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Pressure-temperature dependence of growth bottlenecks and phenotypic transitions of Escherichia coli PRADEEP KUMAR, ALBERT J. LIBCHABER, Center for studies in Physics and Biology, Rockefeller University, New York, NY — A vast majority of bacteria and archaea can grow in diverse environmental conditions. The range of those conditions include high pressures, high temperature, low temperature, high salinity, low and high pH etc. We investigate the growth bottlenecks and phenotypic transitions of Escherichia coli (E. coli), a mesophilic bacterium, as a function of pressure and temperature. We find that E.coli can grow and proliferate in a wide range of pressures (1-400 atm) and temperatures (23-40 deg C). Moreover, we find that the division time of E. coli increases monotonically upon increasing pressure and exhibits a sharp increase in division time at pressures between 250-400 atm for all the temperatures investigated in our experiments. The sharp change in division time is followed by a sharp change in phenotypic transition of E. Coli at high pressures where bacterial cells switch to an elongating cell type. We propose that this phenotypics changes in bacteria at high pressures is an irreversible stochastic process whereas the switching probability to elongating cell type increases with increasing pressure. Furthermore, we propose an irreversible stochastic model of cell phenotype switching. We find that model fits well the experimental data. We discuss our experimental results in the light of structural and so the functional changes in proteins and structural changes in membranes at different pressure and temperature.

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