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A Rules-Based Simulation of Bacterial Turbulence MAXWELL MIKEL-STITES, ANNE STAPLES, Virginia Tech — In sufficiently dense bacterial populations (>40% bacteria by volume), unusual collective swimming behaviors have been consistently observed, resembling von Karman vortex streets. The source of these collective swimming behavior has yet to be fully determined, and as of yet, no research has been conducted that would define whether or not this behavior is derived predominantly from the properties of the surrounding media, or if it is an emergent behavior as a result of the "rules" governing the behavior of individual bacteria. The goal of this research is to ascertain whether or not it is possible to design a simulation that can replicate the qualitative behavior of the densely packed bacterial populations using only behavioral rules to govern the actions of each bacteria, with the physical properties of the media being neglected. The results of the simulation will address whether or not it is possible for the system's overall behavior to be driven exclusively by these rule-based dynamics. In order to examine this, the behavioral simulation was written in MATLAB on a fixed grid, and updated sequentially with the bacterial behavior, including randomized tumbling, gathering and perceptual sub-functions. If the simulation is successful, it will serve as confirmation that it is possible to generate these qualitatively vortex-like behaviors without specific physical media (that the phenomena arises in emergent fashion from behavioral rules), or as evidence that the observed behavior requires some specific set of physical parameters.

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