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receptor clustering; Chapter summary; Further reading; 8 Accuracy of sensing; 8.1 Perfectly absorbing sphere; 8.2 Perfectly monitoring sphere; 8.3 Sensing with cell-surface receptors; Chapter summary; Further reading; 9 Motor impulse response; 9.1 Impulse response; 9.2 Time and frequency domains; 9.3 Minimal pathway model; 9.4 Linear response approximation; 9.5 Noise power spectra Chapter summary; Further reading; 10 Optimization of pathway; 10.1 Optimal receptor-complex size; 10.2 Optimal adaptation dynamics; Chapter summary; Further reading; 11 "Seeing like a bacterium"; 11.1 Typical chemical gradients; 11.2 Weber's law; 11.3 Perception; 11.4 Fold-change detection; 11.5 Matching relations; 11.6 Predicting typical stimuli; Chapter summary; Further reading; 12 Beyond E. coli chemotaxis; Chapter summary; Further reading; Appendix More techniques; A.1 Derivation of the fluctuation-dissipation theorem; A.2 Variational principles and the Euler-Lagrange equation A.3 Gillespie simulations A.4 Fokker-Planck approximation; A.5 Derivation of the Langevin noise; A.6 Time versus frequency domain; A.7 Model fitting to data; A.8 Principal component analysis; Chapter summary; Further reading; Index; A; B; C; D; E; F; G; H; I; L; M; N; O; P; Q; R; S; T; V; W

Sommario/riassunto

Although invisible to the bare eye, bacterial cells are large enough to make complex decisions. Cells are composed of thousands of different molecular species including DNA, proteins, and smaller molecules, allowing them to sense their environment, to process this information, and to respond accordingly. Such responses include expression of genes or the control of their movement. Despite these properties, a living cell exists in the physical world and follows its laws. Keeping this in mind can help answer questions such as how cells work and why they implement solutions to problems the way they