

Genome Dynamics and Evolution of *Escherichia coli*

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Escherichia coli K-12 and B have been the subjects of classical experiments from which much of our understanding of molecular genetics has emerged. We determined the complete genome sequences of *E. coli* B strains, REL606, used in a long-term evolution experiment, and BL21(DE3), widely used as a protein cell factory. We also sequenced genomes sampled through 40,000 generations from a laboratory population of *E. coli* REL606. Although adaptation decelerated sharply, genomic evolution was nearly constant for 20,000 generations. Such clock-like regularity is usually viewed as the signature of neutral evolution, but several lines of evidence indicate that almost all of these mutations were beneficial. In the talk, exhaustive exploration of the gene-knockout space for genome-scale optimization of the metabolic network as well as integrated comparative multi-omics systems analysis of B and K-12 will also be presented briefly. Systems-level and evolutionary knowledge on life would open the door to synthetic biology and next-generation biotechnology for sustainable biofuels and biochemicals.