

4.7.2. Role of Cell Receptors in Metabolism and Cellular Differentiation

Almost all cells have receptors on their surfaces. These receptors can bind a chemical in the extracellular space. Such receptors are important in providing a cell with information about its environment. Receptors are particularly important in animals in facilitating cell-to-cell communication. Animal cell surface receptors are important in transducing signals for growth or cellular differentiation. These receptors are also prime targets for the development of therapeutic drugs. Many viruses mimic certain chemicals (e.g., a growth factor) and use cell surface receptors as a means to entering a cell.

Simpler examples exist with bacteria. Some motile bacteria have been observed to move up concentration gradients for nutrients or down gradients of toxic compounds. This response is called *chemotaxis*. Some microbes also respond to gradients in oxygen (*aerotaxis*) or light (*phototaxis*). Such tactic phenomena are only partially understood. However, the mechanism involves receptors binding to specific compounds, and this binding reaction results in changes in the direction of movement of the flagella. Motile cells move in a random-walk fashion; the binding of an attractant extends the length of time the cell moves on a “run” toward the attractant. Similarly, repellents decrease the length of runs up the concentration gradient. Chemotaxis is described in Fig. 4.13.

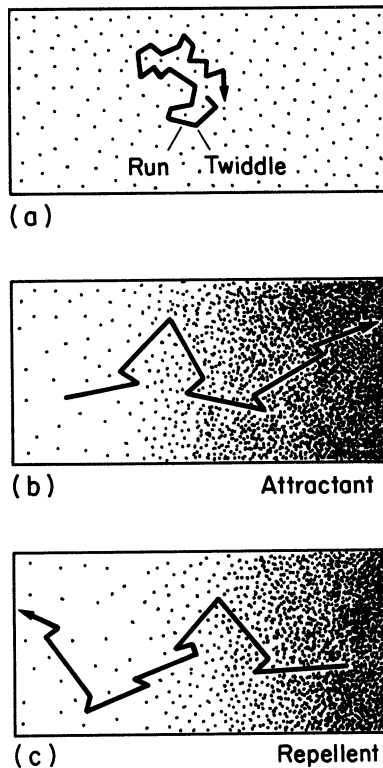


Figure 4.13. Diagrammatic representation of *Escherichia coli* movement, as analyzed with the tracking microscope. These drawings are two-dimensional projections of the three-dimensional movement. (a) Random movement of a cell in a uniform chemical field. Each run is followed by a twiddle, and the twiddles occur fairly frequently. (b) Directed movement toward a chemical attractant. The runs still go off in random directions, but when the run is up the chemical gradient, the twiddles occur less frequently. The net result is movement toward the chemical. (c) Directed movement away from a chemical repellent. (With permission, adapted from T. D. Brock, D. W. Smith, and M. T. Madigan, *Biology of Microorganisms*, 4th ed., Pearson Education, Upper Saddle River, NJ, 1984, p. 43.)