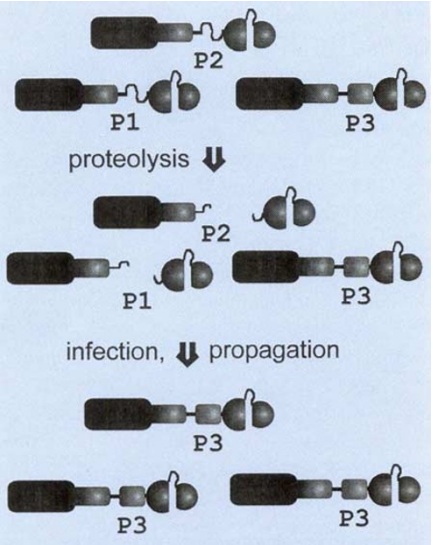
Bioremediation by poplar demand

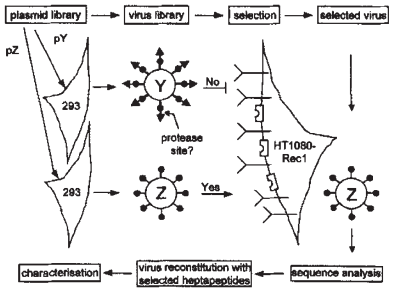
With their extensive root systems and long lives, trees have large advantages for phytoremediation—the use of plants to clean contaminated soils. By introducing a modified bacterial gene, which confers mercury resistance, into yellow poplar, Rugh et al. have generated plantlets that can eliminate elemental mercury at 10-fold the rate of parental plants (see pp. 905 and 925).

Bugs meltdown radioactive waste

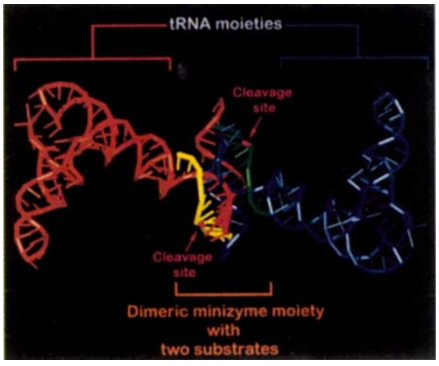
Cleaning up waste sites of organic pollutants is difficult enough, but add radioactivity to the toxic cocktail and remediation becomes particularly dangerous and expensive. *Deinococcus radiodurans*, an exceptional bacterium that is able to withstand prolonged exposure to ionizing radiation, may provide an answer. By introducing the genes for the toluene dioxygenase pathway from *Pseudomonas putida*—a bacteria notable for its ability to use organic solvents as a carbon source—Lange et al. have created an organism that can grow on and degrade toluene under radiation levels likely to be present at many radioactive waste sites (see pp. 910 and 933). Further engineering may allow this bacteria to find employment in some of the least hospitable places on earth.



By inserting a protein between two domains of the phage gene-3-protein (gIIIp) and subjecting the engineered phage to specific proteolysis, proteins that are protease-resistant can be selected on the basis of their ability to remain infective by virtue of maintaining an intact gIIIp (see p. 955).



Buchholz et al. have engineered recombinant retroviruses to contain a random protein sequence between the envelope glycoprotein and an epidermal growth factor (EGF) domain. Because the EGF domain prevents virus from infecting mammalian cells, the EGF domain must be cleaved for replication to take place. The authors exploit this property to allow the selection of protease cleavage sequences (see p. 951).



Kuwabara et al. have designed minimal ribozymes, replacing the stem/loop II (which is present in hammerhead ribozymes) with an oligonucleotide linker that allows dimerization. Placing the gene under the control of a tRNA promoter results in the formation of a dimeric minizyme that has even greater activity in cells than its parental full-length hammerhead ribozyme (see p. 961).

Two-hybrid calcium inhibitor

The yeast two-hybrid system has been a valuable tool for the identification of interacting proteins in vivo. Young et al. have modified the system to identify small molecules that disrupt calcium channels involved in neurotransmitter release. The ability to express specific subunits in the yeast two-hybrid system has allowed these investigators to identify selective inhibitory compounds from a diverse library without relying on tedious and difficult electrophysiologic assays (see pp. 906 and 946). Ultimately, drugs derived from such calcium channel inhibitors could be used in treating stroke.

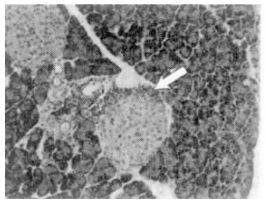
Net casts for MHC II binders

Major histocompatability (MHC) class II peptides are used by the immune system to distinguish self from nonself. At present, predicting how native antigens will be processed into MHC class II-binding peptides is a tricky process, particularly because these peptides are difficult to isolate from the limited material available. Honeyman et al. have trained an artificial neural network to predict MHC class II binders. Their computer approach successfully selected binding peptides from a type-1 diabetes autoantigen, tyrosine phosphatase, reducing the number of peptides that had to be tested to find efficient T-cell stimulation (see p. 966).

Mining for regulatory elements

Even in the pregenomic era, gene families have been defined by the relatedness of the structure and function of their translation products. Roth and colleagues have taken advantage of the available yeast sequence to categorize genes based upon coordinated expression patterns. Using microarrays to identify genes that are differentially expressed under different growth conditions and then selecting these gene sequences for subsequent analysis by computer program, they have identified known and putative regulatory elements of gene expression. The presence of these sequences can be used to characterize gene families based on an ability to similarly respond to a given signal (see pp. 907 and 939).

Plant-based vaccines are attractive alternatives to more traditional antigen preparations because of their ease of production and delivery. To be effective in ameliorating autoimmune disease, they must produce autoantigens in a manner that allows immunotolerization. Toward this end, Arakawa et al. have developed a transgenic potato that produces human insulin—an insulin-dependent diabetes mellitus autoantigen (IDDM)—fused to the nontoxic carboxyl terminus of the cholera toxin B subunit. When the transformed potato was fed to a mouse model of IDDM, the fusion protein was presumably directed to the gut-associated lymphoid tissue, where it induced oral tolerance, as shown by decreased insulitis and suppression of diabetic symptoms (see p. 934).



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