

SCIENCE & EDUCATION Impact

Benefits from USDA/Land-Grant Partnership

Gene Dreams are Now Reality

The benefits of biotechnology are stepping up.

Biotechnology is a collection of powerful tools that yield insights into the fundamental biological processes that determine how plants and animals grow and prosper, fight disease and adapt to their environments. Land-Grant researchers have used those tools to reduce dependence on pesticides, boost nutritional content, protect natural resources and improve human and animal health. The USDA/Land-Grant partnership also is charged with evaluating the risks and benefits of biotechnology and educating the public on the impact of new developments.

Payoff

- **Enhanced plants.** Modifying a plant's genetic structure can help it be all it can be and more. **North Carolina A&T** has developed alfalfa that thrives in the acidic soils of the Appalachian Mountains. The plants promise to open up more land for livestock production and will save producers money on soil treatments. **Nebraska** researchers are zeroing in on the gene they think could boost wheat yields by 15 percent. They've also genetically modified soybeans to produce more than four times as much oleic acid as a conventional plant, which should increase their worth, too. A genetically engineered plant in **Wyoming** produces spider silk. University scientists estimate that a commercial variety of a silk-expressing alfalfa could snare \$200 million a year.
- **Pass the salt.** The USDA estimates that 25 million acres of farmland are lost to irrigation-induced salinity each year. **California** scientists have genetically engineered a tomato that thrives in salty soils, a common problem in heavily irrigated agricultural areas. The first truly salt-tolerant plant, it also does well with salty irrigation water. A **Connecticut** researcher has patented transgenic plants that tolerate high salinity, drought and frost and grow larger than their wild cousins. A **Purdue** team has identified the protein and gene that allows salt into plants, an essential step to developing more crops suited for high-salt soils.
- **Scientifically safe.** Land-Grant scientists have been conducting a variety of studies to evaluate the safety of biotech products. **South Dakota State** scientists have fed

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genetically modified soybeans and corn to several generations of pregnant laboratory mice and found no ill effects. **Purdue** researchers evaluating milk from cows fed genetically modified corn found no difference in the milk produced. There also were no differences in milk composition, production or feed intake between the cows fed modified corn and the conventional corn-fed control group. **Kentucky** scientists conducting similar tests on pigs fed genetically modified soybeans found the meat did not contain either the modified genes or the proteins. **Maryland** researchers have found no major effects on non-target insects in a field-sized research study of modified corn.

- **New knowledge.** Genetically engineered crops can be good at stifling the implanted gene's activity, a process known as "gene-silencing." **California** researchers have invented a technique that attaches the gene of interest to a set of "jumping genes," mobile pieces of DNA that move around on a plant's genome. The introduced traits hold up over several generations with very low rates of gene silencing. Metabolic engineering is the term **Georgia** scientists use to describe the targeted modification of microorganisms to produce industrial chemicals. They've already commercialized two technologies that improve the production of enzymes, polymers and other specialty chemicals.
- **An ounce of prevention.** Land-Grant scientists are using new methods of protein detection to develop faster, cheaper ways to diagnose diseases, improve food for consumers and cut costs for producers. **Arizona** veterinarians have developed gene probes for shrimp diseases that are used in aquaculture laboratories around the world. **Arkansas** researchers have developed one genetic test that helps eliminate unsightly meat colorization in broiler flocks and another that can predict feed efficiency in individual birds. **Louisiana** rice producers soon may save up to \$12 million per year, thanks to a university test that will identify seed infected with panicle blight.

- **Human health.** Sixteen Americans die each day waiting for organ transplants. They are just a fraction of the 75,000 Americans on the waiting lists, some of whom may someday benefit from xenotransplantation, animal-to-human organ transplantation. A **Missouri** scientist may have leaped one hurdle by cloning a miniature pig that lacks one of the genes that triggers human rejection of animal-provided organs. A quick test for sperm quality developed by **South Dakota State** is used in at least seven countries to help infertile couples. The next generation of antibiotics could come from **Texas A&M**, where researchers have discovered two virus proteins that attack bacteria, and they're working on a third. Each destroys the germ's cell walls differently, which means that multiple drugs could be developed.
- **Biotech booster shots.** Some plants resist bacteria and viruses better than others do, and biologists can introduce those strengths into other crops. **Kentucky** plant breeders have developed a number of transgenic soybean plants that stand up to bean pod mottle virus, a disease implicated in yield losses up to 55 percent on some farms. **Kansas State** biochemists have produced transgenic wheat that resists scab, a disease that costs Kansas wheat producers 17 percent of their yields each year. They've also created a sorghum that fights back against stalk rot, a disease that affects up to 200,000 acres of Kansas sorghum each year. **Louisiana State** scientists developed a method for placing disease-resistance genes in the eggs of channel catfish while **Mississippi State** scientists are using catfish viruses to deliver pieces of bacteria that promote immunity. The healthier fish don't require the levels of medicated feeds typically used in aquaculture operations.



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