Despite substantial progress, birth-to-death identification, including birth date and sire, continue to be problems for genetic evaluation of dairy cattle. Meinert and Norman reported that the percent of official DHIA records that were usable for genetic evaluations was 43.9% in 1968, 49.9% in 1979, and 63.8% in 1990. Values for Illinois cows for the same years were 55.2, 56.1, and 68.3%. Little change was noted after 1988. The largest cause of records being not being usable was missing sire identification. The problem is confounded by the availability of official records from more and more non-registered cows (only 42% of usable records were from registered cows in 1990 vs 64% in 1968). Missing sire identification contributes to inaccuracy of identification both for daughters of bulls being progeny tested and for herdmates of the daughters of the bulls.

A potential method for improving this situation is to implant or permanently attach an electronic chip to the animal at birth, and to register the electronic number in a national database. We have worked with Holstein Association and National DHIA toward such a system during the last four years. A permanent electronic chip would have the added advantage of replacing the current neck mounted transponders used for computer feeders and for linking with milk meters for automatic recording of milk weights, and could replace the metal ear tags that are used for disease control by the regulatory agencies. The miniature ID units can be manufactured and sold substantially cheaper than the current $25 to $40 for neck mounted transponders.

UNIVERSITY OF ILLINOIS STUDIES

Our first studies were with transponders that could be injected. The transponders were injected under the scutiform cartilage at the base of the left ear. This was a very secure location when yearling heifers were used. When the transponders were injected at the same location in baby calves, a few transponders were found to not be retained. In some cases we found the still-active transponders in the bedding. In other cases the transponders did not respond after one or two weeks of age and were presumed to have been ejected into the bedding and broken by the calf stepping on the transponder. These heifers now have calved, and almost all of the transponders continue to function. Except for physical breakage, the transponders should have an infinite life since they do not contain batteries or other components that wear out with usage.

Our approach changed when FDA ruled that ID transponders had the potential to remain in meat after slaughter, and therefore, must be approved by them. Some method must be in place to assure the public that the transponders does not appear in meat after slaughter. Although approval eventually may be granted for injection at some body location, such approval is not certain and the timing for a ruling is indefinite. Therefore, our current approach is to use tamper resistant electronic ear tags.

Our first testing with ear tags was to determine the per cent automatic reads that could be achieved as cows walked through the milking parlor. This approach was based on the belief that automatic reading was a necessary feature of an electronic ID system if it was to be attractive for use with cattle. Previously, only hand held readers with a limited read range were available for the miniature transponders. We first tried several versions of the
industrial antenna that was supplied by the manufacturer (Texas Instruments). These antenna units had a greater read range (about 5 ft under optimum conditions) than the hand held reader. They performed admirably when installed at a waterer to monitor heifers when they came to drink or when installed in the return alley of the milking parlor. Their disadvantage was that their configuration was awkward for installation in a milking parlor.

We currently are working with Allflex ear tag company in the testing of a portal (walk through) style antenna, a design that has a proven track record with neck mounted transponders. The testing is progressing nicely, with almost 100% reads as cows walk through the antenna. A remaining problem is how to prevent cows that are standing near the portal antenna, but have not yet walked through it, from being erroneously identified. Additional studies with shielding will be conducted to correct this problem.

We are working with Holstein Association to use this technology for registration. The calves are tagged with an electronic tag in one ear and a visual tag in the other ear (Figure 1). The tags are ordered from Holstein Association with herd numbers permanently stamped on the studs for the tags in both ears. Therefore, herd numbers can be easily read from the front or back of either ear. As an anti-fraud feature, the visual tag and its matching stud have serial numbers that are registered with the Holstein Association. The hole for the stud is covered on the front of the tags so that, in the event that a tag is removed from an ear by cutting the stud, the tip of the stud cannot be removed to allow reuse without visually defacing the tags. Holstein Association has approved recording of this information (the electronic number, the herd number, and the serial number on the tags) as an acceptable alternative to sketches of the color markings for registration. This information can be submitted on a floppy disk, a procedure that can be automated at the farm and which will save Holstein Association the time that it ordinarily would take to enter the data on their computer. In our case, we designed a special routine to pick out the needed data from our herd database (Dairybase, from Boumatic) and transfer it to a floppy disk using the data format supplied by Holstein Association.

**IMPORTANCE OF STANDARDS**

The International Standards Organization is in the midst of setting technical standards for animal identification systems. The main goal is that a universal reader could be built that would read any transponder that was manufactured to conform to the technical standard that was approved for transponders. A single reader could read any manufacturer's transponder. For example, an Australian system uses a transponder than is encased in a pellet and inserted in the rumen. As long as the transponder is manufactured to ISO standards, it could be read by the same antenna system that we are testing. Standardization would thus allow electronic identification of animals at the slaughter plant to improve trace back of animals that were found to be carriers of chemical residues, diseases, or dangerous pathogens. This system also could enhance the return of carcass information to breeders of meat animals for their use in genetic improvement programs.
SUMMARY

Substantial progress has been made toward the implementation of electronic identification as a national system for dairy cattle. The technology appears to be far enough advanced that such a system is now technically feasible. Acceptance of the technology by livestock commodity groups such as breed registry organizations and livestock marketing groups, or by food safety and animal health regulatory agencies could cause implementation of the technology to occur rapidly as a national system.

Figure 1. Calf with electronic identification transponder in left ear and visual tag in right ear. This system is now accepted by Holstein Association for registration instead of sketches of color markings.