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**Molecular Evolution of Gene Expression in *E. coli***

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Understanding the evolution of gene regulation is an outstanding challenge to systems biology. Here we use molecular methods to study in detail the evolution of promoter sequences needed to express gene(s) essential to the growth of *E. coli* cells. We quantitatively characterize changes in the genotype and phenotype of the evolving population, and study how different challenges imposed by the environment affect the dynamics and the final outcome of the evolutionary process.