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Thesis abstract

Coordination between chromosome translocation and peptidoglycan remodelling during spore development

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Successful cell proliferation requires coordination between chromosome segregation and cell division. During bacterial development into spores, an asymmetric division results in two cells of different size and fate: a smaller forespore and a larger mother cell. Interestingly, the asymmetric septum forms over the forespore chromosome, trapping ~30% of the chromosome in the forespore, with the remaining 70% being translocated across the septum by the highly-conserved DNA translocase SpoIIIE. Asymmetric division also triggers cell-specific transcription that initiates remodeling of septal peptidoglycan. How these processes are coordinated has remained a mystery.

Using *Bacillus subtilis*, we demonstrate that peptidoglycan remodeling and chromosome segregation are coordinated at a highly-stabilized septal pore. This pore stability is maintained by multiple factors including SpoIIIE, a protein called SpoIIIM, peptidoglycan synthase PbpG and the highly-conserved SpoIIIAH-SpoIIQ interaction across the septal membrane. In the absence of these factors, peptidoglycan hydrolysis by DMP complex, and chromosome-induced turgor pressure on the septal peptidoglycan during chromosome translocation into the forespore, lead to septal pore expansion, loss of cytoplasmic and chromosomal compartmentalization, and a block to spore development. Overall, our work highlights how coordination between peptidoglycan remodeling and chromosome segregation is critical to ensure maintenance of genetic and cytoplasmic compartmentalization during development.

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