NATIONAL ACADEMY OF SCIENCES

# EYEING BIOTECH'S AGRICULTURAL APPLICATIONS

WASHINGTON, D.C.—Concerned that current regulatory uncertainties threaten biotechnology's application in the agriculture and food industries, some industrial biotechnologists are asking academic leaders to come forward and "demystify" genetic engineering.

"We should not let a handful of ideologues set public policy," said Howard Schneiderman, senior vice president for research and development at Monsanto (St. Louis, MO). He spoke during a conference here in December arranged by the Board on Agriculture of the National Academy of Sciences (NAS). "The new technology will hasten the change of U.S. agriculture—whether or not it is adopted by U.S. farmers.... [They must] either become innovative farmers or compete with [innovative farmers]." Schneiderman speaks from experience about regulatory frustrations, given Monsanto's oft-foiled plans to field-test a pseudomonad carrying the gene for a *Bacillus thuringiensis* insecticidal toxin.

Schneiderman and others in similar straits might draw some comfort from Senator Albert Gore Jr.'s (D—TN) comments to the National Academy's Food and Nutrition Board, which also sponsored a meeting on biotechnology in December. "We can't afford to leave environmental release in limbo forever," he said. "My own gut feeling is that the risks are wildly overstated. But it is also of vital importance to establish procedures for asking the right questions. Otherwise the public won't allow speedy development of technologies." Anticipating some time when biotechnology will be more widely accepted, Gore recommends "exploring the possibility of a biotechnology extension service."

Agricultural biotechnologists are finding creative ways to cut through or by-pass regulatory entanglements. For example, David Reed of Molecular Genetics (Minnetonka, MN) recommends following "mid-level" instead of high technology paths to products. This approach may speed development of commercial products; it may also mean a lower regulatory profile, since non-recombinant techniques seldom draw critical fire.

Reed described several developments where mid-level technology has proved advantageous. For example, his company now is making a non-recombinant subunit pseudorabies vaccine, using affinity chromatography to produce highly purified antigens unlikely to produce complicating allergic reactions even when administered with potent adjuvants. The purification process "is easy to scale up and cheap," Reed says. "There is an extraordinary need for this kind of middle technology."

There is wide agreement that the U.S. farm industry is undergoing fundamental economic changes, and those changes are being influenced by changing technology. Gadfly Jeremy Rifkin has argued that some of the first agricultural products of genetic engineering should be rejected on economic grounds, among other reasons. He condemns, for example, administering growth hormone (also called somatotropin) to dairy cows: Why increase milk production when there already is a milk glut that would drive many small dairy farmers out of business, he asks. Such reasoning forms the basis of one of his many legal actions to block biotechnology.

Several counter-arguments surfaced during the NAS meetings, though. Economist Robert Kalter of Cornell University (Ithaca, NY) argued that genetically engineered growth hormone could prove relatively cheap for small dairy farmers—it entails no capital cost beyond original purchase and administration. Moreover, using growth hormones would reduce requirements for feed, land, and herd size per unit of production—all of which may benefit small farm operations. Because the diets of hormone-treated animals would need substantial adjusting, the biggest changes might be expected in land use: more land will be needed for growing high-protein soybeans, but less will be necessary for other feed, such as corn.

Growth hormones also improve productivity in hogs and cattle being raised for meat. Perhaps more significant, the somatotropin dramatically decreases the fat content of meat while leaving no residues, according to Thomas Wagner of Ohio University (Athens). Thus, growth hormones could offer a safer alternative to steroid hormones and subtherapeutic doses of antibiotics—at the same time providing leaner, more healthful meat to consumers.

Estimating more precisely the impacts of growth hormone and similar genetically engineered products on the farm economy is difficult, Kalter and others argue, because additional new technologies, such as computers and robotics, also are coming into wider use. Thus, the surplus of milk or other commodities that often stems from technologies that increase the efficiency of output is not something that can be blamed simply on a single development. **—Jeffrey L. Fox**

VETERINARY RESEARCH

# NEW AFRICAN SWINE FEVER TEST

LONDON—Restriction enzyme analysis has solved the previously intractable problem of how to differentiate between strains of highly contagious and invariably fatal African swine fever (ASF). Studies at the Institute for Animal Disease Research's Pirbright Station indicate that the technique will be useful in identifying the source of virus strains and thus preventing or stifling outbreaks at an early stage—the only possible control strategy in the absence of effective vaccines. The potential value of the method is indicated by the £2.5 million that it cost to eradicate ASF virus from 12 premises involved in an outbreak in Belgium during February 1985.

ASF is endemic to many parts of Africa south of the Sahara, where the virus is maintained through a transmission cycle between warthogs and soft ticks, from which it will probably never be eliminated. The virus also occurs in Portugal, the Iberian Peninsula, and Sardinia, where it poses a constant threat to Europe's pig industry.

Pirbright researchers sought a new method of typing because conventional techniques (even monoclonal antibodies) are insufficiently discriminating to pick up minor variations between strains; the scientists selected restriction enzyme analysis because the African swine fever virus genome is a large, linear double-stranded DNA. They have found that alterations in the restriction endonuclease fragment pattern, due to the creation or elimination of cleavage sites by mutation or sequence rearrangements, can distinguish between even closely related strains. Thus isolates from Europe, the Caribbean, and Cameroon have been shown to be closely related (suggesting a common origin for epidemics in those regions), whereas the genomes of other African isolates usually vary considerably. **—Bernard Dixon**