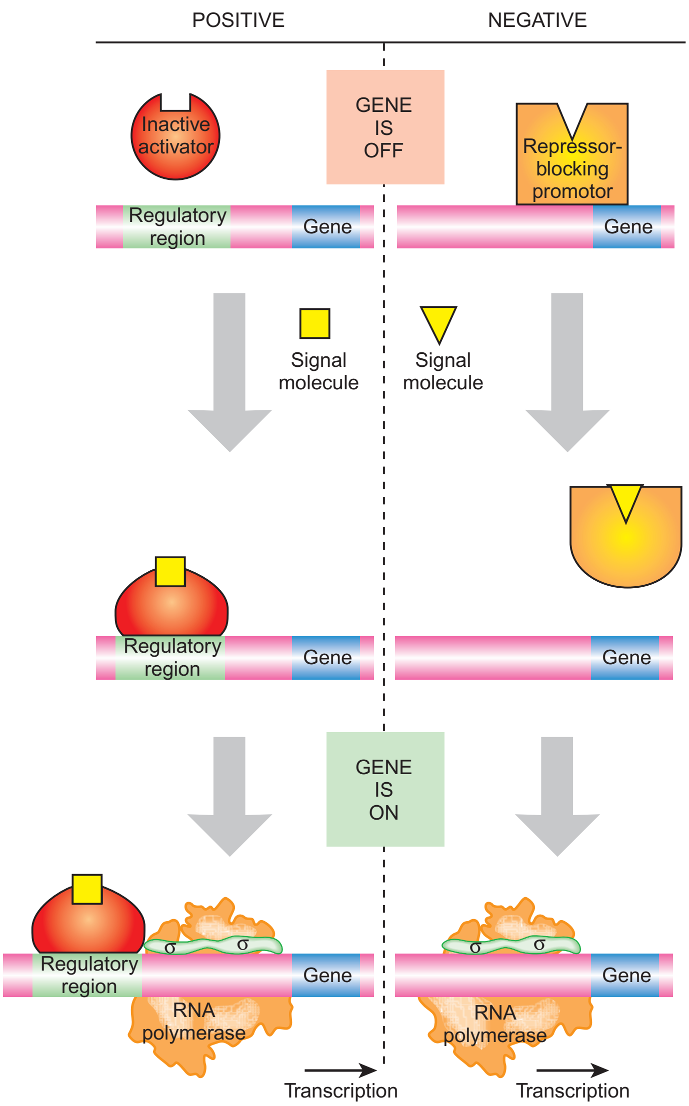

FIGURE 16.10
Principle of Positive and Negative Regulation

In positive regulation, a signal changes the conformation of an inactive regulator, which then becomes active and binds to the regulatory region of a gene. Its presence aids the binding of the RNA polymerase and helps switch on the gene. In negative regulation, a repressor molecule blocks the promoter of the gene. A signal changes the conformation of the repressor, releasing it from the gene and allowing the RNA polymerase to bind.

(Fig. 16.10). Similarly, in typical negative regulation, the DNA-binding form of a repressor protein is converted to its inactive form by binding the signal molecule.

4.1. The Operon Model of Gene Regulation

Operons are clusters of genes that are controlled as a unit.

An **operon** is a cluster of genes that are transcribed together to give a single messenger RNA (mRNA) molecule, which therefore encodes multiple proteins (Fig. 16.11). Such **polycistronic mRNA** is typically found in prokaryotes. The genes in an operon are often related functionally, so it makes good sense to regulate them as a group. For example, an operon may encode several enzymes that take part in the same biochemical pathway. Some operons have only a single gene; most have two to half a dozen and a few have more.

The operon model for regulating bacterial genes was first proposed by François Jacob and Jaques Monod using the negatively regulated lactose genes of *E. coli* as an example. Since then a vast number of bacterial genes, including those with activators as well as those with repressors, have been fitted to this model or variants of it. Operons are very rare in eukaryotes, but do exist (Box 16.01)). The lactose operon,

operon A cluster of prokaryotic genes that are transcribed together to give a single mRNA (i.e., polycistronic mRNA).
polycistronic mRNA mRNA that carries several structural genes or cistrons.