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Changing resource allocation and growth rate of *Escherichia coli* by a genetic control of transcription and DNA replication

Abstract: We have constructed a strain of *Escherichia coli* where the expression of the key protein controlling the initiation of DNA replication, DnaA, and the expression of the large subunits of RNA polymerase, coded by the genes rpoBC, are under the control of two separate, inducible promoters. By varying the concentration of these regulatory proteins we globally control transcription and DNA replication. Lowering the intracellular concentration of either protein leads to a very cooperative transition between growth and growth arrest. In the case of RNA polymerase, diminishing the concentration to half the wild-type value completely stops growth. We characterize the physiology of the cells using measurements at the population level and in single cells, using a microfluidics device. We show that the shut-off of these two fundamental biological processes is reversible. In the case of transcriptional shutdown we observe a very significant re-allocation of cellular resources. A synthetic metabolic pathway producing glycerol introduced in this strain attains, after growth arrest, a product yield of close to one hundred percent of the theoretical maximum. We discuss our results in terms of the fundamental functions of bacteria, general growth laws, mechanisms of resource allocation and potential applications in biotechnology.

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Hosted by: Dr. Lawrence McIntosh & Dr. Lindsay Eltis

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12:30pm to 1:30pm, LSC 3