The Hebrew University of Jerusalem , Special Biological Physics Seminar

Dr. Rami Pugatch

Institute for Advanced Studies, Princeton

Danciger B Building, Seminar room

"Scheduling self-replication"

We study the scheduling problem of a self-replicating factory. We find that the distribution of optimal replication times has a universal shape. We show that optimality is achievable by random decentralized “critical” scheduling algorithms, that are biochemically feasible. Compared to a serial self-replication factory, this optimal scheduling factory runs faster by allowing several production lines to run in parallel. The excess inventory then decouples these lines, resulting in a universal extreme value distribution for the replication time. We postulate that bacteria that are evolutionary tuned for fast replication, combine this load-balancing scheduling strategy to optimally control the number of parallel self-replicating units within them. We analyze recent data on growth of E. Coli and obtain a good agreement with the measured distribution of division times from which we also infer the growth rate without further fitting parameters. If time permits, future prospects and possible experimental tests will be discussed.

Dr. Pugatch uses tools from process optimization algorithms to ask general questions on cell-to-cell variability in the cycle duration.