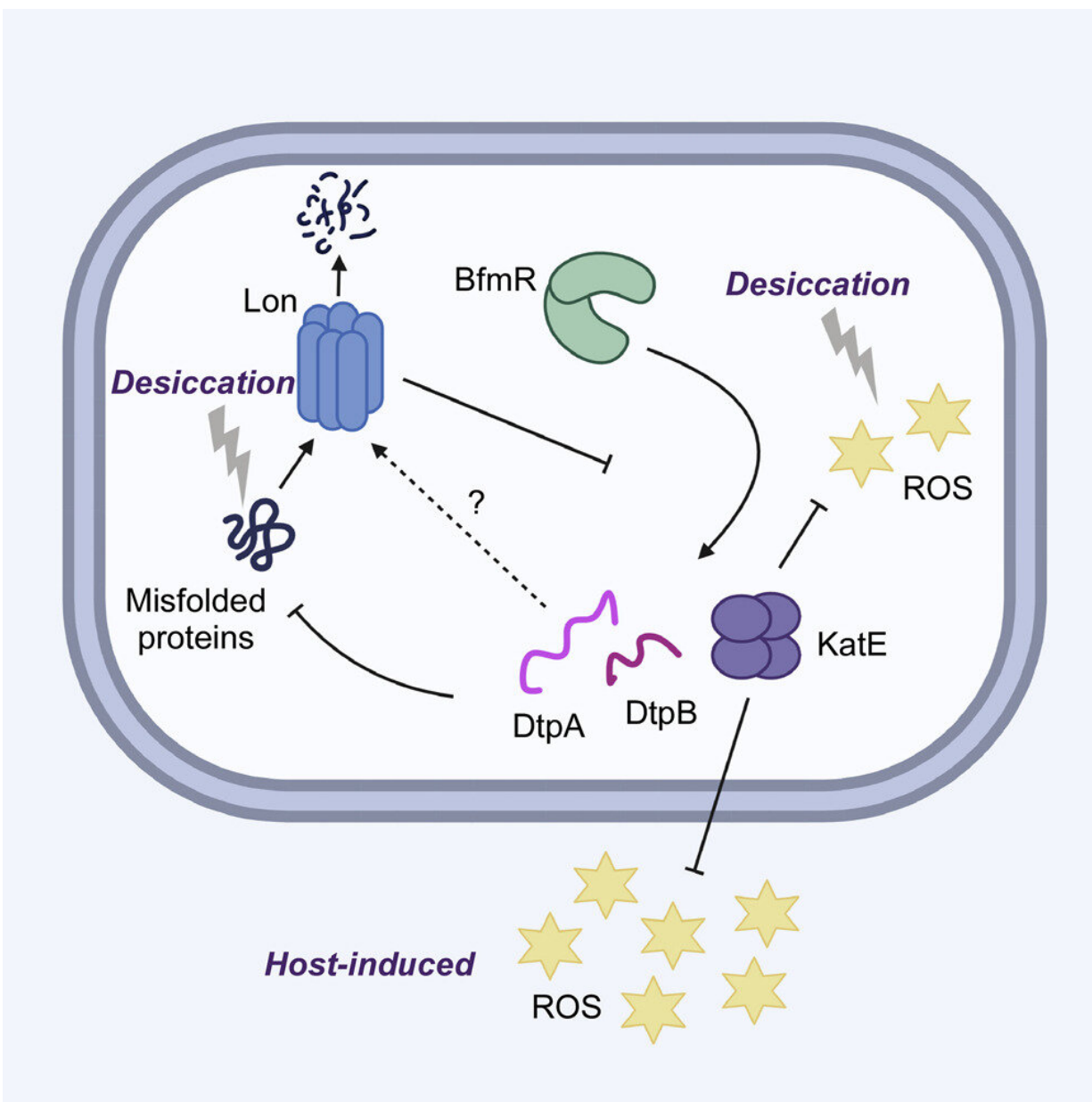


Study finds how *Acinetobacter baumannii* survives without water on hospital surfaces

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Graphical abstract. Credit: *Cell Host & Microbe* (2022). DOI: 10.1016/j.chom.2022.03.019

The pathogen *Acinetobacter baumannii* can survive on hospital surfaces—without water—for months, an ability that has helped it become a leading cause of hospital-acquired infections.

Now, a team of Vanderbilt University researchers has discovered a mechanism this bug uses to live in a dried-out state: It produces "hydrophilin" proteins that protect against water deprivation.

The discovery, reported in the journal *Cell Host & Microbe*, could guide new strategies to eliminate *A. baumannii* from surfaces by targeting these hydrophilin proteins.

The World Health Organization considers *A. baumannii* one of the highest priority bacteria for which new antibiotics are needed because of its growing [antibiotic resistance](#), said Eric Skaar, Ph.D., MPH, Ernest W. Goodpasture Professor of Pathology, Microbiology and Immunology.

"The fact that *A. baumannii* contaminates hospital surfaces and is extremely difficult to get rid of puts it into close contact with very vulnerable patients," said Skaar, who is also director of the Vanderbilt Institute for Infection, Immunology, and Inflammation. Disruptions to infection control practices during the COVID-19 pandemic have resulted in recent surges in *A. baumannii* cases.

The findings might also have translational applications for preserving protein- and live bacteria-based pharmaceuticals (probiotics) that are dried and packaged into pill form, with only a fraction surviving.

"A challenge for probiotics is getting enough bacteria through the stomach and into the gut," Skaar said. "If you put these proteins from *Acinetobacter* into a probiotic, that organism would be much more likely to survive the desiccation (drying) process and come out of the pill alive."

To explore how *A. baumannii* tolerates [water loss](#), postdoctoral fellow Erin Green, Ph.D., led studies that first examined the effects of desiccation on *A. baumannii* physiology and pathogenesis. The researchers found that *A. baumannii* could survive more than seven months of desiccation and that when it was dried and then rehydrated, it caused more virulent infections in mice. They also demonstrated that recently isolated clinical strains of *A. baumannii* were 10 times more resistant to desiccation compared to an older laboratory strain.

Using a genetic screen, Green and colleagues discovered two *A. baumannii* "desiccation tolerance proteins," which the group named DtpA and DtpB. The proteins have an unusual amino acid sequence of repeating units and don't look like typical proteins, Skaar said.

"The [protein sequence](#) really surprised us, and we figured out pretty quickly that DtpA and DtpB share these unusual features with a group of proteins called 'intrinsically disordered proteins' that are present in organisms known to be extraordinarily resistant to water starvation."

The list of organisms includes tardigrades, nematodes, yeast and plant seeds. DtpA and DtpB are some of the first bacterial intrinsically disordered proteins to be characterized.

"It was pretty cool to figure out that *Acinetobacter* is using the same strategy to resist water deprivation as tardigrades, which are among the most resilient animals known and have even survived exposure to outer space," Skaar said.

The researchers demonstrated that expressing DtpA in a different, probiotic strain of [bacteria](#) could extend protection against water loss to that strain, lending support to the idea of using DtpA or similar proteins to aid probiotic survival after desiccation. They also showed that drying or heat-inactivating a purified protein [enzyme](#) in the presence of DtpA protected the enzyme's activity.

"We think these proteins may have a valuable commercial application for preserving activity of protein and probiotic therapeutics," Skaar said.

Authors in addition to Green and Skaar include Andrew Monteith, Ph.D., and Hualiang Pi, Ph.D., at VUMC and Joseph Fakhoury and David Giedroc, Ph.D., at Indiana University.

More information: Erin R. Green et al, Bacterial hydrophilins promote pathogen desiccation tolerance, *Cell Host & Microbe* (2022). [DOI: 10.1016/j.chom.2022.03.019](https://doi.org/10.1016/j.chom.2022.03.019)

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