Freak Herd Provides Researchers With Answers

A unique herd of animals with congenital defects is enabling K-State researcher Dr. Horst Leipold and his coworkers to assess malformation problems more clearly.

by Lee Jorgensen
Dept. of Extension Information
Kansas State University

Kansas State University has a herd that would take the prize, but it's not the kind any respectable beef breeder would want to brag about.

From a distance the animals look like any other critters. It's when you move in close that you notice the cow with the horse's hoof, the young steer whose hindquarters collapse in grotesque disarray when it tries to run, the cow that has an additional set of pink eyelids that interfere with vision or the bull with the cleft palate.

There are about 40 animals with a variety of congenital (or birth) defects in the Kansas Agricultural Experiment Station research herd, looked after by Dr. Horst Leipold, a teratologist (a veterinarian whose specialty is the study of malformations). At its peak, the herd had about 80 animals. But a funding crunch and a destructive fire about four years ago forced the College of Veterinary Medicine to reduce the herd. Replacements, which are delivered by producers, are gradually beginning to increase.

Only researchers would be proud of a collection like this, which is known about by livestock scientists and most breed associations around the world. It's the only one of its kind. Leipold's work is to animals what the March of Dimes is for humans—a concentrated effort at K-State to eliminate congenital defects (both genetic and environmental). The basic difference is that in animals you eliminate the gene rather than attempt corrective surgery. However, what Leipold learns about animal birth defects also could benefit researchers in human health.

Dr. Horst Leipold (center) and his graduate students research the nature and causes of congenital defects in cattle. He works closely with the American Angus Assn. in identifying carriers of genes for genetic defects.

Researching animal birth defects, which until 15 to 20 years ago was a neglected science, became important for two reasons. That's when the thalidomide scare occurred in Germany. Physicians thought livestock researchers might offer some clues to why babies were deformed. That's also when livestock producers moved to artificial insemination in their quest for the perfect animal—one that fits the conformation ideals and that will produce the most for the least.

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"The problem," according to Leipold, "is that there's nothing certain about nature. In these animals we've collected from producers' herds, something's gone wrong with nature's assembly line. In the case of livestock, when one bull through A.I. can produce 300,000 offspring, if something goes wrong you don't have recalls, you have lawsuits."

Because of those heightened interests,

Dr. Leipold's Expertise Drawn on by Industry

A monstrosity caused by a genetic defect in a calf might have been a laughing matter a dozen years ago, but now, with widespread use of artificial insemination, no one is laughing.

One bull with a genetic defect could, through artificial insemination, pass on the defect to as many as 70,000 calves. This actually happened. It's a case history in the voluminous files of Dr. Horst Leipold (pronounced LY-polled) at Kansas State University, Manhattan.

His interest has led to a genetic disease detection service offered nowhere else in the United States. It combines diagnosis, control and research with food animals and has led to better methods for early detection of bulls with defective genes.

Dr. Leipold has refined his methods so well that tests that used to cost $100,000 and take five months now cost $10,000 and take 60 days.

Dr. Leipold spent four years on research and finally solved a dairy breed mystery (recto-vaginal constriction in Jerseys), an effort breeders applauded because the disease was costly for them and such costs had to be passed on to consumers.

A technique which Dr. Leipold pioneered at KSU—use of embryo transfer and Caesarian section 60 days later for identification of sires with the recessive gene for mulefoot, the single most important disease of cattle in the U.S. and probably in the world—is now used by all breed associations to identify carriers.

Much in demand as a consultant, Dr. Leipold has traveled extensively throughout the nation and abroad to extend the benefits of his knowledge and services. His work is sponsored by the KSU College of Veterinary Medicine and funded by the Kansas Agricultural Experiment Station.

Dr. Leipold became involved in studying the genetic defects of cattle through the thalidomide scare in Germany in the early 1960s. Then a veterinarian at a leading German research university, he was among those asked by physicians if veterinarians had observed similar difficulties in cattle.

"You get the same range of defects in animals that you do in humans," says Dr. Stanley Dennis, head of veterinary pathology at KSU. "An important by-product of the K-State work in genetic diseases of cattle is the information on congenital defects. Dr. Leipold shares his materials with such places as the American Forces Institute of Pathology. These people are interested on a comparative basis because these defects can be bred into animals and studied—you cannot do that with people, obviously."

It was not long after the thalidomide scare that the late Arthur D. (Dad) Weber visited the German institution where Dr. Leipold was working and persuaded him to spend a year at KSU as a Fulbright Scholar studying genetic defects under Keith Huston. With the exception of two years in Canada, Dr. Leipold has been at KSU ever since. He was twice the recipient of the distinguished teaching award.

Dr. Leipold is quick to point out that "there have been people before me from whom I draw." Some of the earliest work in genetic diseases in beef cattle was done by Weber in the early 1930s.

"F.W. Atkeson, head of dairy science at KSU from 1935-1958, was a particularly keen observer of abnormalities in dairy animals and he collected data on this type of thing for many years—I still have his old files," Dr. Leipold says. "Frank Eldridge studied some of these problems, and then Keith Huston. There really has been a long line of K-Staters who have addressed themselves to these economically-significant questions for livestock breeders."

Dr. Leipold, who is described by Dr. Dennis as "hard working and methodical," has files bulging with case histories and records—enough material to keep him busy through the rest of his working years.

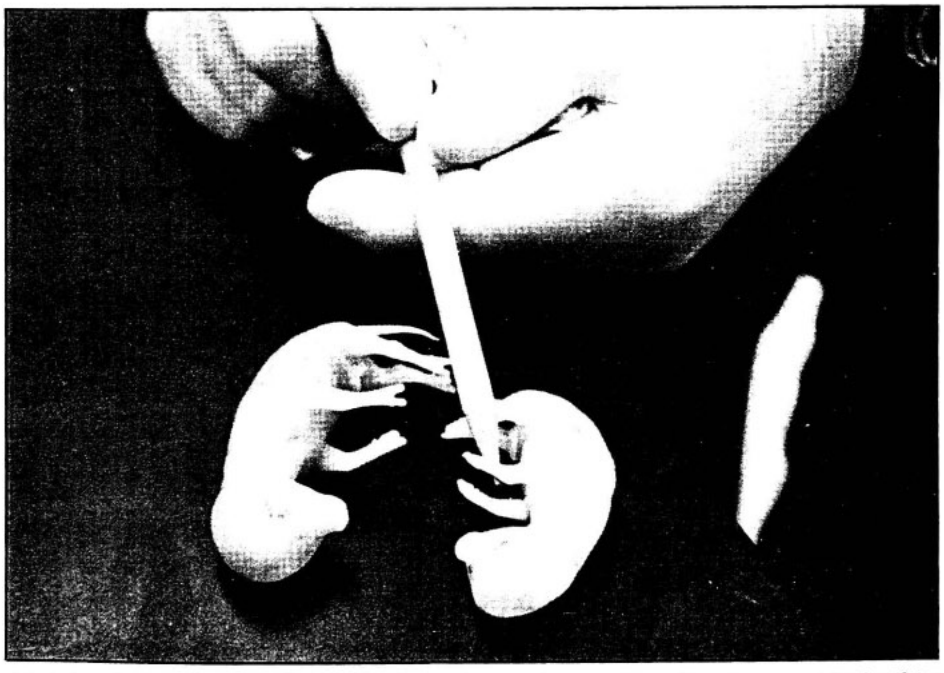
One might be concerned about who will carry on for Dr. Leipold, who admits to "approaching 50." But Dr. Leipold believes he has left a legacy in the 25 pathologists he has trained in his work—pathologists not only in this country, but also in Ireland, Australia, Canada, Nigeria, Uruguay, and other countries. AJ

Leipold today finds himself sitting in one of the toughest consulting hotseats in the world. Virtually all the major breed associations rely on him to make an accurate, honest diagnosis of a suspected defect. The last lawsuit in which he was a witness was for a settlement of more than $4 million.

So it's an understatement when Leipold says, "We don't jump the gun. We don't say prematurely things we aren't sure of. We don't make big press releases. What we say, we say quietly and gentlemanlike. We stay absolutely with the truth and nothing but the truth. It's the only way to survive in this business."

As breed organizations move toward the desired animal using A.I. or embryo transplants, the need for Leipold's expertise will become more acute, especially since the industry will discard gene sources with less desirable characteristics and thus create less and less of a pool to draw from for breeding. That means genetic abnormalities that do show up in the mainstream in the future will create even more havoc. That's why livestock people in the next 10 years will be hearing about Leipold and the foundation work at K-State.

Leipold says teratology will move into the spotlight as science conquers the other diseases of livestock. "Today, we know the cause of perhaps 20 percent of the defects. About 5 percent of them are clearly caused by environmental problems, some of them viruses and 15 percent are genetic. The rest are unexplained."



A technique for determining mulefoot at early embryonic stages has saved the cattle industry years in identifying carriers of the gene for mulefoot. This technique was pioneered by Dr. Leipold at Kansas State University.

When problems do crop up, in most cases Leipold and his crew will be relying on cooperative herdsmen to bring them to their attention, to describe trends they've observed or circumstances that seem to repeat themselves. After numerous interviews that confirm those suspicions, the KSU "sleuth" will use all of the tools of science, including a case history review, blood tests, X-rays, electron scanning microcopy, chromosonal analysis, DNA studies, necropsy of adult animals as well as embryos, new chromosome staining technology and other technology that comes down the pike, to zero in on the cause.

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So far Leipold and his graduate students have files describing 88 genetic defects in cattle. Leipold has either discovered or was the first to fully describe 12 of those problems. Included are:

Albinism (lack of normal coloration)—He's identified at least three different types.

Arthrogryposis—Rigid joints of animals.

Atlanto-occipital fusion—Abnormal fusion of the spine.

Dermoid eye—Feather eye (double eyelids).

Cleft lip—Abnormal development of the muzzle.

Adactylia—Animals with no toes.

Heterochroma-irides—Two different kinds of eye color problems.

Hydrocephalus—Water on the brain.

Mannosidosis—Another brain disease.

Epitheliogenesis-imperfecta—A skin defect.

Multiple ocular defect—(multiple eye defects).

Osteopetrosis—Marble bone disease (causing hard, very brittle, easy-to-fracture bones).

Polydactylia—Animals with more toes than normal.

Weaver—A degeneration of the spinal cord which results in death.

Recto-vaginal constriction.

He's also refined descriptions in:

Syndactyly—Mulefoot or uncloven hooves in cattle, which can cause lameness and result in feeding and breeding problems as well as increase death losses in hot weather.

Umbilical hernia.

Short lower jaw—Problem in horses and cows.

Leipold would like to expand studies on brain and reproductive system problems. AJ

Hot Boning Gets Cool Reception in U.S.

According to Kansas State University meats researcher Curtis Kastner, beef processors in other countries will probably adopt hot carcass boning techniques before the United States.

Research has shown considerable savings can be realized through hot carcass boning, coupled with electrical stimulation to tenderize the meat. Savings could include about 55 percent less cooler space requirement, approximately 25 percent lower labor costs, two percent less weight loss, and lower interest costs through shorter storage.

Hot processing requires electrical muscle stimulation within one hour of slaughter to improve both tenderness and muscle coloring. Stimulation overcomes problems encountered when fresh beef is hot boned and chilled rapidly.

Denmark and Sweden use the technique extensively; Australia, New Zealand and Great Britain have used the process on a limited basis. American processors are evaluating the concept, but few are actually using it.

Experts say the following areas must be explored further before hot boning will be widely accepted in the United States:

* Hot processing requires cutting meat before chilling. In the United States, carcasses are graded after chilling. Until hot carcass quality and yield measures are established, the marketing system and the hot boning technology won't mesh.
* Ideal carcass weights and composition best suited for hot boning must be identified.
* Conditioning, chilling and freezing practices, facilities and technologies must be developed which will satisfy meat cleanliness, taste and other requirements.
* Methods for identifying high pH levels in meat soon after slaughter must be established. High pH levels affect meat appearance and storage quality.
* Boning and trimming practices best suited to hot processing must be developed.
* Packaging technology most appropriate for optimizing shelf life, meat appearance and shape must be investigated. AJ