Department of Microbiology

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Clostridioides difficile Subverts Nutritional Immunity through Formation of Iron Storage Organelles

ABSTRACT

Iron is indispensable for almost all forms of life but toxic at elevated levels. To survive within their hosts, bacterial pathogens have evolved iron uptake, storage, and detoxification strategies to maintain iron homeostasis. However, these iron homeostatic systems are largely undefined in the human pathogen Clostridioides difficile. C. difficile is a Gram-positive, spore-forming anaerobe and the leading cause of nosocomial and antibiotic-associated infections in the United States. In this study, we demonstrated that C. difficile undergoes an intracellular iron biomineralization process, stores iron in membrane-bound ferrosome organelles containing non-crystalline iron phosphate biominerals, and the ferrosome system is required for bacterial colonization and survival in the inflamed gut to combat calprotectin-mediated iron sequestration. The discovery of ferrosome nanoparticles in pathogenic bacteria has the potential to reshape our understanding of host-pathogen interactions during infection, redefine the concept of trace element storage in anaerobes, unveil important insight into how gut microbes cope with changes in elemental levels within the host, and provide a prototype for production of metal nanoparticles and drug delivery vesicles, opening countless new avenues of research.

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