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Antibiotics and the mechanics of cellular bulging in gram-negative bacteria K. DALY, NED S. WINGREEN, RANJAN MUKHOPAHYAY — For most bacteria, the cell wall, consisting of a cross-linked polymer network, is the primary stress-bearing structure. Due to the high osmotic pressure difference across the cell membrane, the presence of the cell wall is essential for cell stability. Recent experiments have addressed the effect of cell-wall defects induced by antibiotics such as vancomycin, and find that in Gram-negative bacteria, antibiotics can lead to pronounced bulging of the cell membrane and eventually to lysis. Here we address the mechanics of bulging and its relationship to cell-wall defects. We estimate the critical defect size for bulging and discuss the biological implications of our results. We also discuss the relevance of our physical model to blebbing and vesiculation in eukaryotic cells.

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