of [fluorescence microscopy](#) experiments and high-resolution image analysis enabled the researchers to overcome a theoretical limitation of [light microscopy](#), pinpoint the location of the spores' coat proteins with a high degree of precision, and build a map of the spore coat. These experiments suggested the existence of a new outermost layer of the spore coat. They were then able to confirm the existence of this new layer using electron microscopy.

The researchers named this coat layer, located on the spores' outer surface, the "spore crust." While it has not yet been confirmed, it is possible that the spore crust is a common feature of all spore-forming bacteria, such as the [botulism](#), tetanus, and anthrax pathogens.

Provided by New York University

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