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A Stochastic Single-Molecule Event Triggers Phenotype Switching of a Bacterial Cell SUNNEY XIE, PAUL CHOI, Harvard University, LONG CAI[1], Caltech — By monitoring fluorescently labeled lactose permease with single-molecule sensitivity, we investigated the molecular mechanism of how an Escherichia coli cell with the lac operon switches from one phenotype to another. At intermediate inducer concentrations, a population of genetically identical cells exhibits two phenotypes: induced cells with highly fluorescent membranes and uninduced cells with a small number of membrane-bound permeases. We found that this basal-level expression results from partial dissociation of the tetrameric lactose repressor from one of its operators on looped DNA. In contrast, infrequent events of complete dissociation of the repressor from DNA result in large bursts of permease expression that trigger induction of the lac operon. Hence, a stochastic single-molecule event determines a cell's phenotype.

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