



# Genetics and Genomics

Highlights of the 2007 BIF Annual Research Symposium and Annual Meeting.

by Angie Stump Denton

Nearly 600 seedstock and commercial producers, university and Extension beef specialists, and breed association staff joined in Ft. Collins, Colo., June 6-9, for the 2007 Beef Improvement Federation (BIF) Annual Research Symposium and Annual Meeting. Industry leading geneticists, producers and allied industry professionals shared insights on what's new in genetic collection and selection tools.

A unique feature of this year's conference was the ability for speakers to ask questions and then, through an electronic

keypad, the audience could input their answers. The responses were captured, summarized and displayed for everyone to see.

## Celebrating 40 years

2007 marks BIF's 40th anniversary. To kick off the conference on Thursday morning, Ike Eller, Virginia Tech Extension animal scientist, emeritus, shared history about the organization and beef improvement. "Any look back at BIF's 40-year history has to be about three things — people, leadership and technology," Eller said.

He explained that Frank Baker formulated a plan to

achieve some standardization and coordination of beef performance programs — a committee report of the U.S. Beef Cattle Records Committee, Recommended Procedures for Measurement of Traits of Economic Value in Beef Cattle. "It was the first time that someone got the breeders from various breeds, Extension members and others together to put something together."

For more information about BIF's 40 years of history, you can order *A History of Gaining Value from Genetics* DVD from the BIF Web site, [www.beefimprovement.org](http://www.beefimprovement.org).

## Performance programs at crossroads

The past, present and future of performance programs were the focus of the general session Thursday morning. Kent Anderson, North American Limousin Foundation executive vice president, talked about who benefits and who pays for genetic improvement. The Australians have calculated return on investment (ROI) for genetic improvement to be 28-to-1, and the Canadians estimate the ROI for genetic improvement to be 3-to-1.

Anderson encouraged breed associations to prioritize

## Why haven't we seen an improvement in quality grade?

Are seedstock breeders and their respective breed associations doing all they can to enhance carcass quality through genetic improvement? Despite prevailing perceptions of selection emphasis for carcass merit, Kansas State University geneticist Dan Moser said the resulting industry-wide improvement to carcass quality grade has been modest. During the recent Beef Improvement Federation (BIF) conference in Ft. Collins, Colo., Moser discussed factors that have limited progress in improving beef quality through genetic selection.

"There is a perception that we're just doing a bang-up job in terms of changing our carcass genetics to meet consumer expectations. Yet any measure of carcass performance that you see out in the industry doesn't reflect that," said Moser. "We're not seeing dramatic changes in quality or cutability."

Moser acknowledged "a little bit" of improvement in quality grade (increased percentage of carcasses grading Choice and Prime) industry-wide while cutability has declined. Most of the push for improved quality is breed-dependent. Moser said the Angus breed's trend toward selection for improved marbling is illustrated by an increase of .015 units of marbling expected progeny difference (EPD) per year during the last 10-15 years. While it is more compared to other breeds, Moser said the trend does not represent dramatic change. At that rate, he suggested, moving the average of the cattle population from mid-Select to mid-Choice would take about 60 years.

"I think, in many cases, we have overstated what change we are really making," said Moser. "That's not to underestimate the changes that individual breeders are making. Some have made remarkable changes."

To explain why the industry, as a whole, finds improvement of beef quality such a challenge, Moser noted the primary factors that drive genetic change — genetic variation, selection intensity, accuracy of selection and generation interval. Admitting that environment and management also affect beef quality, Moser said these four genetic factors demand the attention of breeders and breed associations because of their effect on the rate at which genetic improvement occurs.

### Genetic variation

While the beef industry is often scolded for its great genetic diversity, Moser called that diversity an asset to animal breeders. Greater genetic variation allows for greater change through selection. However, he called the major beef breeds less divergent than they once were — more similar in growth rate and mature size. From the standpoint of beef quality improvement, the most prevalent breed at the current time — Angus — is superior.

Greater genetic change would be possible if other breeds would aggressively develop superior meat quality lines, suggested Moser. Then, commercial cow-calf producers could emphasize beef quality when selecting sires of multiple breeds for crossbreeding systems.

### Selection intensity

According to Moser, genetic variation describes the potential advantage available through selection for superior traits, while selection intensity describes how much of that potential has been realized. Maximum selection intensity occurs with single-trait selection. However,

beef cattle breeders base selection on many economically relevant traits. This selection method, said Moser, explains why improvement for any particular trait occurs slowly.

Moser said selection intensity for beef quality varies among producers because they have different opinions regarding the true economic reward of increased marbling. Since a relatively small proportion of producers practice retained ownership, many producers do not experience the economic rewards that grid marketing offers to sellers of high-marbling cattle. Additionally, said Moser, the feeder cattle marketing system insufficiently values calves with superior genetic potential for quality grade.

"If market signals more clearly indicated significant increases in profit associated with higher-marbling scores, more intense selection would likely occur," Moser stated.

### Accuracy of selection, generation interval

Moser addressed these two factors collectively, noting how their interaction affects the rate of genetic change. High accuracy of selection can almost always be achieved for a highly heritable trait, like marbling, but accumulating the necessary progeny test data takes time, thus, lengthening the generation interval. Generation interval can be shortened by using younger, less proven sires, but accuracy suffers. According to Moser, the greatest opportunity to enhance the rate of genetic improvement for marbling lies in technologies that provide more accurate information on sires at an earlier age.

The use of ultrasound estimation of marbling score and other carcass attributes is one such technology. However, Moser said one application of ultrasound information that limits genetic progress is the use of actual or adjusted scan data in selection and marketing. He said producers make more informed and correct selection decisions when carcass and ultrasound data are combined into a single set of EPD, with the EPD and accuracy values published for the carcass traits.

"Ultrasound is a powerful tool," stated Moser. "But we still need to carcass test (the progeny of) young AI sires. We shouldn't give up on carcass testing."

DNA tests are another category of tools used to provide information on which to base comparisons for purposes of genetic selection. Unfortunately, said Moser, some producers chose DNA tests over EPDs, rather than using the tools together. He said DNA tests offer great potential, but they have limitations. Marbling is a complex trait likely influenced by many genes in addition to those linked to markers for which DNA tests currently are available. Additionally, it's still hard to estimate exactly what proportion of genetic variability is explained by the tests. Moser said the cost of DNA testing also remains as a significant barrier to widespread application.

Moser called patience the least controversial but possibly the most important factor affecting genetic selection. It is a scarce commodity among cattle breeders, he added. However, considering the cattle breeding generation interval averages five years or more, producers must couple patience with critical evaluation of selection tools for improving beef quality.

"Change can be made," Moser said, "but it takes time."

— Troy Smith, reprinted from Beef Quality Connection



Dan Moser

programs that will provide customers with further improved tools for genetic selection. These include investment in research, development and validation of DNA diagnostics for genetic traits.

Ronnie Green, U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS) national program staff, said the beef industry is at a critical juncture and faces numerous challenges.

Green talked about the history and future of genomic research and ways genomic selection will affect producers. He also explained the challenges facing the advancement of genomic research including the lack of scientists and educators who understand the beef industry and the dilemma that consumers are demanding a reduced "environmental footprint from livestock production." He said we could eventually see our industry shipped off shore.

During the final session on Thursday morning, a group of producers were challenged with the question, "Does the seedstock industry focus on the needs of the commercial industry?" Mark Gardiner, an Angus breeder from Ashland, Kan., said today's commercial producers are demanding:

- Genetics that can capture added value through value-based marketing programs;
- More service after the sale;
- Purchase guarantees; and
- Marketing assistance such as sponsoring feeder calf and replacement heifer sales, offering buy-back programs and fostering retained ownership arrangements with feedlots.

Seedstock producer Steve Radakovich, Earlham, Iowa, said the seedstock industry has typically given the commercial industry what it wanted and maybe more at times. He added that what commercial producers want may not be what they really need.

"The one big injustice of the seedstock industry is evaluating and supplying over-managed, overfed, fossil-fuel-dependent bulls to cow-calf producers forced to survive on solar energy and low-cost production," Radakovich said.

Mike Kasten, a commercial producer from Millersville, Mo., said he thinks seedstock producers have strived to produce high-quality genetics that fit varying environments and serve the wants of beef consumers.

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## BIF recognizes Hereford breeders, staff

The Beef Improvement Federation (BIF) honored annual award winners during its Annual Research Symposium and Annual Meeting June 6-9 in Ft. Collins, Colo. Several Hereford breeders and American Hereford Association (AHA) staff members were recognized.

**CK Ranch**, Brookville, Kan., and **Lacey Livestock**, Paso Robles, Calif., were recognized as Commercial Producer of the Year nominees. **Star Lake Cattle Ranch**, Skiatook, Okla., was a Seedstock Producer of the Year nominee. **Craig Huffhines**, AHA executive vice president, was presented the Continuing Service Award and **Angie Stump Denton**, *Hereford World* editor, was named the 2007 BIF Ambassador Award winner.



Accepting the BIF Commercial Producer of the Year nominee award for CK Ranch were Ray and Mary Negus, ranch managers.

CK Ranch is located in the Smoky Hills region of Saline and Ellsworth counties of central Kansas, which is known as one of the best cow-calf grazing areas in the country. Jack and Donna Vanier and their son, John, own the ranch and the cow herd. Ray and Mary Negus manage the ranch. The ranch includes approximately 15,000 acres of native pastures and 1,000 acres of tillable crop ground. The Vanier family has owned the land since 1933, when the 5,600-acre Root Ranch was purchased.

CK Ranch was first stocked with steers and in the 1950s the ranch managed 2,000 registered cows and registered approximately 1,200 calves each year. Currently the CK commercial herd consists of 600-950 Hereford and Red Angus cows, and 175-200 registered Hereford and Red Angus cows make up the seedstock herd. The primary purpose of the commercial cows is to serve as a testing herd to prove Hereford and Red Angus genetics. The cows calve in the spring with 100-400 heifers calving in January and February and the commercial cows in March and April. CK Ranch uses premium programs to collect data and to improve traits in the commercial herd. The ranch actively participates in the AHA National Reference Sire Evaluation Program (NRSEP) and the Hereford Verified program. Prior to participating in the NRSEP, CK Ranch structured its own sire testing programs in conjunction with producers in Kansas and Nebraska.

The Lacey family has been ranching in California since 1870. After settling in the Owens Valley, John William Lacey and his two sons expanded the operation to include 15,000 acres of city of Los Angeles lease land that increased their carrying capacity to 1,000 head. The ranch began with Hereford and Shorthorn cattle. In 1960 Angus cattle were introduced to replace the Shorthorns.

Today John Lacey and his wife, Dee, along with their children, Mark and Nicki, continue to manage Lacey Livestock. John and Mark still ranch most of the original Lacey outfit. They have divested themselves of all federal lands and have added 40,000 acres more to the Owens Valley Ranches. All together, Lacey Livestock is 60,000 acres with approximately 2,000 cows.

Today the Lacey family ranch is a cow-calf and stocker operation. The Laceys also raise Quarter Horses, and in 2003 Lacey Livestock earned the title of American Quarter Horse Association (AQHA) Remuda of the Year.

The Lacey family owned several ranches in San Luis Obispo County that they sold in 2000 to purchase the historic Dressler Ranch in Bridgeport, Calif. This ranch is 7,000 acres and annually is home to 8,000 steers. Lacey Livestock purchased this ranch with David Wood under the Centennial Livestock partnership. The partners just completed an easement with the American Land Conservancy and the California Rangeland Trust. This ranch will be preserved for perpetuity. Centennial Livestock also leases 230,000 acres of the historic Tejon Ranch, south of Bakersfield, Calif., which is home to about 7,000 head.

The AHA is currently working on a heterosis research project with Lacey Livestock, Harris Ranch and California State University, Chico.

For years Star Lake Cattle Ranch has been a source of Hereford genetics for cattlemen throughout the U.S. and from numerous foreign countries. The ranching operation has been in existence

since 1978, starting in Millbrook, N.Y., and has been in Oklahoma since 1985. The ranch is owned by father and son, Jim and Randy Blinn, and managed by Montie Soules. Encompassing 3,400 acres of native prairie grass in northeastern Oklahoma, the ranch is home to 1,000 head of registered Hereford



Accepting the BIF Seedstock Producer of the Year nominee award for Star Lake Cattle Ranch were Randy Blinn and Montie Soules.

cattle, including more than 400 mother cows. The ranch uses the latest technologies available to make its cattle more efficient and to add to their value. Ranch staff have used embryo transfer (ET) since 1979, ultrasound to sex pregnancies and artificial insemination (AI) on all yearling heifers with sexed semen to increase the value of those pairs as replacement prospects. This year will mark Star Lake's 29th annual spring sale. The ranch also markets pairs, show prospects and 18-month-old ranch-ready bulls in its annual fall sale.

Star Lake has a strong youth market and has awarded more than \$150,000 in cash, credits and prizes during the last 13 years to participants in its junior futurity. Star Lake has shown numerous national champion Herefords and Denver carload champions. The ranch utilizes cattle shows as other businesses would use a trade show to display its genetics to the public. Star Lake is proud to be a Hereford breeder and is constantly striving to breed, produce and offer its customers the best Herefords possible.

Huffhines has served as AHA's executive vice president since 1997. He initially joined the AHA staff in 1992 upon completing a master's degree in meat science from Colorado State University (CSU). His early responsibilities included director of feedlot and carcass programs for AHA's Certified Hereford Beef (CHB) program. He was named CHB LLC director in 1995, launching a fully aligned, breed specific, branded beef program into the retail and foodservice sectors.

A native Texan, Huffhines received his undergraduate degree in animal science from Texas A&M University prior to his master's training at CSU. He was project leader for the CSU Hereford study, which formed the basis for the CHB program. He has since served in several industry capacities, including president of the National Pedigreed Livestock Council from 2003-2006, chairman of the BIF Emerging Technology Committee from 2004-2007, and member of the National Cattlemen's Beef Association (NCBA) National Animal Identification working group.

Huffhines served on the BIF board of directors, where he chaired the BIF emerging technology committee, his leadership has been instrumental in the promising field of molecular genetics.

He and his wife, Mary Jon, are the parents of three sons — Seth, Cole and Miles.



Angie Stump Denton was recognized as the 2007 BIF Ambassador Award winner.

The Ambassador Award is given to a member of the media each year to recognize an individual's efforts to help cattle producers understand cattle performance testing and genetic prediction tools. Denton joined the AHA staff in October 2004. She oversees the editorial content of the *Hereford World* and also assists on the AHA communication team. Prior to joining AHA, she spent nearly 10 years at the *Angus Journal*. She served as assistant and associate editor and then as director of the newly formed web marketing department.

Denton is a graduate of Kansas State University with a degree in agricultural journalism. She was active in junior polled Hereford activities and served on the National Junior Polled Hereford Council.

She and her husband, John, are parents of two sons — Wesley and Dustin. **HW**



Craig Huffhines was presented the 2007 BIF Continuing Service Award.

He said the recent challenge facing seedstock producers is helping their commercial customers adapt genetics to production systems that must change because of higher feed costs.

### The ideal beef animal

Friday morning Darrh Bullock, University of Kentucky animal scientist, summarized attendees' responses to defining the ideal animal. He said there is not a consensus of what the "ideal" product is that producers should be producing.

Based on the survey, attendees said carcass weight is the highest economic value trait. "The needs of the marketplace and a production environment are somewhat antagonistic," Bullock summarized.

More than 50% of producers agreed about nutrition being the biggest limiting factor to profitability and more than 70% agreed about the importance of crossbreeding. Hide color influenced a little more than half of the attendees' genetic decisions. In response Bullock asked, "What effect does color have on production or product? Does it affect calving ease, growth, health, eating quality?"

He said if hide color only affects market, then what does it have to do with breed improvement?

The producers in attendance agreed that input costs were too high and that their cows were too big. "That tells me," Bullock said, "that we're not doing a good job of matching our genetics to our environment."

He summarized, "Can we build an ideal beef animal? Absolutely! We have the ability to build ideal animals that fit different production systems and serve different markets."

The ideal animal, however, he explained, will be regionally, management, market and technology dependent.

### Environment and quality grade improvement

Pete Anderson, VetLife Technical Services, told BIF participants that any nutritional insult at any time during an animal's life will reduce marbling. "Marbling deposition is a lifetime event, not something that takes place during the late stages of feeding," he said.

The VetLife Benchmark Performance Program gathers performance, carcass and financial data on approximately 40% of all fed cattle. Research shows that marbling is different from subcutaneous fat. He explained they are different tissues with different regulatory pathways.

"Marbling results from a different embryonic tissue layer than subcutaneous fat," he

said. "At birth, cattle have nondifferentiated cells within their muscles that have at least three choices — turn into muscle cell nuclei, turn into fat cells or do nothing."

Anderson stressed it is important for producers to keep a close eye on health and vaccination programs. "Cattle that go off feed expend more energy fighting off the negative effects of the disease," he said, instead of depositing fat. "It stands to reason that those cattle that suffer disease at any time in their lifetime could have an impaired ability to deposit marbling regardless of how fat they ultimately get."

### Utilizing DNA technology

The final session Friday morning focused on the use of DNA marker



Luke Lind

technology. Luke Lind, Five Rivers Cattle Feeding vice president of marketing, said right now DNA markers are not better than EPDs and the No. 1

reason is that the producer understands what a birth weight EPD of +1.0 means but has no idea what five stars mean.

He said there is tremendous opportunity if producers can couple the two and develop marker-assisted EPDs.

For use in the feedlot, Lind said DNA tests based on two or three markers for tenderness and marbling are not good enough. He said the tests need to be simple, comprehensive and cost-effective. He said for Five Rivers to consider the technology, there must be a 3-to-1 return on cost.

Jerry Taylor, University of Missouri professor and Wurdack chair of animal genomics, shared information about new genomic technology. A new technology called the Illumina iSelect Infinium Custom Beadchip could revolutionize the way producers identify the genetic merit of cattle by looking at the "whole genome."

The beadchip, which is expected to be commercially available this fall, could give researchers the ability to cost effectively understand the range of genes that affect specific traits.

Taylor explained, "We've taken 5,000 DNA samples from bulls at Circle A Angus and 1,800 samples from AI bulls. We've genotyped 4,000 animals and identified 422 markers. From this research, we've found evidence for 59 individual marbling genes. If there are 59 genes in Angus that are responsible for the genetic differences in marbling and marbling scores, then we need to test for all 59 genes. If we're going to do that,



Jerry Taylor

you need a test that encompasses the entire genome, not just parts of it.

"The test could also help producers accurately predict the EPDs for all traits without having to take measurements or weights," he said. "It will also provide for parentage

verification and traceability. There is an enormous range of applications."

Taylor also said a potential downside with the technology is that each test is breed specific.

### Committee meetings

Thursday and Friday afternoon BIF attendees participated in committee meetings. For highlights of the committee meetings and for more information about the general sessions, visit [www.bifconference.com](http://www.bifconference.com). The site includes session synopses, PowerPoint® presentations, audio files, proceeding papers, award winner coverage and photo galleries. **HW**

## NAAB symposium highlights

U.S. cattle producers often credit the introduction and use of "exotic" beef breeds with increased application of artificial insemination (AI). However, according to Robert Walton, former president of American Breeders Service (now ABS Global), several performance-oriented commercial producers using British breeds were among the first to apply AI seriously.

Walton was the keynote speaker during the National Association of Animal Breeders (NAAB) Symposium, held in conjunction with the recent Beef Improvement Federation (BIF) meeting in Ft. Collins, Colo. Walton guided his audience through a historical look at 40 years of beef AI.

Walton attributed the expansion of beef AI to three key factors. The first was overcoming the severe shortage of AI technicians. ABS developed a field AI training program in 1965, and by the time of Walton's retirement in 1991, 125,000 beef cattle and dairy producers from across the nation had been trained.

The second key factor influencing more widespread adoption of AI was the availability of liquid nitrogen-refrigerated semen tanks capable of keeping semen viable for longer periods of time. "I'm still using one of those tanks on my farm that is nearly 35 years old," Walton said.

The third important factor was development of methods for estrus synchronization that minimize labor and make application of AI practical for many real-world cattle operations. According to Walton, synchronization systems have evolved through the years and gained acceptance. Today, 90% or more of AI is accomplished through the use of modern synchronization protocols.

"Industry now has magnificent tools and management systems for beef AI in commercial production, but we have to keep moving ahead as markets and conditions change," Walton said. "We have to keep our genetic tools sharpened and aimed in the right direction, because yesterday's solutions are soon out of date."

Following Walton, Virginia cattleman Tim Sutphin explained how application of AI makes his commercial cow-calf operation more profitable. Sutphin admitted that his cost per pregnant cow is about \$6 higher compared to natural service. However, the combined benefits of synchronized AI and retained ownership of the resulting calves provide ample return on the additional investment.

Sutphin said synchronized AI has been used on his family's 700-cow operation since 1999. Among the benefits, he cited improved pregnancy rates and more calves born earlier in the calving season. Pregnancy rates have ranged from 95-97.5% during recent years with 85-90% of calves born during the first 30 days of a 65-day calving season. The average age of all calves born is 16 days older than before AI was implemented.

Through use of proven AI sires with high accuracy expected progeny differences (EPDs), Sutphin has minimized calving difficulty while he improved genetic potential for feedlot performance and carcass merit. Rather than selling calves, he believes retaining ownership through harvest offers the best opportunity to claim the added value resulting from a well-managed AI program. According to Sutphin, performance and profitability improve with increased AI influence.

"If we compare a calf that is AI-sired and out of an AI-sired cow with a calf that is sired by a clean-up bull and a non-AI-sired cow, the difference in the end value is \$175," Sutphin said, referring to his 2006-born calves harvested in April and May of 2007.



— Troy Smith