

Alsteens D, Aimanianda V, Hegde P, Pire S, Beau R, Bayry J, Latgé JP and Dufrêne YF. (2013). Unravelling the nanoscale surface properties of chitin synthase mutants of *Aspergillus fumigatus* and their biological implications. *Biophys J*. 105: 320-327.

Understanding the surface properties of the human opportunistic pathogen *Aspergillus fumigatus* conidia is essential given the important role they play during the fungal interactions with the human host. Although chitin synthases with myosin motor-like domain (CSM) play a major role in cell wall biosynthesis, the extent to which deletion of the CSM genes alter the surface structural and biophysical-biological properties of conidia is not fully characterized. We used three complementary atomic force microscopy techniques-i.e., structural imaging, chemical force microscopy with hydrophobic tips, and single-molecule force spectroscopy with lectin tips-to gain detailed insights into the nanoscale surface properties (ultrastructure, hydrophobicity) and polysaccharide composition of the wild-type and the chitin synthase mutant (Δ csmA, Δ csmB, and Δ csmA/csmB) conidia of *A. fumigatus*. Wild-type conidia were covered with a highly hydrophobic layer of rodlet nanostructures. By contrast, the surface of the Δ csmA mutant was almost completely devoid of rodlets, leading to loss of hydrophobicity and exposure of mannan and chitin polysaccharides. The Δ csmB and Δ csmA/csmB mutants showed a different behavior, i.e., the surfaces featured poorly organized rodlet layers, yet with a low hydrophobicity and substantial amounts of exposed mannan and chitin at the surface. As the rodlet layer is important for masking recognition of immunogenic fungal cell wall components by innate immune cells, disappearance of rodlet layers in all three chitin synthase mutant conidia was associated with an activation of human dendritic cells. These nanoscale analyses emphasize the important and distinct roles that the CSMA and CSMB genes play in modulating the surface properties and immune interactions of *A. fumigatus* and demonstrate the power of atomic force microscopy in fungal genetic studies for assessing the phenotypic characteristics of mutants altered in cell surface organization.