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Non-Equilibrium Statistical Physics of Microbes NICK UTLEY, PREET SHARMA, Midwestern State University — A non-linear systems complexity can be measured. The aspiration of this research is a python program that simulates bacterial growth and communicative population density control via quorum sensing and evaluating its time dependence via the Hurst exponent with another python program. A qualitative hypothesis that bacterial population growth as well as virulence are in fact multifractal Brownian processes is to be supported by the Hurst analysis, establishing their stochastic nature to be time variant. Statistical stochastic theory is applied from gathered sources to gage the validity of the program through use of Lotka-Volterra equations and perturbations of the Fokker-Planck equation for multifractal Brownian motion, providing probability density estimates for the population densities at different stages of growth. This simulation is to be used for further development of a generalizable quantitative theory of bacterial growth and order arising from complex systems. Translational probability densities as well as those associated with spatial pattern formation in bacterial cultures will be investigated after that validity of the program is realized and compared to empirical lab data.

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