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Flagellar dynamics reveal the distribution of chemotactic signaling molecule CheY-P in *E. coli* [1] ROSHNI BANO, PATRICK MEARS, YANN CHEMLA, Univ of Illinois - Urbana, IDO GOLDING, Baylor College of Medicine — *E. coli* cells swim in a random walk consisting of "runs" — during which the flagella that propel the cell rotate counter-clockwise (CCW) — and "tumbles"— during which one or more flagella rotate clockwise (CW). The tumbling frequency is modulated by the phosphorylation state of the signaling molecule CheY, which depends on the cell's environment. Phosphorylated CheY (CheY-P) binds to a flagellar motor and engenders a change in rotation state from CCW to CW. Despite advances in methods used to observe chemotactic signaling, it remains a challenge to measure the CheY-P level in cells directly. Here, we used an optical trap assay coupled with fluorescence microscopy to observe the dynamics of fluorescently labelled flagella in individual cells. By measuring the distribution of flagellar states in multi-flagellated cells and using our recent finding that each flagellar motor independently measures the cellular CheY-P concentration, we are able to extract the probability distribution of the CheY-P level in the cell. This analysis reveals the magnitude of fluctuations in chemotactic signaling in the live cell. We further investigate how this CheY-P distribution changes when cells encounter chemical gradients and perform chemotaxis.

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