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Giving Vitamins to the Most Basic Bacterium[1] HALONA DANTES, University of North Carolina at Chapel Hill, ZAIDA LUTHEY-SCHULTEN, BENJAMIN GILBERT, University of Illinois at Urbana-Champaign, THE LUTHEY-SCHULTEN GROUP TEAM — This project revolves around the JCVI-syn3A and uses it as a platform to contribute to the understanding of the fundamental rules of life and how living things respond to changing environments and situations. The JCVI-syn3A is a minimal bacterial cell, i.e, it only contains genome essential for survival. The motivation behind the creation of the minimal cell is to create a simple cell that can be complexified to understand more complex cells and systems. This summer, we explored the JCVI-syn3A and used methods such as the Chemical Master Equation and Gillespie algorithm (a Monte Carlo Method for numerically generating trajectories of molecular populations) to simulate trajectories for processes such as the assembly of the ECF transporter. Due to the reduction in genome of the JCVI-syn3A, ECF transporters play an important part in the transportation of cofactors since the JCVI-syn3A cannot metabolize its cofactors and needs to transport cofactors from the external medium. Our aim was to simulate trajectories of the assembly of the ECF transporter under different conditions using Lattice Microbes (an implementation of the Gillespie algorithm using GPUs). From a biophysical standpoint, if we understand the assembly of such transporters, we can analyze the physical underpinnings of both their structure and the transportation they aide in. Future work may focus on determining the assembly models for all membrane protein complexes in the JCVI-syn3A and use these models for other complex cells.

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