



# WAYS OF WORKING WITH CELLS

## Analyzing Cells, Molecules, and Systems

CHAPTER

# 8

IN THIS CHAPTER

ISOLATING CELLS AND  
GROWING THEM IN CULTURE

PURIFYING PROTEINS

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ANALYZING AND MANIPULATING  
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OF CELL FUNCTIONS

Progress in science is often driven by advances in technology. The entire field of cell biology, for example, came into being when optical craftsmen learned to grind small lenses of sufficiently high quality to observe cells and their substructures. Innovations in lens grinding, rather than any conceptual or philosophical advance, allowed Hooke and van Leeuwenhoek to discover a previously unseen cellular world, where tiny creatures tumble and twirl in a small droplet of water (**Figure 8-1**).

The twenty-first century is a particularly exciting time for biology. New methods for analyzing cells, proteins, DNA, and RNA are fueling an information explosion and allowing scientists to study cells and their macromolecules in previously unimagined ways. We now have access to the sequences of many billions of nucleotides, providing the complete molecular blueprints for hundreds of organisms—from microbes and mustard weeds to worms, flies, mice, dogs, chimpanzees, and humans. And powerful new techniques are helping us to decipher that information, allowing us not only to compile huge, detailed catalogs of genes and proteins but also to begin to unravel how these components work together to form functional cells and organisms. The long-range goal is nothing short of obtaining a complete understanding of what takes place inside a cell as it responds to its environment and interacts with its neighbors.

In this chapter, we present some of the principal methods used to study cells and their molecular components. We consider how to separate cells of different types from tissues, how to grow cells outside the body, and how to disrupt cells and isolate their organelles and constituent macromolecules in pure form. We also present the techniques used to determine protein structure, function, and interactions, and we discuss the breakthroughs in DNA technology that continue to revolutionize our understanding of cell function. We end the chapter with an overview of some of the mathematical approaches that are helping us deal with the enormous complexity of cells. By considering cells as dynamic systems with many moving parts, mathematical approaches can reveal hidden insights into how the many components of cells work together to produce the special qualities of life.