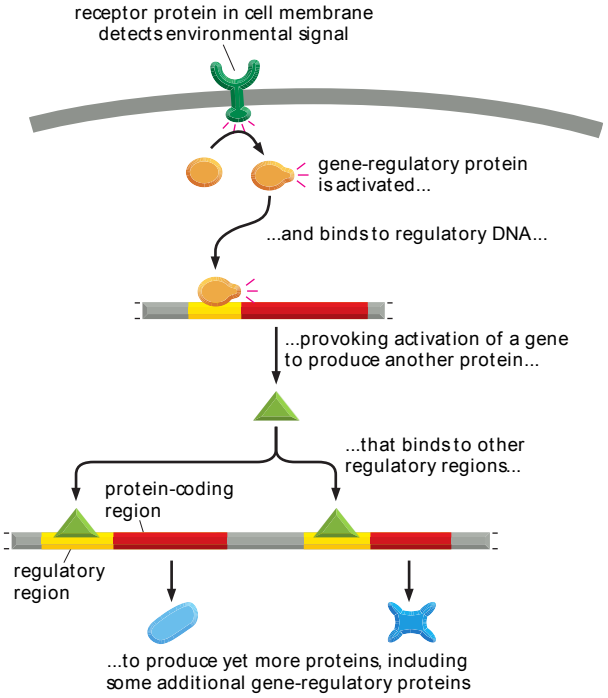

Figure 1–39 Controlling gene readout by environmental signals. Regulatory DNA allows gene expression to be controlled by regulatory proteins, which are in turn the products of other genes. This diagram shows how a cell's gene expression is adjusted according to a signal from the cell's environment. The initial effect of the signal is to activate a regulatory protein already present in the cell; the signal may, for example, trigger the attachment of a phosphate group to the regulatory protein, altering its chemical properties.

binding, directly or indirectly, to the regulatory DNA adjacent to the genes that are to be controlled (Figure 1–39), or by interfering with the abilities of other proteins to do so. The expanded genome of eucaryotes therefore not only specifies the hardware of the cell, but also stores the software that controls how that hardware is used (Figure 1–40).

Cells do not just passively receive signals; rather, they actively exchange signals with their neighbors. Thus, in a developing multicellular organism, the same control system governs each cell, but with different consequences depending on the messages exchanged. The outcome, astonishingly, is a precisely patterned array of cells in different states, each displaying a character appropriate to its position in the multicellular structure.

Many Eucaryotes Live as Solitary Cells: the Protists

Many species of eucaryotic cells lead a solitary life—some as hunters (the protozoa), some as photosynthesizers (the unicellular algae), some as scavengers (the unicellular fungi, or yeasts). Figure 1–41 conveys something of the variety of forms of these single-celled eucaryotes, or protists. The anatomy of protozoa,

Figure 1–40 Genetic control of the program of multicellular development. The role of a regulatory gene is demonstrated in the snapdragon Antirrhinum. In this example, a mutation in a single gene coding for a regulatory protein causes leafy shoots to develop in place of flowers: because a regulatory protein has been changed, the cells adopt characters that would be appropriate to a different location in the normal plant. The mutant is on the left, the normal plant on the right. (Courtesy of Enrico Coen and Rosemary Carpenter.)