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Investigating the Relationship between Cell Size and Biosynthetic Capacity in Bachillus subtilis

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Investigating the Relationship between Cell Size and Biosynthetic Capacity in *Bacillus subtilis*

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It is known that nutrient availability is a primary determinant of cell size in Bacillus subtilis. Cells cultured under nutrient-rich conditions are up to three times larger than cells cultured under nutrient-poor conditions. These variations in cell size arise from changes in the relative rates of cell cycle progression and cell expansion. Several nutrient-dependent regulators modulate cell size in bacteria by impacting the cell division machinery to retard cell cycle progression, but relatively little is known regarding the relationship between nutrient availability, cell expansion and cell size. We reasoned that nutrient availability impacts cell size by altering the biosynthetic capacity of the cell, but it is unclear whether size is a function of global biosynthetic capacity, or of the activity of specific biosynthetic pathways. To answer this question, we treated *B. subtilis* with subinhibitory concentrations of antibiotics targeting multiple biosynthetic pathways (transcription, translation and fatty acid synthesis) and quantified cell size. We found that size decreased most dramatically when cells were cultured in the presence of fatty acid synthesis inhibitors, and that this decrease in size was reversed to a certain degree when the cultures were supplemented with exogenous fatty acids. After narrowing down our focus to the fatty acid synthesis pathway, we are trying to determine how the expression of particular genes in this pathway impact cell size. Fatty acid synthesis in *B. subtilis* is regulated by FapR, a transcriptional repressor that down regulates expression of multiple genes involved in fatty acid synthesis. As an alternative means of modulating fatty acid synthesis, we will determine the impact of deleting or overexpressing fapR on cell size. Future work will be focused on the role of individual genes in the FapR regulon in cell size control.