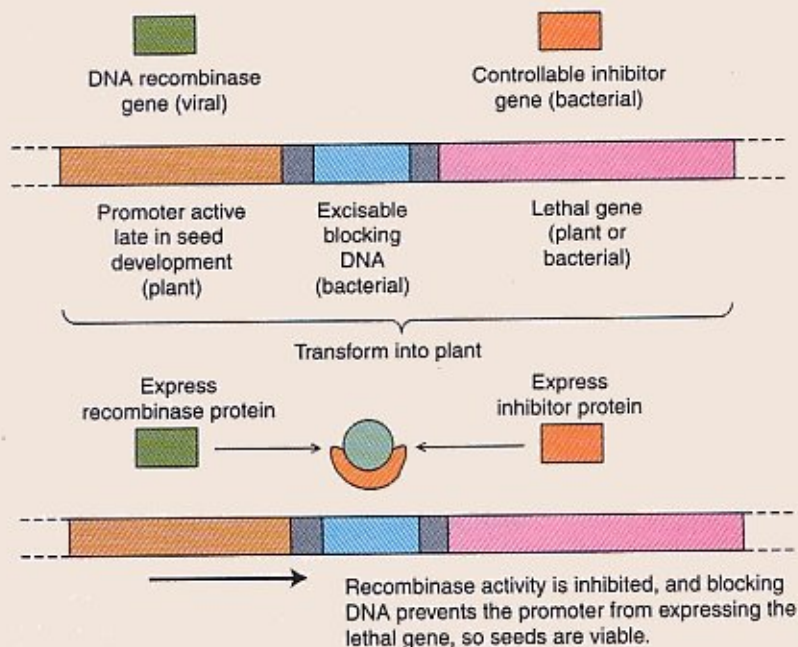


Chrispeels and Sadava. 2003. *Plants, Genes, and Crop Biotechnology*. 2nd Ed. Jones and Bartlett, Massachusetts.

Box 9.2

A Biological System to Prevent Unauthorized Propagation of Seeds

In the "technology protection system" developed by the USDA and Delta & Pine Land Company, also dubbed the "terminator gene," the parent plants are engineered to contain a gene that would kill the seeds after they had completed development in the crop production generation. This mechanism requires several components: (1) a DNA recombinase, an enzyme that can recognize a specific piece of DNA, excise it, and rejoin the two cut ends; (2) an inhibitor protein that can block the action of the recombinase; (3) a genetic promoter that allows an adjacent gene to be expressed late in seed development; (4) a piece of "blocking" DNA that the recombinase enzyme recognizes; and (5) a gene that makes a product that when expressed, kills the cell. The blocking DNA is inserted between the promoter and the lethal gene, preventing the latter from being expressed. When these components are transformed into a plant, both the recombinase and the inhibitor are expressed, so essentially nothing happens and viable seeds are produced. To trigger the system, a chemical is applied to the seeds that prevents production of the inhibitor protein. This frees the recombinase to excise the blocking DNA and join the promoter directly to the lethal gene. Still, nothing happens immediately because the promoter is only active late in seed development. The treated seeds can germinate normally, grow to maturity, and produce seeds. Only then, after seed development is essentially completed, does the promoter become active, causing the lethal gene to be expressed, and resulting in the loss of seed viability. This system was designed to prevent unauthorized propagation of seeds; many other applications could be conceived where the ability to control the generation in which a specific trait is expressed would be useful.



To induce expression of the "terminator" trait, seeds are treated with a triggering compound that blocks the inhibitor.

