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Adaptation at the output of the chemotaxis signaling pathway[1] JUNHUA YUAN, RICHARD BRANCH, BASARAB HOSU, HOWARD BERG, Department of Molecular and Cellular Biology, Harvard University — The chemotaxis signaling pathway allows bacterial cells to sense and respond to changes in concentrations of chemical attractants or repellents. In E. coli, the machinery required for bacterial chemotaxis includes two large membrane-embedded multiprotein complexes, one that processes input (receptor clusters) and the other that generates output (flagellar motors). These complexes are coupled by diffusion of a small phosphorylated cytoplasmic protein, CheY-P, which binds to the flagellar motors, increasing the probability that they spin clockwise. Receptor output (the steady-state concentration of CheY-P) varies from cell to cell. However, the motor is ultrasensitive, with a narrow [CheY-P] operating range. How might the receptor output and motor input be matched? By combining various techniques such as FRET, single-motor TIRF, and single-motor bead assay, we showed that the motor shifts its operating range to match the receptor output by changing its composition. The number of FliM subunits in the C-ring increases in response to a decrement in the concentration of CheY-P, increasing motor sensitivity. Such adaptive remodeling is likely to be a common feature in the operation of many molecular machines.

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