

USDA Scientists Amplify Genetic Secrets To Detect Animal Diseases

WASHINGTON, D.C. — Amplify a radio wave and inaudible signals become sounds, such as music or speech. In the same way, a new technology based on a polymerase chain reaction (PCR) is amplifying hidden genetic information to reveal animal diseases that have been difficult to detect.

Since the discovery of PCR in 1985, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) has been putting the PCR technique to practical use in the laboratory. APHIS also is involved in licensing commercial production of the diagnostic kits that make use of the process.

"Disease organisms may be present in an animal at a very low level, especially in the early stages of infection," said David Espeseth, who heads the licensing division in APHIS. "Detecting these organisms can be like hunting for a certain piece of a jigsaw puzzle. PCR technology provides a way to amplify the target piece exactly, many times over, so that the chances of finding it are greatly increased."

The technology relies on looking closely into the organism's DNA — its genetic blueprint. Since each blueprint is unique, it reliably reveals the identity of its owner.

"PCR doesn't amplify the entire DNA complement. It focuses on one unique, detectable sequence," Espeseth said. "It's like duplicating just the needed edge of the target puzzle piece. This is speedier and more efficient than old propagation methods that repli-

cated an entire organism."

Once scientists identify the unique sequence that will reliably indicate the presence of the disease organism, they synthesize a complementary DNA sequence called a DNA probe. If the disease organism is present in a test sample, the targeted sequence will pair with the DNA probe. A color change or radioactive glow built into the DNA probe confirms the disease.

"DNA probes have been used for some years and are extremely accurate," said Espeseth. "The pairing never happens if the disease isn't present. Without amplification, however, DNA probes aren't very sensitive. Amplifying the DNA with PCR techniques produces a very specific and very sensitive test for the presence of animal disease organisms."

Espeseth's group recently licensed the first PCR-based diagnostic test kit, which is now commercially available. It identifies the bacteria responsible for paratuberculosis (or Johne's disease), which is a chronic, contagious, incurable disease of ruminants. The PCR-based test takes 24 hours — much less than the existing test, which depends on bacterial cultures and takes about 10 to 12 weeks.

In the future, PCR tests also promise to support the fight against pseudorabies, a contagious viral disease of swine that spurred American pork producers to call for a nationwide eradication program that began in 1989. Developmental work on PCR is being conducted at the National Veterinary

Services Laboratories (NVSL) in Ames, Iowa.

"Pseudorabies can be carried by an apparently healthy pig, which may suddenly begin to shed the virus, infecting others in the herd," said Jon Katz, who heads a team of APHIS microbiologists at NVSL. "Available diagnostic tests scan for antibodies or infectious viruses but may miss latent infections that will be caught by PCR techniques. The gain in accuracy could help the swine industry rid itself of the disease more quickly."

At its current stage of development, the PCR technique for pseudorabies testing has a major drawback. It requires brain tissue, which necessitates sacrificing the test animal. Katz said his team is working on an adaptation that would use tonsil tissue instead.

PCR technology also is being adapted for detecting foot-and-mouth disease, one of the world's most destructive illnesses of livestock. This highly contagious viral disease has been successfully kept out of the United States for the last several decades. If the disease ever bypassed APHIS inspectors at the border and started infecting U.S. livestock, APHIS would take prompt countermeasures — the success of which would depend on early, accurate detection of the virus.

Richard Meyer is an APHIS microbiologist at Plum Island Foreign Animal Disease Diagnostic Laboratory, located offshore near Orient, N.Y., with highly secure facilities that make it safe to work with exotic disease organ-

isms. Meyer and his coworkers have developed a PCR test for foot-and-mouth disease that can confirm or deny the presence of the disease in a fraction of the usual time. The PCR procedure can be accomplished in a plastic tube, while the confirmatory diagnostic procedure requires sacrificing a live animal.

Despite the promise of PCR procedures, laboratory workers aren't about to throw away their traditional test tubes and culture plates. Even in situations where PCR procedures are practical, they require

sophisticated training and equipment, which results in increased operating costs. However, at times, the procedures already offer immediate savings, as in the case of foot-and-mouth disease tests where a plastic tube can replace a cow.

"The scientific community is excited by the potential of PCR techniques," Espeseth said. "We are finding applications in all fields of medical technology where DNA identifications can furnish crucial evidence."

Md. Ag Still Going Strong

ANNAPOLIS, Md. — Maryland Secretary of Agriculture Wayne A. Cawley, Jr. has announced that since Governor William Donald Schaefer's trade mission to Eastern Europe and the Soviet Union last spring, his department, along with the University of Maryland, has continued to build strong ties with these countries.

"In Poland, Hungary, Romania, and the Soviet Union, we have increased our contacts and exchanges. Our follow-up from the Governor's trip has been fantastic," Cawley said.

"In January, my department and the university hosted the governor and a delegation from Poznan, Poland. An immediate result of their visit is a serious effort by a Maryland poultry processor to further explore a joint venture in the poultry area," said Cawley.

"In Hungary, we are working with an American businessman on

developing a 6,000-acre farm. The University of Maryland System sent three experts to Hungary at the expense of the Hungarians to help on the project. The potential is unlimited," Cawley said.

Deputy Secretary of Agriculture Robert L. Walker met with the Romanian Ambassador in Washington. As a result, the Minister of Agriculture from Romania invited two of the department's animal health experts to visit Romania at the expense of the Romanian government. The trip took place last fall and laid the groundwork for future business contacts.

The department's most extensive contacts have been with various Soviet organizations. Maryland farmers hosted 10 students this past summer from the Timiryazev Agricultural Academy and the Moscow Institute of Agricultural Engineers.

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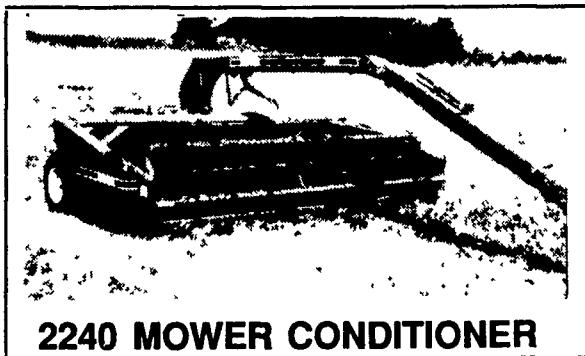
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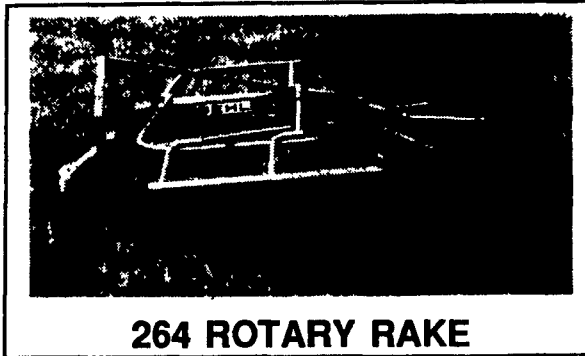
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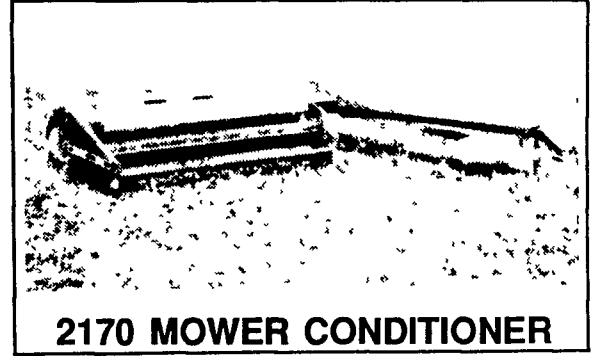
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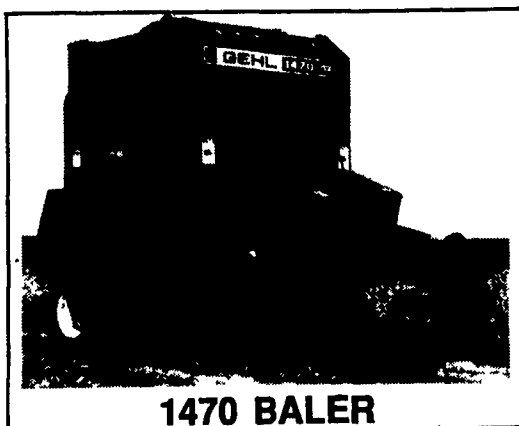


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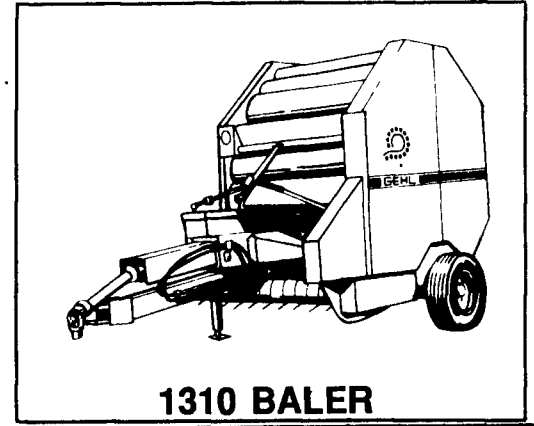
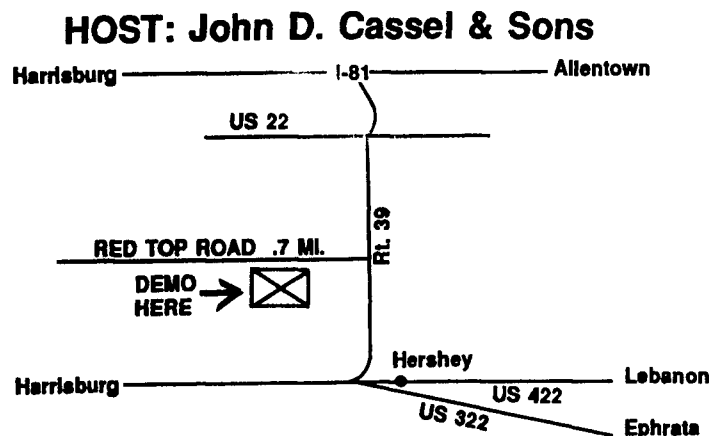


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