

# ANIMAL RECOMBINANT GENETICS...???

It's a mouthful, but it's very meaningful to Ohio's research scientists who are probing the secrets of gene transfer in animals and plants. The science is expected to provide better livestock, lower consumer prices and higher profits for producers.

By LYNN WASNAK

What do fast-growing mice, eggs with "windows," crushed corn cobs, municipal sludge, waste heat, polystyrene pellets, and a new livestock vaccine have in common? Each is an important element in breakthrough agricultural research now underway in Ohio. And every one of these projects has been or will be dependent on the private sector, as well as government funding, to fulfill their promise of future jobs, profits, and social benefits.

The fast-growing mice and "windowed" eggs appear in bioengineering laboratories at Ohio University and Ohio State's Ohio Agricultural Research and Development Center (**OARDC**). There, scientists including Dr. Thomas Wagner, an Ohio University biochemist, and Dr. Keith Brown, a poultry reproduction specialist at OARDC, probe the secrets of gene transfer in Ohio's most glamorous, best-publicized research effort - animal recombinant genetics. This science is expected to permanently improve feed efficiency, growth, and disease resistance characteristics of livestock. Once the breeding lines are established, the results should be better quality, lower-cost products for consumers, and higher profits to meat, dairy, and poultry producers everywhere.

It all sounds too good to be true. But Ohio scientists have been on the leading edge of this new technology since 1981 when Dr. Wagner led the Ohio University team which accomplished the world's first transfer of a functional gene from one species (rabbits) into the permanent genetic make-up of another species (mice).

With Dr. Wilfred Konnecker, director of the Ohio University Innovation Center and Research Park, and the Ohio University Fund Inc., Wagner also founded Embryogen Inc., the first commercial group ever established to develop, manufacture, and market genetically engineered livestock embryos using proprietary techniques based on recombinant DNA technology.

Embryogen is raising the matching funds necessary to activate the \$3.1 million grant offered by the State of Ohio to create a Recombinant Animal Biotechnology Center (RABC). This project was recently approved as part of the Thomas Alva Edison Partnership Program to upgrade existing industries. Through the center, which brings together the expertise of scientists at Ohio U.; Ohio State University; OARDC; and Case Western Reserve University's School of Medicine as well as the resources of the Ohio Farm Bureau Federation, Wagner hopes to make Ohio the world leader in bioengineered livestock development and production.

Wagner claims more than \$4.8 billion is spent annually in the United States for replacement breeding stock. "If we could produce lines of animals which cut cost of production by 30 percent to 50 percent, people wouldn't buy regular animals anymore," he says. "If those animals are produced in the State of Ohio through technology controlled, patented, and licensed through the Recombinant Animal Biotechnology Center, it could create a very unique kind of industry. Many major corporations in the world are interested in participating in the production and distribution of embryos. These companies will invest in Embryogen, to join the partnership of the center."

Interesting franchising opportunities will arise as well, says Wagner. "Embryogen will be a research and development company, producing some animals itself. These animals will be produced and sold as breeding groups of a few males and several females, franchised or licensed to independent producers in Ohio, who will then go into the business of propagating and selling the offspring. The franchises will go to Ohioans until we saturate the market; only then will we go outside the state." A royalty on every animal sold will go back to Embryogen and the center, making the project self-sustaining.

All this business activity won't happen overnight, of course. As Keith Brown, associate chairman of poultry science at OARDC says, "The glamour of biotechnology could wear off if business investors expect too much, too soon." He's the man who will be opening "windows" in poultry eggs, to introduce a gene-carrying retrovirus, then sealing the flaps back up to allow normal development of the embryo inside. He hopes this technique, funded in part by the new center, may prove to be an efficient delivery system for the genetic improvement of chickens and turkeys. But marketable numbers of such genetically improved poultry are not expected for several years.

Wagner is more optimistic about his timetable for faster-growing swine. A growth hormone gene from cows is already available which can be introduced into newly fertilized swine ovum, using microscopic surgical techniques. He has already produced fast-growing mice with this procedure, and now that the funding for the Recombinant Animal Technology Center seems assured, he expects the first genetically altered swine will be available for testing within a year.

### **CORN COB ENERGY**

Although biotechnology currently steals the spotlight, other Ohio agriculture research projects deserve notice. One is the redoubtable fluidized bed combustor, currently well along in the prototype stage at Ohio State/OARDC. Harold Keener, Jim Henry, and Bob Anderson, all of the Department of Agricultural Engineering at OARDC, are principally involved in the development of this efficient source of heat and, ultimately, electric power.

Although the fluidized bed combustor is looked on by the power industry as a nonpolluting way to burn high-sulfur coal, the OARDC version burns crushed corncobs. Keener says the unit requires only 10 pounds of corncobs per hour to develop up to 50,000 British Thermal Units (BTUs) of heat. He estimates that no more than 20 acres of corn would produce enough cobs to heat the average home all winter. "A farmer growing 600 acres of corn could meet the needs of 40 to 60 families," he says. The cost of fuel would be approximately half that of natural gas.

With a bit more engineering work, the unit can be adapted to run a hot gas turbine system to generate electricity. It could also be made to accept coal, or by-products of underdeveloped countries, such as rice husks. Keener and his associates are hoping to attract corporate interest in forming a joint project to develop the second-generation prototype and eventually market the combustor.

### **MARKETING SLUDGE**

Unlike biotechnology, sludge is definitely not glamorous. What to do with ever-growing quantities of municipal sewage waste has been a subject of agricultural research in Ohio for the past 10 years. Ohio's experts at OARDC have developed sludge composting and marketing techniques that convert more than 25 percent of processed Ohio sludge into a form that can be used on sod farms, in greenhouse and nursery horticulture, for strip mine reclamation, and crop land soil amendment.

At present the city of Columbus is producing and marketing composted municipal sludge (CMS) and the city of Akron is building a similar plant.

### **HOT WATER FOR SALE!**

Lots of hot water, releasing up to 6 trillion BTUs a year, is the energy recovery goal of the new nonprofit Pike County Development and Energy Management Corp. The project, to utilize waste heat from the Piketon uranium enrichment plant, is the largest energy-conservation project in the country. It's hoped that the \$1.3 million loan from the U.S. Department of Energy to design and engineer the system will help create new agribusiness industries and jobs in rural Pike county.

The reclaimed energy will be the primary means of space heating, water heating, and process temperature control for industries which locate in the planned Piketon Agribusiness Center near the uranium enrichment plant, which is operated by the U.S. Department of Energy. The hot water for the system will utilize heat exchangers and will be completely separate from cooling water. Planned temperatures will be in the 130° F to 140° F range, ideal for greenhouses, poultry operations, lumber drying, and fish farming. Corporation chairman John Vanmeter is eager to talk to individual companies about their needs.

### **POLY PELLETT PROJECT**

Could Ohio florists be selling roses some day for \$2 a dozen? Dr. Ted Short think it's possible. Also possible is a greatly increased production of all types of flowers, plus winter tomatoes, cucumbers, lettuce, and other vegetables.

Dr. Short has developed a greenhouse insulating system that can slash energy cost of operating Ohio's greenhouses by 90 percent, virtually eliminating fuel as a factor in greenhouse cultivation. Short's system pumps polystyrene pellets between the double layer of plastic that substitutes for glass in modern greenhouses. The pellets can be pumped in at night to cut heat loss, and removed when the sun shines again.

Short's pellet project development is nearly complete. Next he needs a cooperative grower or two to put the system into place for commercial testing.

Ideally, Short would like to see a fresh marketing approach by Ohio greenhouse operators. He is in favor of mass-marketing cut flowers in supermarkets, for example-an activity that would require a whole new philosophy among Ohio rose growers. After spending time in the Netherlands, home of the world's most successful floriculture industry, he thinks the U.S. idea of promoting a big rose bud on a long, long stem is inefficient. "If you're Miss America, you keep the long stem on, but if you're Mrs. Housewife, you whack it off." The Dutch prefer medium buds with shorter stems, thus producing volumes of roses at much lower cost. He would also like to see greenhouse tomato growers marketing their high quality products to the gourmet market, rather than dumping them into the tomato market without fanfare. "I think for the good of the industry, there's a lot to gain from cooperative efforts in floral sales and new marketing techniques," he says. "These large concepts, if adopted, would make our research really take off."

## **CATTLE VACCINE**

Shipping-fever pneumonia, a serious scourge of the beef-cattle industry that costs millions of dollars each year in treatment and losses, may be on the way out due to the efforts of an OARDC research veterinarian and the more than 500 Ohio small business and professional persons who helped Dr. Clyde Smith test his vaccine.

Initial tests were started in 1976, and during the years that followed, Smith estimates more than 10,000 Ohio animals were vaccinated, with no adverse results other than local tissue reaction. OARDC holds the patent on the product, which has since been licensed by the U.S. Dept. of Agriculture to A.H. Robins Inc., of Richmond, Va., which is marketing the vaccine to veterinarians nationally, under the trade name of PRECON-PH.

According to OARDC, most cattlemen consider this vaccine the first really effective treatment for a disease that costs the industry an average of \$20 per head each year. The new vaccine is expected to cost about \$1 per dose, representing a tremendous cost savings for beef producers.

## **THE LEADING EDGE**

These examples are just a few that demonstrate the continuing and increasingly important role that agricultural research plays in Ohio's economic strength. Opportunities for investment and job creation are clearly present. Dr. Michael Sprott, director of the Ohio Cooperative Extension Service, says an honest evaluation of the cost and economic impact of many such research efforts is the goal of OHIO 21, an on-going inventory of opportunities in Ohio's food and agricultural industries. Under the sponsorship of his organization and with the backing of Dr. Max Lennon, vice president of the College of Agriculture at Ohio State University, Sprott says OHIO 21 is an attempt to present to the decision-makers of our state the opportunities surrounding investment in agriculture, and an attempt to cost out those investments and estimate the value of their results."