SCOTT BAUER (K9486-1)

Helping Heifers Calve Easier

Minutes after giving birth, a 2-year-old cow attends to her newborn calf.

As far back as he can remember, Tom Mott has helped with calving. When he was young, he and his dad would place bets on which of the Herefords on their Utah ranch would calve first. "That's how my dad taught me to watch heifers," says Mott.

Heifers are females before they become mothers; after that, they're called cows. A week or two before they're ready to calve, Mott says, the heifers' udders will tighten up with milk. Then, as they get ready to calve they will swish their tails and try to go off by themselves.

Mott's family still runs a ranch, but he now works as a herdsman at ARS' Fort Keogh Livestock and Range Research Laboratory (LARRL), in Miles City, Montana.

Once the pregnant heifer goes into labor and lies down, Mott expects a birth within an hour or two. Otherwise, she's having trouble.

Calving difficulty—or dystocia—can cause the death of calves and cows, increase the susceptibility of calves to disease, and lower weaning weights. Cows experiencing dystocia produce less milk and rebreed later than those that give birth more easily. Dystocia costs the U.S. beef and dairy cattle industries more than $400 million annually.

Heifers are usually bred at 12 to 14 months of age and deliver their first calf at about 2 years. But cows don't reach their mature size until at least 4 years.

"Breeding them at a young age leads to more calving trouble," says ARS physiologist Robert A. Bellows. "But the beef and dairy industries depend on producing calves—they can't afford to support nonbreeding females for 4 years before they get any return."

For nearly 40 years, LARRL researchers have been helping uncover the causes of calving difficulty and improving the ability of cows to rebreed. Some of their early findings—such as the importance of calf birth weight—have led to industry-wide changes. Now they're investigating the role of hormones in calving and working to isolate specific genes that would give

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Herdsmen Jim Watts lifts a calf with a weight scale for a few seconds while Jim Kessler records its birth weight.

cause of calving difficulty: Large calves mean more dystocia. While this finding seems intuitive, previous scientific evidence had been inconclusive.

And larger birth weight is exactly what beef cattle breeders had sought. The weight of a calf when it is weaned at 6 to 8 months determines its market value—and larger birth weights are associated with larger weaning weights.

"But we showed that it's a trade-off," Bellow says. "The cost of lost calves and slower rebreeding caused by dystocia diminishes the value of large birth weight."

Another key, Bellows found, was maximizing growth of the young cows.

"Feeding young heifers so they grow more rapidly from weaning to breeding increases the size of their skeleton and pelvis, which helps reduce dystocia," he says.

Sires also have a major influence on dystocia, Bellows and colleagues found. "Large, high-gaining sires produce calves with large birth weights," he says. Sire selection is crucial in balancing desired birth weights and calving difficulty.

Using this information, geneticists developed selection tools to improve calving ease. Additionally, breeders stopped selecting primarily for weaning weight and looked closely at keeping birth weight under control. That helped, but didn't solve the entire problem.

producers even more breeding tools.

Miles City scientists work exclusively with beef cattle, but because dystocia also affects dairy cows, the dairy industry can apply many of the lab's findings.

"When I started with ARS in the early 1960s, we knew that dystocia had an economic impact, but there was little information about it," says Bellows. Now considered an international expert on dystocia, he still consults at the lab, though he retired last year.

Thanks to research by Bellows and others, producers can reduce calf deaths by up to 55 percent and heifer deaths by 80 percent with proper management.

By 1971, Bellows and colleagues pinpointed birth weight as the most important

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Geneticist Michael MacNeil (left) and physiologist Robert Bellows examine implantable transmitters used to record body temperature and heart rate of cows before, during, and after giving birth.

"When producers apply the research—by selecting sires and cows for reduced calving difficulty and lower birth weights, giving timely obstetrical assistance at calving, and providing proper nutrition before and after calving—the incidence of dystocia decreases up to 25 percent and rebreeding improves up to 15 percent," says Bellows.

The latest work at the laboratory has been on hormonal and genetic factors influencing dystocia.

"We knew in the 1970s that cows carrying male calves had more difficulty at calving than those carrying females," Bellows said. "But in 1993, we discovered that it was more than size difference between the genders. Cows carrying male calves have higher testosterone levels than cows carrying females." That could influence the cow's ability to deliver a calf, Bellows says.

They've also found that cows that have difficulty calving have different estrogen and progesterone levels than cows that don't need assistance. This may indicate a difference in the degree of relaxation and expansion of the birth canal and the force of labor contractions.

Another project under way: LARRL scientists are working to develop genetic tools that will enable breeders to more precisely select animals having less dystocia.

Ideally, producers want to maximize growth and weaning weight while keeping birth weight low enough to reduce calving problems. The traits are correlated, but researchers have identified a genetic region that may help separate them.

"There are probably many genes that affect those traits jointly," says ARS geneticist Michael D. MacNeil. "We suspect there are also some genes that act independently, and it appears we've found a location on chromosome 2 that influences birth weight without influencing subsequent growth."

While the discovery is exciting, it may be a while before scientists determine its value. "We haven't found the specific gene and don't know how the region influences birth weight," he says.

By analogy, MacNeil says the bovine genome is 3,000 units long; in miles, that's about the distance from New York to Los Angeles. They've narrowed the gene location down to a stretch of 30 to 40 units, or to within the Los Angeles metropolitan area in the cross-country analogy.

"It is still a substantial challenge to find the right 'address,'" says MacNeil.

Mott's family started selecting sires for lower birth weights years ago, sacrificing some growth but reducing dystocia. In the future, the lab's work with hormones and genetics may help ranchers and breeders help their heifers even more.—By **Kathryn Barry Stelljes,** ARS.

This research is part of Food Animal Production, an ARS National Program (#101) described on the World Wide Web at http://www.nps.ars.usda.gov.

Robert A. Bellows, Michael D. MacNeil, and Tom Mott are at the USDA-ARS Fort Keogh Livestock and Range Research Laboratory, Rte. 1, Box 2021, Miles City, MT 59301-9202; phone (406) 232-4970, fax (406) 232-8209, e-mail bob@larrl.ars.usda.gov and mike@larrl.ars.usda.gov. ◆

A cesarean section may be necessary when calving difficulty is extreme.

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