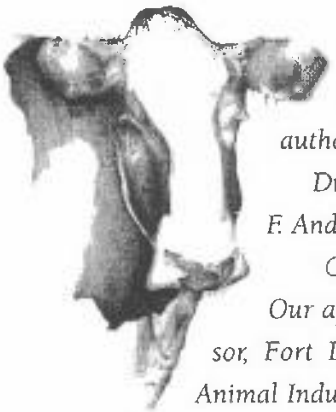
Reprinted from the JOURNAL OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION, Vol. 219, No. 10, Pages 1368-1397

Animal Welfare Forum: Bovine Welfare

November 10, 2000, Itasca, Illinois

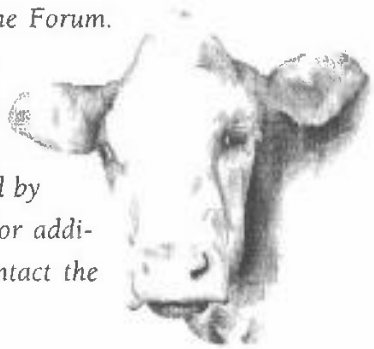


The following papers were submitted by speakers at the 2000 AVMA Animal Welfare Forum, held at the Wyndham Northwest Chicago Hotel in Itasca, Illinois. These papers have not undergone peer review; opinions expressed are those of the authors and not necessarily those of the American Veterinary Medical Association.

During the Forum, the 2000 AVMA Animal Welfare Award was presented to Dr. John F. Anderson of Cannon Falls, Minnesota.

Contributions from sponsors ensure the success of the Forum. Our appreciation to Hill's Pet Nutrition Inc, our gold sponsor, Fort Dodge Animal Health, our silver sponsor, and the Animal Industry Foundation, our bronze sponsor.

The AVMA Animal Welfare Forum is an annual event planned by the Animal Welfare Committee, under the direction of the Executive Board. For additional information about the Forum or the Animal Welfare Award, please contact the AVMA Communications Division.



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Welcome

James H. Brandt, DVM
2000–2001 AVMA President-Elect

Good morning and welcome to the American Veterinary Medical Association's Eleventh Annual Animal Welfare Forum. It is my pleasure to welcome you on behalf of the more than 65,000 members of the AVMA. The Animal Welfare Forum is held each year as the highlight of the AVMA's Animal Welfare Week, which is a series of media events designed to promote the welfare of animals. Throughout the years, the Forum has served as a useful platform for highlighting and exploring important animal welfare concerns affecting many different species. This year the AVMA is pleased to present "Bovine Welfare."

Today's Forum topics include the evaluation of management practices for their impact on welfare, the welfare of cattle destined for slaughter, dairy cow comfort, dairy heifer replacement, veal calves, beef feedlots, the ethics of livestock shows, and rodeo cattle. Many of the issues we will be discussing are contentious. Furthermore, addressing all these issues during a 1-day Forum is incredibly ambitious. While we don't pretend to have all the answers, the AVMA's Animal Welfare Committee has assembled an excellent panel of speakers to review these issues and provide all of us with scientifically based information that we can use to understand and improve the welfare of cattle involved in these industries.

Our goal for this Forum, as it has been for all previous Forums, is to promote the well-being of animals. The AVMA is proud of the vital role veterinarians have played in advancing bovine welfare.

A look at bovine welfare—what's good, what's bad, and the lessons within

AnnMaria de Grassi, MS

Animal welfare is the single most important concern on dairy farms and cattle operations across the United States and around the world. The American Farm Bureau Federation, the largest general farm organization in the United States, maintains as a matter of policy its belief that no segment of society has more concern for the well-being of farm animals than does the producer.[1] Good animal welfare practices promote comfort, health, and production efficiency by preventing or reducing stress, illness, and injury to animals. Profit motives aside as the incentive to treat cattle well, farmers strive to carefully handle their animals as a matter of personal commitment.

Farmers take this commitment seriously. "I have contributed my whole life to taking care of animals. They have always come first. Before I sit down for my Christmas meal, my cattle have been already fed," says a rancher who for nearly 5 decades has managed beef cattle and professes to treat them "the best they can be treated while they are on this earth."[2] In their 27 years of marriage, and without complaint, this rancher and his wife have never been off their ranch for more than 3 days at a time. "I love the land, I love the animals. That's why I have 2 jobs," another cattle rancher explains.[3] Given the financially fragile state of American agriculture, this rancher stays in business and helps preserve the family enterprise by taking off-farm employment. He and his family are dedicated to preserving the wildlife and natural beauty of the property while raising 1 of the top commercial Angus herds in California. Among dairy farmers there is also open appreciation for the interdependency of farmers and their cattle. "Every farm is made up of a unique blend of people, land, buildings, and animals working together every day. These daily interactions are not only vital to the success of the farm but also tend to create strong ties between the people and everything on their farms. The human-animal bond on dairies is a good example of this," comments another farmer.[2] Every day, 7 days a week, year-round, this farmer and her husband rise to milk at 5:30 AM, and every night, 7 days a week, year-round, they wrap-up at about 9:00 PM.

In my look at bovine welfare, what do I see that is good? For starters, attitude. In my 13 years as the animal welfare director for the California Farm Bureau Federation, I have met and worked with many producers, farm advisors, researchers, animal welfare advocates, and regulators around the world who embody

From the National Affairs & Research Division, California Farm Bureau Federation, Sacramento, CA 95833.

the right welfare attitude. And where there are problems to be addressed, they make a dedicated effort to resolve them. I'd like to share with you several examples of programs that have the potential to move us forward.

Quality assurance programs (QAP) exist throughout the world as voluntary educational efforts that broadly apply to animal care, environmental health, and food safety. For example, in 1987, a large California feedlot started a comprehensive QAP with the USDA. Since then, many similar programs have developed, including the California Cattlemen's Association (CCA) Basic Cow-Calf QAP. With input and instruction from veterinarians, academics, and cooperative extension advisors, this program offers an opportunity for producers with herds of all sizes to "raise cattle that meet the consumers' concerns for the welfare of the animals and for the production of quality products."[3] Since 1993, nearly 3,900 producers have completed this program.[c] The California Dairy QAP is built on the same principle. An animal health and welfare module will soon accompany the existing module on environmental stewardship and the nearly complete module on food safety.

Quality assurance program components typically include formal instruction on good animal handling practices, instruction on pertinent laws and regulations, training sessions, documentation (record keeping), and verification (third-party evaluation) that the goals of the program are being met. These programs are always a work-in-progress as they are revised when experience, new research, and new technologic advances indicate the need for revision.

Researchers at the Animal Welfare Centre in Werribee, Victoria, Australia, are developing a training program called Cowcare that targets stockperson attitudes and behavior. The goal of the program is to improve dairy cattle welfare and productivity. Cowcare will be commercialized for use not only within Australia but also internationally. Director Paul Hemsworth states, "The unusual nature of the topic, in which attitudes and behaviour are targeted, together with its personal nature and sensitivity, requires a carefully considered strategy to effectively introduce the training program into the industry."[d]

Cowcare is based on several years of research in the Australian dairy industry studying human-animal interactions in agriculture. That research has shown important relationships between farmer attitude and behavior toward cows and dairy cow behavior and productivity. In Hemsworth et al's study[4] completed in 1999, milk yield during the peak period of milk production was 5% higher ($P < 0.05$) on Northern Victoria farms that received a cognitive-behavioral intervention procedure versus farms that received no intervention (control treatment).

Various animal care practices publications exist throughout developed countries. These publications come by different names and vary in formality—such as the Animal Care Series,[5] the Code of Accepted Farming Practice for the Welfare of Cattle,[6] the Recommended Code of Practice for the Care and Handling of Farm Animals,[7] and the Code of Welfare[8]—but all aim to educate readers and promote sound welfare practices.

An animal care helpline, such as that offered by the Ontario Farm Animal Council (OFAC), is another example of an educational service offered to farmers to safeguard animal welfare. The OFAC service is a mechanism "to assist farmers in providing adequate or improved care for their animals and/or in following practices that meet industry standards."[9] Concerned citizen calls are not that numerous, with about 25% of the calls representing invalid concerns (no welfare problem at issue) and only a small percentage identifying serious animal care issues.[e] The Alberta Farm Animal Care Association[10] and the Farm Animal Council of Saskatchewan Inc[f] have helplines too, and the Indiana State Board of Animal Health established a similar program with consultation from the OFAC.[g]

Organizational, academic, and agency resources dedicated to animal welfare issues are numerous and laudable. Speakers at the AVMA Animal Welfare Forum represent several excellent examples. Further, groups such as the National Institute for Animal Agriculture (NIAA), the National Cattlemen's Beef Association (NCBA), the National Milk Producers Federation, and the American Association of Bovine Practitioners (AABP) each work to promote responsible animal management and progressive attitudes. The NIAA video *Understanding Dairy Cattle Behavior to Improve Handling and Production*, the AABP Animal Welfare Committee's *Practical Euthanasia of Cattle* guide, and New Zealand's video series *Farming With Pictures* are 3 noteworthy educational tools. *Farming With Pictures*, for example, contains a segment on tail docking that highlights research findings, market considerations, and farmer viewpoints.[11]

Most people agree that regulation to proscribe intentional and malicious mistreatment of cattle is justified and necessary. However, farmers and others generally view regulation that imposes a 1-size-fits-all standard for acceptable farming practice as impractical and untenable. They look to advances in scientific knowledge and effects on profitability, not legal mandates, as the impetus for determining practices. Dusty de Braga, range manager for 1 ranch owned by and 2 ranches that sold conservation easements to the Nature Conservancy, has said, "Ranchers generally subscribe to the way they've always done things, for better or worse. If someone wants to help you change, you feel threatened. But the people who refuse to change are going out of business."[12] In my experience I have noticed, fortunately, that there are many progressive-minded farmers and ranchers around the globe who are not only open to making changes based on science but also open to those based on changing societal values.

In November 1999, a group of dairy farmers and a dairy consultant accompanied me on a 2-week study tour of Australia and New Zealand. The purpose of the trip was to learn how 2 major US agricultural trading partners address animal health and welfare domestically and internationally. Among other things, the group became familiar with Hemsworth et al's research on handler attitude, Lindsay Matthews' research on tail

docking, industry segment attitudes, and how these countries approach policy development with diverse stakeholder input.

I was particularly impressed with the management attitude of the MC Herd Abattoir in Geelong, Victoria, Australia, where discussion of animal welfare is welcome and encouraged. Signage imploring appropriate handling is reinforced by management's open invitation for producers to come into the plant to see how their cattle are processed through the facility. Regardless of whether animals arrive with bruises or sustain injury once on site, the company wants to identify the source of the problem and fix it immediately.

In terms of changing societal values, farmers do respond to market signals. One recent example is the participation of the Northern California dairy cooperative Clover-Stornetta in the American Humane Association's (AHA) newly established Free-Farmed Certificate Program. According to AHA, this program aims to provide independent verification that the care and handling of cattle raised for food meet welfare standards set by AHA. Citing results from a 1999 survey[13] by the Animal Industry Foundation, AHA believes consumers are willing to pay a premium for products labeled humanely raised. A recent e-mail message we received from a consumer may be confirmation of this: "I'm not a member of any radical group, nor am I a vegetarian, but I am definitely for better treatment and health of the animals that ultimately end up on our table. I'll bet most people...would be willing to pay a higher price for their food if it means more humane farming."[h]

The key lesson in this brief discussion of what's good in bovine welfare is that all these programs—and others—are largely meaningless if they simply remain good intentions, as manuals on a shelf, or employed by the very few. To build credibility of a program, there should be evidence that the program works. If window dressing is the strategy—that is, creating the illusion of a good effort—the strategy will eventually fail as consumers see or hear proof of inattention to welfare lapses.

I have addressed several commendable aspects of cattle care, but what about bovine welfare challenges? In other words, what practices or situations may need reevaluation in light of changing societal values? Where must improvements be made in how we handle cattle? Again, I highlight examples that illustrate the welfare issues that come to my attention most often.

Traditional practices as branding, castration, and dehorning remain welfare topics because science, technology, economics, and policy have yet to produce universally acceptable alternatives to achieving the goals of those practices. In California, hot iron branding, for example, is still the most widely used legally recognized form of permanent identification for establishing cattle ownership.' As long as there is even the specter of cattle thieves, permanent identification will be necessary. Ongoing research into an alternative to physical castration may eventually resolve the castration debate. Industry, at least, is open to exploring alternatives, as evidenced by the CCA resolution to support continued research and product development at the University of California, Davis, on immunocastration for cattle.[14]

In my experience, facility and equipment design and maintenance remain in some measure welfare challenges, whether at the farm, marketing, or processing level. Facilities built before the advent of, or without considering, present knowledge of cattle behavior can be problematic if, for example, tools like hot shots are used to overcome design faults. Dr. Temple Grandin's facility and equipment design work is representative of learned thought on how modern methods of livestock handling can improve animal welfare and productivity.[15] More facility and equipment designers should internalize this thinking, especially as facilities are renovated or newly built. The 1999 National Market Cow and Bull Quality Audit, for example, identified that abnormal swelling and abscesses were most prevalent among dairy versus beef cattle. These defects were thought to be associated with the confined housing environments under which dairy cattle are often raised. The report states that remedial "[a]ctions that producers may consider include training of all personnel to avoid causing injuries to cattle, selection for structural correctness, and improvement of flooring and housing in production facilities (particularly dairies) to reduce the incidence and severity of arthritic joints." The audit, sponsored by the NCBA, resulted in good and bad news for producers. Whereas 96% of market cows and bulls had clear eyes, 96% were without abscesses, and 85% were sound or had only minor structural problems, room for improvement is visible. Marketing cull cattle in a timely and appropriate manner remains a key message.[16]

There are practices such as tail docking and industry structural changes such as intensification of production and processing that elicit the question, "Are these compatible with good animal welfare?" Joseph Stookey[17] wrote a thought-provoking paper on this topic in 1994, concluding, "Because animal welfare is a continuum, it is difficult to draw a definite line between acceptable and unacceptable levels. Regardless, we should continue to utilize the current information and take steps towards improving animal welfare and move away from practices which compromise an animal's well-being."

New Zealand originally introduced tail docking of dairy cattle for product hygiene and human health reasons, to protect farmers from leptospirosis before the advent of a vaccine and routine cattle vaccination. New Zealand research has shown no benefit to animal health, welfare, or milk quality from the tail docking practice, and the practice is now declining in the New Zealand national dairy herd.[18] In the United Kingdom, tail docking of cattle has been prohibited for several years.[19] On the other hand, tail docking in North America is relatively new and on the rise. Producers cite several reasons for docking, including milking machine cleanliness,[20] ease of milking equipment attachment between hind legs, cow cleanliness, and udder health. Research at the University of British Columbia, however, found no treatment differences in 4 measures of cow cleanliness, 2 measures of udder cleanliness, or udder health in docked versus

undocked cows.[21] Stookey[17] makes the point, "The dairy industry in N[orth] America has survived without tail docking for so long that it is hard to believe that such a procedure should now be necessary. The traditional means of keeping animals clean such as trimming the switch, providing adequate bedding, or frequently cleaning the barn are chores that responsible producers would be willing to accept." Presently, however, there is no universally accepted global position on the practice of tail docking.

There are at least 2 lessons within this discussion of welfare challenges. One is that there is a continued need for applied research to identify more welfare-friendly alternatives to traditional practices. The other is that we need a broader dialogue with cattle caregivers and allied industries as to what research reveals about novel practices and facility planning.

Pictures often dictate what is deemed bad about cattle welfare. The cliché "A picture is worth a thousand words" clearly applies here. What's bad about cattle welfare typically comes to my attention through pictures in the newspaper or on the evening news. Therefore, cull cattle, including lame, nonambulatory (downer), and neonatal animals, remain a major issue for the cattle industry. The number of animals in compromised care is relatively small, but the public image fallout from negative events can be and has been huge. Examples of this that come to mind include the May 1991 national broadcast of NBC's *Exposé* segment on the treatment of disabled livestock at a South St. Paul, Minn, stockyard, the October 1999 multistate television coverage of improperly euthanatized calves on a Florida dairy, multiple network affiliate coverage, also in October 1999, of allegedly neglected dairy calves at a federally inspected Arizona slaughterhouse, and the June 2000 multistate media coverage (print and broadcast) of allegedly mistreated cattle at a Washington slaughterhouse.

A public relations maxim states that subsequent events reinforcing an original stimulus for opinion change tend to increase the degree and durability of the change.[22] The NBC *Exposé* segment is a prime illustration of such a stimulus, with subsequent events represented by these other cases. In Florida, 13 calves were destroyed in January 1999 by methods that were later deemed "inadequate and deficient, and may have resulted in the dairy calves unnecessarily suffering before death." Video footage of the incident has been posted on the Internet for more than a year. The State of Florida signed a pretrial intervention agreement with the dairy farm requiring, among other things, that the farm actively assist in the passage of legislation providing for the humane euthanasia of sick and cull animals, actively participate in the joint development of a training program to provide specific guidelines for the euthanasia of sick and cull animals, and pay for training materials up to $27,500.[23] The Arizona case involves multiple dairy calves that had arrived live at a federally inspected slaughterhouse in October 1999 but that hours later were dying or dead before slaughter. The incident was covered on 4 major television network affiliates (ABC, CBS, Fox, NBC) and 1 independent station, for a total of 15 broadcasts in Phoenix in a single day.[24] The Washington incident centers on allegations that cattle were processed too rapidly, ineffectively stunned, and skinned alive. The case is under investigation on order of the governor.[25]

Psychologists estimate that 83% of human learning is achieved through sight. Fifty percent of what humans retain consists of what they see and hear.[26] Potentially, these negative stories, regardless of whether they are true or not, are what the public sees and hears—and therefore "learns"—about cattle production. Do these events, or any others, mean we need to be humiliated into doing the right thing? I surely hope not! Yet there are cases like the 1 in Arizona that remain stymied and, thus, unresolved months later. There has been discussion in Arizona about pursuing a citizen's initiative to achieve reform regarding the alleged mistreatment of livestock. The idea grows out of frustration from ignored pleas for voluntary corrective responses or poor enforcement of existing anticruelty regulations.[j] The causes of these and other welfare problems vary, ranging from ignorance to indifference. Still, no single proposal for dealing with problematic cull animals seems to meet everyone's expectations of a satisfactory solution. The bottom line, though, is that the public image of how these animals are handled is emotive and commands a firm unified response from industry at all levels.

There is another complication in advancing the standard of care for farm animals. In my experience, those groups and individuals who depict farmers and ranchers as inherently cruel have not just irritated and insulted the dedicated producer but have succeeded in creating producer skepticism toward valid welfare advocates and reformers. A case in point: in early 2000, arsonists caused tens of thousands of dollars damage to a poultry processing plant and a slaughterhouse in Sonoma County, Calif. Through donations by the agricultural community, a reward was offered to help law enforcement identify those responsible. A toll-free telephone line was established to receive any information that could be helpful to the cases. Only 3 calls were received, all of which anonymously disparaged farmers, and included calling farmers murderers and remarking that they deserved whatever they got.[k] It is still unknown who set the fires, and the fires may have nothing to do with whether or not someone is opposed to animal agriculture. But the crank calls are examples of the sorts of actions that tend to paint as extremists even nonindustry individuals truly interested in advancing animal care.

Lapses in animal care—wherever they occur—must be swiftly and properly addressed. If they are not, not only is animal welfare not served, but public confidence in the caretaker erodes, and growing public cynicism triggers more legal intervention. Industry needs to conduct and expand legitimate self-audits to resolve trouble areas; waiting to see what first hits the news is a lousy tactic for safeguarding animal welfare and managing problems. We could all do a better job of holding each other accountable for our actions. We should broaden our working alliances with individuals and groups promoting animal welfare; therein lie untapped opportunities. Such alliances may help us

identify and assess welfare enhancements from around the world, allowing us to adopt or adapt that which will benefit cattle in different environments.

"In dairying, you better have it in your heart and soul, all the time, or you won't last," states a seasoned dairyman.[l] A rancher echoes this sentiment, concluding, "[T]oday's business of raising beef is so much more than about cattle. It's about grass, water, monitoring, fences, education, meetings, and mainly trying to stay ahead of the constant regulatory bureaucracy while meeting your overhead. It is way more than 9 to 5."[m] These remarks really do represent the reality of progressive-minded farmers and ranchers, people who truly care about what they do—raising cattle. That's not to say it is an industry without its share of welfare concerns. Surely they exist. But are they rampant the world over? In my experience, I do not believe so. Where welfare challenges and problems exist, whether they affect 1 animal or many, we must rise to address them without excuse. Each animal that provides us with food and fiber deserves at least that much consideration. Whether farmer, veterinarian, animal welfare advocate, researcher, public member, or consumer, we each must exert influence to promote the care of these animals. To this end, each of us doing our best means each of us doing our part.

[a]Lucchetti T, Hopland, Calif: Personal communication, 2000.
[b]Stone S, Woodland, Calif: Personal communication, 2000.
[c]Davis S, Member and Media Relations, California Cattlemen's Association, Sacramento, Calif: Personal communication, 2000.
[d]Hemsworth PH, Animal Welfare Centre, Werribee, Australia: Personal communication, 2000.
[e]Ballentine L, Ontario Farm Animal Council, Mississauga, ON, Canada: Personal communication, 2000.
[f]Buettner A, Farm Animal Council of Saskatchewan Inc, Saskatoon, SK, Canada: Personal communication, 2000.
[g]Derrer D, Indiana State Board of Animal Health, Indianapolis, Ind: Personal communication, 2000.
[h]Mills A, Fountain Valley, Calif: Personal communication, 2000.
[i]Sherbo L, Bureau of Livestock Identification, California Department of Food and Agriculture, Sacramento, Calif: Personal communication, 2000.
[j]Goethe B, Arizona SPCA, Phoenix, Ariz: Personal communication, 2000.
[k]James J, Sonoma County Farm Bureau, Santa Rosa, Calif: Personal communication, 2000.
[l]Scott B, Moreno Valley, Calif: Personal communication, 2000.
[m]Bradford P, Hopland, Calif: Personal communication, 2000.

References

1. American Farm Bureau Federation. Animal care 104. In: *Farm Bureau policies for 2000. Resolutions on national issues adopted by elected voting delegates of the member state farm bureaus to the 81st annual meeting of the American Farm Bureau Federation.* Park Ridge, Ill: American Farm Bureau Federation, 2000;85–87.

2. DiBenedetto J. *The Times of Halcott. A quarterly newsletter.* 2000;10(spring):6–7.

3. *California Cattlemen's Association cow-calf quality assurance program: the solution.* Sacramento, Calif: California Cattlemen's Association, 1995.

4. Hemsworth PH, Coleman GJ, Barnett JL. *The effects of a training program targeting stockperson attitudes and behaviour on cow productivity. A final report prepared for the Dairy Research and Development Corporation.* Victoria, Australia: Animal Welfare Centre, Victorian Institute of Animal Science, Department of Natural Resources and Environment, 1999;1–27.

5. Arana M, Bath D, Berry S, et al. *Animal care series: dairy care practices.* 2nd ed. Davis, Calif: University of California, 1998;1–54.

6. *Code of accepted farming practice for the welfare of cattle. Revision number 1. Bureau of Animal Welfare.* Victoria, Australia: Department of Natural Resources and Environment, 1998;1–28.

7. Canadian Agri-Food Research Council. Recommended code of practice for the care and handling of farm animals. Veal calves. Available at: http://www.carc-crac.ca/english/codes_of_practice/factsheets/dairye.htm. Accessed Oct 6, 2000.

8. Animal Welfare Advisory Committee. *Animal Welfare Advisory Committee 1999 annual report.* Wellington, New Zealand: Ministry of Agriculture and Forestry, 2000.

9. Ontario Farm Animal Council. Available at: http://ofac.org/anicare.html. Accessed Oct 6, 2000.

10. Alberta Farm Animal Care Association. Available at: http://www.afac.ab.ca/alert_line.htm. Accessed Oct 6, 2000.

11. *Farming with pictures. Dairying.* Auckland, New Zealand: Tiger Films Limited, 1997.

12. Wilkinson T. Homes on the range: slowing sprawl by building on the 'radical center.' *Nature Conservancy* 2000;Jul/Aug:23.

13. *Free farmed certification program questions and answers. Fact sheet.* Englewood, Colo: American Humane Association, 2000;Sep:1–2.

14. *Support for cattle castration research. Animal care committee resolution 99-02.* Sacramento, Calif: California Cattlemen's Association, 1999.

15. Livestock behaviour, design of facilities, and humane slaughter. Available at: http://www.grandin.com/index.html. Accessed Oct 9, 2000.

16. *Executive summary of the 1999 national market cow and bull quality audit. Improving the consistency and competitiveness of market cow and bull beef and increasing the value of market cows and bulls. Version I.* Fort Collins, Colo: Colorado State University, 2000;1–16.

17. Stookey JM. Is intensive dairy production compatible with animal welfare?, in *Proceedings.* West Can Dairy Semin 1994;6:209–219.

18. *Animal welfare in New Zealand.* Wellington, New Zealand: Ministry of Agriculture and Forestry, 1999;10.

19. *Codes of recommendations for the welfare of livestock: cattle.* London: Ministry of Agriculture, Fisheries and Food, 1983;12.

20. Fitchette T. Cleanliness in the milk parlor begins at the end. *Western Dairy Business* 2000;Sep:51.

21. Tucker CB, Fraser D, Weary DM. Tail docking dairy cattle: effects on cow cleanliness and udder health. *J Dairy Sci* 2001;84:84–87.

22. Center AH, Jackson P. The purposes of public relations. In: Kart C, ed. *Public relations practices: managerial case studies and problems.* 4th ed. Englewood Cliffs, NJ: Prentice Hall, 1990;1–8.

23. The Humane Society of the United States. McArthur pretrial intervention agreement. Available at: http://www.hsus.org/programs/farm/hot/mcarthur_pretrial101299.html. Accessed Oct 11, 2000.

24. *Tri Western 10/14 to 10/15 monitoring report.* San Francisco: Video Monitoring Services of America, 1999.

25. Locke orders probe of alleged cruelty at IBP slaughterhouse. Available at: http://seattlep-i.nwsource.com/local/slau05.shtml. Accessed Jun 5, 2000.

26. Wilcox DL, Ault PH, Agee WK. Communication. In: Rosati MA, Goldfarb S, eds. *Public relations: strategies and tactics.* 3rd ed. New York: HarperCollins Publishers, 1992;188–209.

Forum continued on next page.

Evaluating management practices for their impact on welfare

Julie L. Morrow-Tesch, PhD

What is Good Animal Welfare?

A lack of scientific knowledge regarding the general welfare of food animals exists today mainly because accurate indicators and an understanding of the relationship between indicators of animal welfare are lacking. Welfare is a poorly defined term in the scientific literature. Some issues surrounding animal welfare are ethical considerations on how animals should be treated. Clearly, however, welfare is a multidimensional phenomenon.[1] No animal is in an optimal state of welfare for its entire life, in part because of the everyday stressors that confront all animals. Human-animal interaction is of particular importance and, in many cases, may be overlooked. As several researchers have discovered, inappropriate stockmanship can have negative consequences on cattle behavior and productivity.[2]

The AVMA defines animal welfare as: "encompassing all aspects of animal welfare, including proper housing, management, nutrition, disease prevention and treatment, responsible care, humane handling and euthanasia."[3] What can be reasonably assumed is that an acceptable state of welfare takes into consideration several points—namely, no disease, no hunger or thirst, adequate protection from extreme environmental conditions, and freedom from pain and injury. This is simply good management. If an animal is not provided with these things, then production and welfare are affected.

The environment we keep animals in is important to their welfare. Nevertheless, we humans would not like to reside in many of the environments in which we house our livestock. Does this mean they are unacceptable to the animal? The problem is that humans and animals perceive the same environment very differently. Some have even gone so far as to describe welfare as a human perception problem.[4] Animals do not perceive their environment the same way we humans perceive our environment. Cattle, for example, have a large binocular field of vision but a narrow monocular field, which is very different from that of humans. By better understanding the way animals perceive environmental stimuli, we will perhaps be able to create environments that enhance welfare. What is lacking now is an understanding of how farm animals process the information they receive from the environment. This processing is called cognition, or the ability of an animal to collect information and to store and apply this information in an appropriate way. We are only now beginning to study cognition and learning in food-producing animals. By understanding how and to what degree animals process information from their environment, we will be able to clearly demonstrate what is required in cattle production environments to maximize welfare and productivity.

From the USDA-ARS Livestock Issues Research Unit, Texas Tech University, Lubbock, TX 79409-2141.

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How is Welfare Measured?

The next question to consider is how the animal responds to its environment following the information gathering and processing steps. These responses can generally be grouped into major categories: behavior, physiology, and the stress response. We can measure all of these responses when assessing animal welfare.

There is, unfortunately, no litmus test for animal welfare.[5] Nevertheless, we must have some objective criteria by which animal welfare can and should be measured. Attempts have been made to assess the overall welfare of animals in relation to management practices. Some consider an objective assessment of welfare as subjective and impossible to perform. Generally, we want to take the "best estimate" approach to assessing welfare and measure parameters that are indicators of welfare, including stress physiology, behavior, mortality, health, and productivity.[6] Change in these variables per se is not an indicator of a change in welfare but the biological response to stress.

At the Agricultural Research Service Livestock Issues Research Unit, we have taken the approach that every basic and applied science can yield important information about cattle welfare. We have continued to develop objective indicators of animal welfare and are using these measures to understand the physiological correlates of behavior so that the associations between welfare, behavior, health, and productivity can be better interpreted. Measures include acute phase proteins, immune responses (immunoglobulin production, cytokine production, changes in populations of blood cells), changes in hormone concentrations (corticotrophin releasing hormone, cortisol, beta endorphin), and receptors for specific neurotransmitters, as well as quantification of changes in behavior.

Management Practices that Alter Bovine Welfare

The level of welfare experienced by cattle in production systems can be attributed to management practices such as painful procedures or other environmental causes. Reduced welfare caused by painful procedures used in cattle production is generally more specific and, at least in research situations, more amenable to remediation. Environmental factors such as housing, social interactions, and human handling tend to be more complex and include physical and psychological components. Examples of environmental

factors include social, nutritional, or transportation stress, isolation, crowding, weaning, regrouping, and direct environmental stressors such as heat, cold, wind, and dust.

Current bovine welfare issues include induced calving, lameness, transportation (particularly calves), human-animal interaction, tail docking, dehorning, twining in beef and dairy (increased dystocia, retained placentas, calf mortality), biotechnologic developments such as the use of bovine growth hormone in the dairy industry,[7] social stress when mixing unfamiliar animals, pain associated with electroejaculation in bulls, branding,[8] and restraint.[9]

Management of Pain in Cattle

We understand that certain management practices such as dehorning, castrating, or banding produce pain, but we understand little about the effects of such procedures on long-term welfare. Through studies at numerous locations it is becoming obvious that many of the routine management practices used with cattle are painful. Pain can have physical and emotional components and can induce distress.[10] Distress is generally the result of unrelieved pain.[11] Some painful procedures include castration, dehorning, branding, tail docking, and removal of supernumerary teats. What is less clear is how we can most appropriately manage pain in the production setting, as effective and affordable analgesics and anesthetics are still lacking.[11] Appropriate training of individuals performing such management practices is critical. Management of pain in farm animals must include performing the procedures for the right reasons, using the best method and appropriate equipment, choosing an appropriate time in the animal's life, and providing postprocedural care.[12] Many times, we do not know what is the least stressful method or least stressful time in the animal's life.

Several studies have been conducted in our laboratory to identify the effects of age and method of castration on cattle.[4] Surgical and banding methods of castration were compared in newborn calves, and surgical castration at weaning or before weaning was compared in older animals. Results suggest that banding may have a more immediate effect on the time spent nursing. Surgically castrated young calves may have a delayed behavioral response to castration, as indicated by increased time spent lying down 3 days after the procedure was performed. Stress, as indicated by increased cortisol concentrations, returned to pretreatment values within 4 hours of castration, whereas behavior was affected for up to 3 days. In older calves, physiologic data, such as cortisol concentrations, indicated no difference between castrated calves when castration was performed before or at weaning. However, haptoglobin concentration in weaned calves was greater at the conclusion of the study, compared with calves before weaning, indicating that measures of the acute phase response may be useful in detecting an animal's response to psychologic stressors such as weaning.

We have also looked at the practice of tail docking in dairy cattle.[13] Tail banding had little effect on cortisol concentrations, immune measures, and behavior, but removal of the tail following banding increased acute phase protein response (haptoglobin). Behavioral response to flies following tail docking was markedly altered, suggesting little acute response but greater long-term response to the environment.

Weaning and early weaning—Weaning in beef cattle is generally not a welfare issue. On the other hand, age at weaning (removal from the dam) for dairy calves remains a controversial issue. Many visitors to a dairy become concerned when they are told that dairy calves are removed from the cow within their first week of life (often immediately after they are born). When you look at this issue from the standpoint of animal behavior, another picture arises. When the calf remains with the cow, a strong bond forms. By removing the calf at a young age, this bond does not form as strongly, and the stress associated with weaning may be reduced.[14]

Social stress—Stress stemming from tension in groups (which typically develops during the formation of new groups, introduction of a new animal, or when a dominant animal loses its position) is important in livestock production systems. However, social stress is an area that we often overlook in managing animals. The social status of an animal has been revealed to be an important factor determining its neuroendocrine response to stress. Social stress can also affect cell-mediated and humoral immune reactivity. Large individual differences exist in the reaction to certain stressors, and therefore, the coping style of the individual to stressors may well be different between animals of different social status. Only recently have we begun to see investigations into the complex nature of stress and social status and the effects on individual animal welfare. Examples of cattle production practices that induce social stress include introduction of new heifers into the milking herd and mixing of groups of feedlot cattle.

Enhancing Welfare in Production Systems Includes Stress Management

Management of stress involves reducing the biological cost of stress to the animal. It does not, however, presume that we should have completely stress-free environments for livestock. Managing stress may take different forms depending on the specific situation. Creativity on the part of stock persons can go a long way toward managing animal stress. Research has provided some tools for stress reduction in management systems.

Example 1: environmental enrichment for cattle

With all the fighting that goes on between animals in groups, is it better to isolate them? In general, we think of cattle as a social species. When cattle are left to their own devices in seminatural environments, they form stable social groups. Thus, it is probably best to keep animals together in groups when possible. Health concerns and development of problem behaviors are sometimes issues in group housing systems. There are potential management solutions to stressors that induce health and behavior concerns. One example of a management practice that may reduce stress and enhance welfare in production systems is environmental enrich-

ment.[15] Specifically, a problem that arises with group-housed dairy calves is cross sucking. When calves are provided with environmental enrichment (in our studies a Braden bottle), this behavior is reduced. Feedlot cattle may also benefit from the provision of environmental enrichment devices to reduce boredom and redirect agonistic (aggressive and submissive) behavior.

Example 2: altering feeding time for cattle

We have studied the behavior of feedlot cattle in Texas for about 3 years now. What we have found is that cattle become very active at sunset.[b] When the behavior of grazing cattle has been studied, it has been shown that they have 2 intensive feeding times: 1 at sunrise and another at sunset.[16] What we hypothesize is happening in the feedlot is that cattle are motivated to eat at sunset. Because of feeding times, the feed bunks may be empty at sunset. In many situations, when an animal is motivated to perform a behavior but is prevented from performing that behavior, the animal redirects its behavior. For feedlot cattle, this redirected behavior is an increase in general activity and agonistic behavior. When the management of these animals is changed and they are fed near sunset, they change their behavior from active to eating or waiting to eat. When cattle are active, they can produce dust, which is also reduced when feeding times are changed.[c] High amounts of dust have implications for reduced health and welfare for cattle and the humans that care for them.

Example 3: management practices to reduce heat stress

Heat stress in cattle has been studied for a number of years. It is a costly production problem, particularly for dairy and beef cattle.[17] Creative measures to reduce heat stress have been attempted and include sprinkling water directly on animals as well as providing shade. We have recently made a direct comparison between these methods of reducing heat stress in cattle. When cattle were provided with shade, behavioral and physiological indicators of heat stress were reduced. This was not the case for cattle that were misted with water. An improvement in weight gain was also seen for cattle provided with shade.[d] Provision of shade to these cattle is a management practice that improves welfare.

Conclusions

We have reached a new plateau in animal welfare.[18] In the past, it has been enough to say that cattle need to be kept comfortable and free from disease. Nevertheless, this may not be enough to meet the psychologic needs of animals. We must know more about how the animal perceives its environment and how it processes information before we can proceed much further into the psychologic welfare aspects of cattle production. Psychologic welfare encompasses good health (the link between health and mental state), exhibition of species-typical behaviors, freedom from distress, and a demonstrated ability to effectively adapt to and cope with the environment.[19]

Clearly, some implementation of alternative systems for raising animals is required if we are to improve cattle welfare. Creative ways of managing stress in cattle production systems have been achieved in some situations, but researchers must continue to assess new and alternative management practices and their impact on bovine welfare.

[b]Jones BA. *The effect of castration on behavior and physiology in cattle.* MS thesis, Purdue University, West Lafayette, Ind, 1999.

[b]Morrow-Tesch J, McGlone JJ, Dailey JD, et al. Behavior of feedlot cattle in a commercial environment throughout the year (abstr). *J Anim Sci* 1997;75:157.

[c]Mitloehner FM, Morrow-Tesch, JL, Dailey JW, et al. Altering feeding times for feedlot cattle reduces dust-generating behaviors (abstr). *J Anim Sci* 2000;77:148.

[d]Mitloehner FM, Morrow-Tesch JL, Wilson SC, et al. Shade and water misting effects on behavior, physiology, performance and carcass traits of heat stressed feedlot cattle (abstr). *J Anim Sci* 2000;78:36.

References

1. Baxter MR. Housing and welfare from first principles. In: Baxter SH, Baxter MR, MacCormack JAD, ed. *Farm animal housing and welfare.* Boston: Martinus Nijhoff Publishers, 1983;3.
2. Seabrook MF, Wilkinson JM. Stockpersons' attitudes to the husbandry of dairy cows. *Vet Rec* 2000;147:157–160.
3. American Veterinary Medical Association. *The veterinarian's role in animal welfare.* Schaumburg, Ill: American Veterinary Medical Association, 1991.
4. McInerney J. A socio-economic perspective on animal welfare. *Outlook Agric* 1991;20:51–56.
5. Hahn GL, Morrow-Tesch JL. Improving livestock care and welfare. *Agric Eng* 1993;74:14–17.
6. Hemsworth PH, Barnett JL, Beveridge L, et al. The welfare of extensively managed dairy cattle: a review. *Appl Anim Behav Sci* 1995;42:161–182.
7. Kronfeld DS. Recombinant bovine somatotropin and animal welfare. *J Am Vet Med Assoc* 2000;216:1719–1722.
8. Schwartzkopf-Genswein KS, Stookey JM, Welford R. Behavior of cattle during hot-iron and freeze branding and the effects on subsequent handling ease. *J Anim Sci* 1997;75:2064–2072.
9. Bolinger D, Albright JL, Morrow-Tesch J, et al. The effects of restraint using self-locking stanchions on dairy cows in relation to behavior, feed intake, physiological parameters, health, and milk yield. *J Dairy Sci* 1997;80:2411–2417.
10. Mellor DJ, Cook CJ, Stafford KJ. Quantifying some responses to pain as a stressor. In: Moberg GP, Mench JA, eds. *The biology of animal stress.* Wallingford, England: CABI Publishing, 2000; 171–198.
11. Short CE. Fundamentals of pain perception in animals. *Appl Anim Behav Sci* 1998;59:125–133.
12. Bath GF. Management of pain in production animals. *Appl Anim Behav Sci* 1998;59:147–156.
13. Eicher SD, Morrow-Tesch JL, Albright JL, et al. Tail-docking alters behavior and immunological and endocrine measures. *J Dairy Sci* 2000;83:1456–62.
14. Chenoweth PJ. Animal production and welfare issues: dairy cattle and veal calves, in *Proceedings.* North Am Vet Conf 1998;902–903.
15. Mench J, Morrow-Tesch J, Chu L-R. Environmental enrichment for farm animals. *Lab Anim* 1998;27:32–36.
16. Arnold GW. Ingestive behavior. In: Fraser AF, ed. *Ethology of farm animals. World animal science.* Vol A5. Amsterdam: Elsevier, 1985;183–200.
17. Nienaber JA, Hahn GL, Eigenberg RA. Quantifying livestock responses for heat stress management: a review. *Int J Biometeorol* 1999;42:183–188.
18. Curtis SE. Animal welfare and animal care. *Vet Clin North Am Food Anim Pract* 1987;3:369–382.
19. Swanson JC. Farm animal welfare and intensive production systems. *J Anim Sci* 1995;73:2744–2751.

Welfare of cattle during slaughter and the prevention of nonambulatory (downer) cattle

Temple Grandin, PhD

I am often asked whether cattle know they are going to die at a slaughter plant. Most people assume that animals experience things the same way we do. Early in my career, I answered this question by observing cattle being moved through chutes at a feedlot for vaccinations and then on that same day watching cattle being moved up the chute at a slaughter plant. I observed that their behavior was the same in both places. If they knew they were going to die, they would become more agitated at the slaughter plant. Improving handling and keeping animals calm by using behavioral principles will help improve cattle welfare during slaughter.

The things that scare cattle are not the same things that scare us. Little details that people do not notice frighten cattle. A paper cup dropped in the entrance of the chute will make cattle balk and turn back. Bright contrasts of light and dark or a small swinging chain on a gate will often make cattle stop. They are also reluctant to enter dark places. Adding a light at the entrance of a restrainer often makes it possible to greatly reduce the use of electric prods, because the cattle become willing to enter.[1]

Remove Distractions and Reduce Noise

At 1 plant, the employees had done extensive experimentation with lighting to improve cattle movement into the stunning box. Ninety-six percent of cattle walked into the box without being touched. Prior to changes in lighting, an electric prod was required to move animals that constantly balked and backed up.

It is impossible to have good animal welfare if cattle are constantly balking and refusing to move. Sometimes something as simple as moving a ceiling lamp will improve animal movement, because sparkling reflections on a wet floor often disappear when a lamp is moved. It is necessary to get into the chute at a cow's level to identify things that might scare cattle. Air drafts blowing in the faces of approaching cattle will also cause balking and refusal to move. Loud noises from equipment, such as air hissing, should be eliminated. Further information on eliminating distractions that impede animal movement can be found in other papers I've written.[1-3]

Rapid movement is another thing that can agitate cattle. Cattle with nervous excitable temperaments were more likely to flinch and become highly agitated when they were exposed to the sound of a ringman yipping and quickly swinging his arm at an auction.[4] The sound of people yelling and screaming is stressful and aversive to cattle, and shouting at cattle is highly aversive.[3] Canadian researchers found that the sound of people yelling and whistling raised animals' heart rates more than the sound of a gate slamming.[5] I have observed that plants where cattle or pigs are walking quietly up the chute have quiet people moving the animals. There is no yelling or whistling. Cattle that remain calm are easier to move and less likely to balk at small distractions. Cattle should be moved in small groups, and the crowd pen that leads to the single file chute should be only half full.

Recognizing the Importance of Behavior

One of my biggest frustrations has been getting people to fully recognize that using behavioral principles is more humane and efficient than using force. If an animal balks and refuses to move, we should find and remove the thing that it is afraid of instead of prodding it harder with an electric prod.

There are now 25 center track conveyor restrainers that I have designed in use in beef slaughter plants.[3,6,7] In 5 (20%) plants, the welding shop or equipment installers removed parts from the system that served important behavioral functions. Cattle behavior is greatly influenced by what cattle can see. The welders could not understand why extra metal sheeting was needed to prevent incoming cattle from seeing that the restrainer was mounted 10 ft (3 m) above the floor. They thought they were doing the plant a favor by removing the extra metal. When the false floor was removed, most animals had to be prodded with an electric prod to induce them to enter the restrainer. When I reinstalled it, 95% of cattle entered when tapped on the rump. Ruminants perceive depth and respond to the visual cliff effect.[8] The false floor provided the visual illusion of a solid floor to walk on.

Recently, I visited the 25th restrainer system to replace the false floor and another metal shield that prevented cattle from seeing out until they were fully restrained. The plant manager called me because the new system worked poorly and cattle were constantly balking and refusing to enter. A few pieces of metal that control what the cattle see are the difference between a system in which cattle stay calm and a system where they become agitated. In 4 plants, extending a metal cover that had been shortened by the welding shop resulted in calm cattle that rode the conveyor quietly. Extending this cover prevented cattle from seeing out until their back feet were completely off the entrance ramp. Even when the welding shop personnel read my papers, they often did not believe that some extra metal sheeting could make such a difference. People need to learn that use of behavioral principles improves efficiency and animal welfare.

Effect of Welfare Audits

Over the years I have observed that excessive use of electric prods or other bad practices can sometimes become normal because a plant has no standard of comparison. In 1996, I surveyed 10 beef plants for the USDA.[9] Only 3 beef plants were able to stun 95% or

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more cattle on the first attempt, and only 1 plant stunned 100% correctly. One plant hung a fully conscious live animal on the bleed rail. I was appalled at the abusive practices that occurred in 2 of these plants. At 1 plant, employees paralyzed bulls with an electric prod even though they knew I was doing a survey for the USDA. Bad practices had become normal. In every plant, electric prods were used on a high percentage of cattle.

In 1999, the McDonald's Corporation audited 41 US beef plants on stunning and handling practices. I audited 27 of these plants and trained the McDonald's auditors. There was great improvement in beef stunning in 1999, compared with the results of the 1996 USDA survey.[9,10] The percentages of cattle stunned with 1 shot from a captive bolt stunner were: 100% at five (12%) plants, 99% at 10 (24%) plants, 98 to 95% at 22 (54%) plants, 94 to 90% at 2 (5%) plants, and < 90% at 2 (5%) plants. All cattle where the first shot missed were immediately restunned prior to skinning or limb removal. In 1 (2%) beef plant, a sensible animal was hung on the bleed rail. Nineteen pork plants were audited. Ninety percent (17) rendered 100% of pigs completely insensible. Two (10%) plants had 1 and 5% of pigs, respectively, that showed possible signs of returning to sensibility on the bleed rail. The signs observed were blinking and righting reflexes. All animals were insensible prior to scalding or skinning. The behavior of the employees in many plants had improved now that a major customer was auditing handling and stunning. When a large plant was removed from the approved supplier list, the industry realized that they had to take animal welfare seriously. During 2000, handling and stunning has further improved in most plants. Several plants with problems improved after being temporarily suspended from the approved McDonald's supplier list. Major meat-buying customers such as restaurants and supermarkets can bring about great improvements in animal welfare.[10]

I observed that electric prods in many plants had been replaced by other driving aids such as flags, plastic bags, and plastic paddle sticks. It is important to get electric prods out of people's hands as their primary driving tool. If an animal balks and refuses to move, the electric prod can be used, but it should be put back down after the stubborn animal is moved. In plants that have worked to remove all the distractions discussed previously, it was easy to move 95 to 100% of cattle without an electric prod. During 2000, 20 of 27 (74%) beef plants had eliminated electric prods in the crowd pen that leads to the single file chute, and 19 (71%) used an electric prod on only 0 to 5% of cattle to move them into the stunning box or restrainer. Half of the pork plants had eliminated electric prods in the crowd pen, and electric prod use in the single chute was reduced. There were also improvements in the attitude of the handlers when yelling was stopped and the electric prod was no longer the primary driving tool. Now, instead of yelling, a handler would touch a steer in the rump, saying "come on boy." Removing electric prods from people's hands helped foster a more caring attitude toward animals.

Line Speed Problems

In a few plants, there are still some problems with high line speeds that overload stunner operators. When an operator is overloaded, the percent of cattle or pigs that are stunned correctly will decrease. I have observed this problem in cattle and pork plants. Operator overload develops within a narrow range of speeds. When overload develops, the operator's performance will suddenly drop. An increase in only 10 to 15 pigs or cattle/h may be all it takes to overload a particular system. The maximum speed at which a particular plant will operate properly is a function of equipment design and staffing level. For example, my data indicate that a beef plant operating at 330 cattle/h with a single overloaded operator stunned only 85% of cattle correctly with 1 shot from a captive bolt stunner. When additional ergonomic handles were attached to the heavy pneumatic stunner, 1 stunner operator was able to stun 97% of cattle with the first shot. In this plant, all cattle in which the first shot missed were immediately restunned and rendered insensible before hanging on the rail. Sometimes a small design change will remove operator overload. In other plants, the line will have to be slowed down.

Animal Welfare and Stunning

A complete review of all stunning methods is beyond the scope of this presentation, but scientific research clearly shows that captive bolt and electrical stunning methods will instantly render animals insensible and unconscious. There have been several reviews of this research.[11-15] Stunning equipment must be properly maintained and used correctly to be effective.

Unfortunately, however, CO_2-induced stunning is not instantaneous, and there has been controversy within the scientific community over whether animals adversely react to CO_2 gas. Some studies[16-19] reveal evidence of aversion; others do not. My own observations lead me to believe that some pigs can be anesthetized peacefully with CO_2, whereas others frantically attempt escape when they first smell the gas (genetic factors appears to influence the reaction).[17] For example, purebred Yorkshire pigs are anesthetized peacefully, whereas other strains become agitated.[16-18] For Landrace Large White cross pigs, breathing either 60 or 90% CO_2 was less aversive than a shock from an electric prod.[20] Carbon dioxide causes highly variable reactions in humans.[21-23] It is my opinion that CO_2 is suitable for some types of pigs but causes problems with other types. In particular, CO_2 experiments should be conducted using stress-susceptible pigs. The potential of other gases, such as argon, for use in stunning is also worthy of investigation, but the cost may be prohibitive.

Assessing Insensibility

Recently, TV newscasts showed undercover video taken in different plants. This video showed a live animal hung on the rail in 1 plant and reflexes that were mistakenly thought to indicate fully conscious animals in 2 others. People need to learn how to assess insensibility. An insensible animal will often have limb reflexes. A properly stunned animal will have wide open eyes, a floppy head, no righting reflex, a limp flaccid tongue, no blinking, and no eye reflexes in response to touch.[11,12] When hung on the rail, the back should be straight. Electrical and captive bolt stunning create spasms immediately after stunning, so it is best to assess insensibility after these spasms cease. The only

exceptions to this recommendation are pigs stunned with an electric stunner where the amperage setting is too low. These pigs may blink immediately after stunning, because the stunning current was not sufficient to induce a grand mal seizure, which is required to induce insensibility. Market weight pigs stunned with the correct setting of 1.25 A should be assessed after bleeding to make sure they do not recover.

Continuous Auditing is Essential

The McDonald's audit uses American Meat Institute Guidelines.[9] Continuous auditing by plant management is required to maintain handling quality. It is just like microbiologic testing for food safety. You manage things that you measure. Continuous monitoring and measurement is required to maintain a high standard. Handling has a tendency to become rough and careless unless continuous monitoring is done. Even when financial losses are documented, such as increased pale soft exudative pork or more bruises in cattle, handling practices will deteriorate unless auditing is done on a regular basis. My objective scoring system for handling and stunning at slaughter plants is simple so that it can be easily implemented.[9] It was essential to identify important critical control points but not have too many things to measure. The variables measured are: 1) percentage of animals stunned correctly on the first attempt, 2) percentage of animals insensible on the bleed rail, 3) percentage of cattle that vocalize (moo or bellow) during movement through the chute and restrainer, 4) percentage of animals for which an electric prod is used, and 5) percentage of animals that slip or 6) percentage that fall.[24] A minimum of 100 animals are scored in large beef and pork plants, and 50 animals are scored in small plants with a line speed of < 100 head/h.

To keep the auditing process simple, each variable is scored on a yes or no basis for each bovid or for each stunning cycle in pigs. For example, vocalized—yes or no, use of electric prod—yes or no. Attempting to determine the intensity of cattle or pig vocalization is not practical under commercial conditions.

Vocalizing Animals are Stressed

Vocalization in cattle (moos or bellows) and pigs (squeals) are correlated with physiologic measures of stress.[25–28] Vocalization scoring is a simple way to identify problems with excessive electric prod use or other problems with equipment, handling, or stunning. In 99% of cattle, vocalization was associated with an obvious aversive event such as missed stuns, slipping, falling, electric prod use, or excessive pressure from a restraint device.[9,29] Isolating a single bovid in a stunning box or race for too long will also cause it to vocalize. Beef plants with careful quiet handling practices and minimal electric prod use will have ≤ 3% of cattle vocalizing. Plants where cattle constantly balk and refuse to enter a stunning box or restrainer will have high vocalization percentages ranging from 7 to 17%, because an electric prod was required to move them.[10] In 1 plant, a light installed on a dark restrainer entrance caused an 8% vocalization percentage to drop to 0%, because electric prod use was reduced. Installing a false floor in a conveyor restrainer to eliminate the visual cliff effect resulted in vocalization percentage dropping from 9 to 0% in 1 plant and 17 to 2% in another plant. In a fourth plant, excessive pressure exerted by a hydraulic head restraint caused 23% of cattle to vocalize. When pressure was reduced, the percentage of cattle that vocalized was reduced to zero.

Ritual Slaughter

When ritual slaughter (Kosher, Jewish, or Halal Muslim) is being discussed, the variable of throat cutting without stunning must be separated from the variable of how the animal is restrained and handled prior to and during slaughter.[11] I have observed that the abusive and cruel restraint methods used in some ritual slaughter plants are a bigger issue than the ritual slaughter itself. In plants where live cattle were restrained for kosher slaughter by shackling and hoisting by 1 rear limb, they could be heard bellowing in the office and the parking lot. I estimate that the percentage of cattle vocalizing in some of these dreadful plants was almost 100%.

Restraint equipment that holds cattle in a comfortable upright position has been available for more than 40 years.[11,30–32] There are also restraining boxes available that rotate an animal from a standing position onto its back. Rotating boxes are much better than shackling and hoisting live animals, but they are probably more stressful than the best upright restraint. Restraint equipment must be designed and operated correctly. Calm animals are easier to restrain. If cattle vocalize when they are restrained, it is likely that excessive pressure is being applied to their body. To minimize stress, ritual slaughter must be done immediately after the animal is restrained. During work on restraint systems at 4 different kosher slaughter plants, I developed 4 behavioral principles of restraint:

1) Block vision—The animal must see a lighted place to move into, but solid panels or curtains should be used to prevent it from seeing people.
2) Slow steady movement—Parts of an apparatus that press against an animal must move with slow steady movement. Sudden jerky motion scares.
3) Optimum pressure—A device must hold an animal tightly enough for it to feel held but not so tightly that it causes discomfort.
4) Do not trigger righting reflex—The device should hold an animal in a comfortable upright position. If the animal slips or feels unbalanced, it may struggle.

I estimate that 5 years ago only 10% of large cattle used for kosher meat in the United States were shackled and hoisted. Today the percentage of kosher cattle that are shackled and hoisted has increased. Since the world beef market was opened up, kosher beef from South American countries such as Uruguay is now entering the United States. Shackling and hoisting is commonly used in Uruguay. This year, I talked to an international beef buyer who was so appalled at the cruel treatment of cattle he observed in Uruguay that he refused to buy beef from plants that shackled and hoisted live cattle. The Israeli magazine *Ha'aretz* also has an article[33] about bad conditions in Uruguay.

Another problem area is the growing Halal market in the United States. Some of these plants are small locker type plants, and the Muslim slaughterers often have been given no training. Fortunately, most Muslim religious authorities will accept stunning. In New

Zealand cattle are electrically stunned for Halal slaughter, and I have observed Halal slaughter in Australia where cattle were stunned with an impact mushroom head nonpenetrating captive bolt. Stunning prior to Halal slaughter will improve animal welfare.

Preventing Dairy Cow Downers

The best way to improve the welfare of nonambulatory (downer) cattle is to prevent them. Selling old cows when they are still fit for transport and handling is the single most important way to prevent downers. I have observed that about 10% of dairies are responsible for 90% of downers. Breeding cattle with strong sound feet and limbs is essential. There are disturbing signs that some dairy cattle breeders are selecting for milk production at the expense of their cows.

The percentage of downer cattle has increased. An audit of 21 cow slaughter plants by Smith et al[34,35] indicated that the percentage of nonambulatory dairy cows arriving at plants had increased. In 1999, 1.5% of arriving cows were nonambulatory, and in 1993, only 1.1% were nonambulatory.[34,35]

In dairy and beef plants, the percentage of cows arriving with arthritic joints has tripled. In 1993, 4.7% of cull dairy cows had arthritic joints, and in 1999, the percentage increased to 14.5%.[34,35] Lameness is increasing in dairy cows, and lame cows are more likely to become nonambulatory. Conformation of feet and limbs is heritable and will affect the incidence of lameness.[36,37] Indiscriminate selection for milk production may reduce fitness, because milk production in dairy cows is more affected by genetic selection than improved management. A survey[38] conducted in Wisconsin and Minnesota indicated that 13.7 to 16.7% of all dairy cows were lame. A dairy veterinarian in Florida told me that, in his opinion, lameness was the number 1 health issue in the year 2000. John Webster from Oxford University estimates that during 1999, 21% of British dairy cows were lame.[3]

Pushing young heifers into production too quickly can also contribute to increased lameness. Heifers that gain > 800 g/d have more hemorrhages in the soles of their feet. These hemorrhages indicate that a heifer's feet have been permanently damaged before the heifer has even reached maturity.[39]

The percentage of dairy cows that are emaciated on their arrival at slaughter plants has increased by 20%, from 4.8% in 1993 to 5.4% in 1999.[34,35] Cows that leave the diary in an emaciated condition are more likely to fall down in trucks and become nonambulatory.

There are 2 factors that have probably contributed to decline in body condition: indiscriminant use of recombinant bovine somatotropin (rBST, also known as growth hormone) and genetic selection for increased milk production. Two studies[40,41] indicate that giving cows rBST reduces body condition score; body condition decreases with increasing dose. Dairy managers who use rBST must carefully monitor body condition. A California truck driver who handles downer cows from dairies told me that dairies using rBST have more downers. It is my opinion that high milk prices contributed to the indiscriminate use of rBST in the late 1990s, but rBST used in moderation probably does not increase risk for nonambulatory cattle. I visited a well-managed 2,000-cow dairy that used a slow release form of rBST given every 2 weeks. More than 99% of cows in that dairy were in good body condition.

There are other management factors that may contribute to dairy cows becoming nonambulatory. Many dairies in the West use bulls instead of artificial insemination. If body condition declines, a cow is more likely to be knocked down when the bull mounts. Health problems can also result in downer cows. Some cows with severe mastitis may become downers. Genetic selection for increased milk production is related to increased mastitis.[42,43] Further research has revealed that selection based strictly on milk yield increases veterinary expenditures and cow health problems.[44]

Poor management and facilities can also increase risk of downers. Nonslip flooring is essential to prevent cows' falling. Quiet careful handling can also help prevent falls. I have observed downer cows that arrived at a slaughter plant with swollen limbs because of careless hoof trimming. Paying hoof trimmers on a piecework basis may encourage better work. People who work with animals should be paid based on quality rather than the quantity of their work.

Beef Cattle Welfare

The incidence of downer beef cattle has declined, compared with dairy cows. The National Market Cow and Bull Audit indicated that the percentage of nonambulatory beef cows arriving at a slaughter plant was 1.0% in 1993 and 0.7% in 1999.[34,35] Unfortunately, the incidence of arthritic joints and severely lame cows increased from 2.9% in 1993 to 11.9% in 1999.[34,35] This indicates that producers may be putting less emphasis on selecting cows for sound feet and limbs. For dairy and beef cattle, selection for sound feet and limbs will prevent many cows from becoming downers. Selection strictly for productivity is likely to be detrimental to animal welfare.

I have observed that some beef cattle with European continental genetics are more excitable than cattle raised 20 years ago. They are more likely to balk at the distractions that were discussed previously and to become agitated during handling. Cattle with excitable temperaments are more likely to panic when suddenly confronted with new experiences. Feedlots and slaughter plants have reported difficulties handling beef cattle that have originated from ranches where they were only handled on horseback. When people on foot attempted to move them, they became highly agitated. Beef cattle should be acclimated to vehicles, people on foot, and people on horseback before they leave a ranch. This will make handling easier and less stressful at feedlots and packing plants.

Accountability and Monitoring

Systems that hold people accountable for losses will help prevent downers and meat quality losses such as bruises or dark cutters. In 1 study,[c] cattle sold by live weight, where the slaughter plant pays for bruises, had twice as many bruises, compared with loads of cattle sold by carcass weight. When producers had to pay for bruises, they handled cattle more carefully.

Computerized systems can be used to monitor quality of handling. Technology is available to instrument a squeeze chute to record how hard cattle hit the headgate.[45] Cattle that are handled quietly will walk in

and out of a squeeze chute. In an Australian study,[46] a radar system used for catching speeders on the highway was used for recording the speed of cattle exiting the squeeze chute.

Cattle that remain calm during handling in squeeze chutes will have better weight gain, fewer dark cutters, and more tender meat.[47] Cattle that run quickly out of the squeeze chute gain less weight. Good handling practices will improve animal welfare and meat quality and prevent injuries that can cause an animal to become nonambulatory.

Conclusions

To maintain an acceptable level of animal welfare in slaughter plants, management must continually measure and audit handling practices and stunning. People manage what they measure. It is also essential that small distractions that make cattle balk and refuse to move be removed from chutes. Good handling is impossible if cattle constantly balk and back up. Supermarkets and restaurants can greatly improve animal welfare by using their economic influence to maintain adequate standards.

[a]Pajor EA, Rushen J, de Passille AM. Aversion learning techniques to evaluate dairy cow handling practices (abstr). *J Anim Sci* 1999;77(suppl 1):149.

[b]Webster J, Oxford University, Oxford, England: Personal communication, 1999.

[c]Grandin T. Bruises on southwestern feedlot cattle (abstr). *J Anim Sci* 1981;53(suppl 1):213.

References

1. Grandin T. Factors that impede animal movement at slaughter plants. *J Am Vet Med Assoc* 1996;209:757–759.
2. Grandin T. Solving livestock handling problems in slaughter plants. In: Gregory NG, ed. *Animal welfare and meat science*. Wallingford, England: CAB International, 1998;42–63.
3. Grandin T. Handling and welfare in slaughter plants. In: Grandin T, ed. *Livestock handling and transport*. Wallingford, England: CAB International, 2000;409–339.
4. Lanier JL, Grandin T, Green RD, et al. The relationship between reaction to sudden intermittent movements and sounds and temperament. *J Anim Sci* 2000;78:1467–1474.
5. Waynert DE, Stookey JM, Schwartzkopf-Gerwein JM, et al. Response of beef cattle to noise during handling. *Appl Anim Behav Sci* 1999;62:27–42.
6. Grandin T. Double rail restrainer conveyor for livestock handling. *J Agric Eng Res* 1988;41:327–338.
7. Grandin T. *Double rail restrainer for handling beef cattle. Technical paper No. 915004*. St Joseph, Mich: American Society of Agricultural Engineers, 1991;1–14.
8. Lemmon WB, Patterson GH. Depth perception in sheep: effects of interrupting the mother-neonate bond. *Science* 1964;145:835–836.
9. Grandin T. Objective scoring of animal handling and stunning practices in slaughter plants. *J Am Vet Med Assoc* 1998;212:36–93.
10. Grandin T. Effect of animal welfare audits of slaughter plants by a major fast food company on cattle handling and stunning practices. *J Am Vet Med Assoc* 2000;216:848–851.
11. Grandin T. Euthanasia and slaughter of livestock. *J Am Vet Med Assoc* 1994;204:1354–1360.
12. Gregory NC. *Animal welfare and meat science*. Wallingford, England: CAB International, 1998.
13. Grandin T. Cardiac arrest stunning of livestock and poultry. In: Fox MW, Mickley LD, eds. *Advances in animal welfare science*. Boston: Martinus Nijhoff Publishers, 1985/86;1–30.
14. Eikelenboom G, ed. *Stunning animals for slaughter*. Boston: Martinus Nijhoff Publishers, 1983;59–63.
15. *Proceedings of the Symposium on Human Slaughter of Animals*. Potters Bar, UK: Universities Federation on Animal Welfare, 1987.
16. Forslid A. Transient neocortical, hippocampal and amygdaloid EEG silence induced by one minute infiltration of high concentration CO_2 in swine. *Acta Physiol Scand* 1987;130:1–10.
17. Grandin T. Possible genetic effect on pig's reaction to CO_2 stunning, in *Proceedings*. 34th Int Congr Meat Sci Technol 1988;249–251.
18. Dodman NH. Observations on the use of the Wernberg dip-litt carbon dioxide apparatus for pre-slaughter anaesthesia of pigs. *Br Vet J* 1977;133:71–80.
19. Raj AB, Johnson SP, Wotton SB, et al. Welfare implications of gas stunning of pigs: the time to loss of somatosensory evolved potentials and spontaneous electrocorticogram of pigs during exposure to gasses. *Vet J* 1997;153:329–339.
20. Jongman EC, Barnett JC, Hemsworth PH. The aversiveness of carbon dioxide stunning in pigs and a comparison of the CO_2 stunning crate vs. the V restrainer. *Appl Anim Behav Sci* 2000;67:67–76.
21. Perna G, Battaglia M, Garberi A, et al. Carbon dioxide/oxygen challenge test in panic disorder. *Psychiatry Res* 1994;52:159–171.
22. Biber B, Alkin T. Panic disorder subtypes: differential responses to CO_2 challenge. *Am J Psychiatry* 1999;156:739–744.
23. Perna G, Bertani A, Caldirola D, et al. Family history of panic disorder and hypersensitivity to CO_2 in patients with panic disorder. *Am J Psychiatry* 1996;153:1060–1064.
24. Grandin T. *Good management practices for animal handling and stunning*. Washington, DC: American Meat Institute, 1997.
25. Warriss PD, Brown SN, Adams SJM. Relationship between subjective and objective assessment of stress at slaughter and meat quality in pigs. *Meat Sci* 1994;38:329–340.
26. Weary DM, Braithwaite LA, Fraser D. Vocal response to pain in piglets. *Appl Anim Behav Sci* 1998;56:161–172.
27. Lay DC, Friend TH, Randel RD, et al. Behavioral and physiological effects of freeze and hot iron branding on crossbred cattle. *J Anim Sci* 1992;70:330–336.
28. White RG, DeShazer JA, Tressler CJ, et al. Vocalizations and physiological response of pigs during castration with and without anesthetic. *J Anim Sci* 1995;73:381–386.
29. Grandin T. The feasibility of using vocalization scoring as an indicator of poor welfare during cattle slaughter. *Appl Anim Behav Sci* 1998;56:121–128.
30. Marshall M, Millburg EE, Shultz EW. Apparatus for holding cattle in position for humane slaughtering. US patent 3,092,871, 1963.
31. Grandin T, Regenenstein JM. Religious slaughter and animal welfare: a discussion for meat scientists. In: *Meat focus international*. Wallingford, England: CAB International, 1994;115–123.
32. Grandin T. Observations of cattle restraint devices for stunning and slaughtering. *Anim Welfare* 1992;1:85–91.
33. Bar-Moha T. Onward conquistadors, kosher meat in Uruguay. *Ha'arefz Magazine* 1998;Sep 25.
34. Smith GC, Morgan JB, Tatum JD, et al. *Improving the consistency and competitiveness of non-fed beef and improving the salvage value of cull cows and bulls*. Fort Collins, Colo: National Cattlemen's Beef Association, Colorado State University, 1994.
35. Smith GC, Belk KE, Tatum JD, et al. *National market cow and bull beef audit*. Engelwood, Colo: National Cattlemen's Beef Association, Colorado State University, 1999.
36. Boettcher PJ, Dekkers JC, Warnick LO, et al. Genetic analysis of lameness in cattle. *J Dairy Sci* 1998;81:1148–1156.
37. Van Dorp TE, Dekkers JCM, Martin SW, et al. Genetic parameters of health disorders and relationships with 305-day milk yield and information traits in registered dairy cows. *J Dairy Sci* 1998;81:2264–2270.
38. Wells SJ, Trent AM, Marsh WE, et al. Some risk factors associate with clinical lameness in dairy herds in Minnesota and Wisconsin. *Vet Res* 1995;27:537–540.
39. Vermunt JJ, Greenough PR. Predisposing factors of lameness in cattle. *Br Vet J* 1994;150:151–164.

40. Jordan DC, Aguilar AA, Olson JD, et al. Effects of recombinant methionyl bovine somatoitropic (sometribove) in high producing cows milked three times daily. *J Dairy Sci* 1991;74:220–226.

41. West JW, Bondair K, Johnson JC. Effect of bovine somatotropin on milk yield and composition, body weight and condition score of Holstein and Jersey cows. *J Dairy Sci* 1990;73:1062–1068.

42. Uribe HA, Kennedy BW, Martin SW, et al. Genetic parameters of health disorders and relationships with 305-day milk yield and information traits in registered dairy cows. *J Dairy Sci* 1995;81:2264–2270.

43. Grohn VT, Eicker SW, Hertl JA. The association between previous 305 day milk yield and disease in New York State dairy cows. *J Dairy Sci* 1995;78:1693–1702.

44. Jones WP, Hansen LB, Chester-Jones H. Response of health care to selection for milk yield of dairy cattle. *J Dairy Sci* 1994;77:3137–3152.

45. Schwartzkopf-Genswein KS, Stookey JM, Crowe JG, et al. Comparison of image analysis, exertion force and behavior measurements for assessment of beef cattle response to hot iron and freeze branding. *J Anim Sci* 1998;76:972–979.

46. Burrows HM, Dillon RD. Relationship temperament and growth in a feedlot and commercial carcass traits of *Bos indicus* crossbreeds. *Aust J Exp Agr* 1997;37:407–411.

47. Voisinet BD, Grandin T, Tatum JD, et al. *Bos indicus*-cross feedlot cattle with excitable temperaments have tougher meat and a higher incidence of borderline dark cutters. *Meat Sci* 1997;46:367–377.

Milking the golden cow—her comfort

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In the days when society was more agrarian, most families had a cow or 2 that were milked for fresh milk and butter. Calves were raised for beef or for replacements when the cow had to be culled. Cows were an integral part of the family. They were milked by hand, and when the cow was not lactating, the family went without milk. Today, approximately 2% of the population provides food for the other 98% of us. It is not uncommon to find dairies milking a thousand or more cows, and in fact, in California the mean herd size is about 700 cows. Cows are milked with machines by hired labor. It is sometimes tempting to compare and contrast large and small dairies; however, there are well-managed large dairies and well-managed small dairies as well as poorly managed dairies in each category. Most dairies in California are family owned and operated regardless of how many cows are being milked. For the purposes of this discussion, I will be talking about larger dairies where the owners do not milk the cows but manage the dairy enterprise.

Cows are herd animals and are uncomfortable when they are isolated from their herd mates. They are also creatures of habit and respond best when they know what to expect and when to expect it. Cows are used to being around humans and respond to the humans that care for them. They are capable of recognizing strangers, and they are also capable of remembering someone who treats them humanely as well as someone who treats them aversely. Dr. Temple Grandin in a previous Forum described her observations of several hundred ranches, farms, feedlots, and packing plants and indicated that she had found that the single most important factor that determines how animals are treated is management attitude.[1] She went on to say that a strong manager acts as a conscience for workers and that this manager has to be involved enough in animal handling to care but not so involved as to be numb. Having been on several hundred dairies during the last 19 years, I have observed the same thing.

This paper will discuss many aspects of housing, management, and facilities that promote cow welfare. The single most important factor in cow welfare is human-cow interaction.[2-6] The best human personality type in terms of milk yield for a given degree of input is considerate, patient, independent, persevering, grumpy, difficult to get on with, forceful, confident, suspicious of change, not easygoing, inadaptable, not neat, not modest, not a worrier, not talkative, uncooperative, and unsociable.[7] In other words, a confident introvert.[8]

During the past 50 years we have made tremendous progress in understanding diseases and controlling or vaccinating against them. This understanding allows us to keep cows in higher density confinement settings and minimize problems with infectious diseases. The most important impediments to productivity are now production diseases. To quote Bernie Rollin, PhD: "In contrast, when animal husbandry departments symbolically became animal science departments in the 1940s and 50s, industry replaced husbandry, and the values of efficiency and productivity above all else entered agricultural thinking and practice."[9] Since I graduated from veterinary school in 1981, we have gone from herd health to production medicine. Emphasis, especially for large dairies with huge capital investments in milking parlors and facilities, has been on throughput. This is a reasonable business principle—that is, if you can make a profit on 100 cows, then you can make more profit on 1,000 cows. Even so, I think that it is time for the pendulum to swing back to more emphasis on cow comfort and health, because it is the cow that provides us with food and a living and helps us feed people efficiently.

There are several North American publications that contain general guidelines on dairy cattle care[10-14]

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or describe needed research.[14] There are also many articles written about the animal welfare movement in Europe and how it has affected management of dairy cows.[15-17] Europe is generally regarded as a sentinel for animal welfare issues in the United States, and its programs are being designed and accepted to various degrees by US producers. The strong preference of US dairy producers is to have industry develop welfare standards that are based on rational husbandry and science, rather than establishing standards by legislation. One of the first programs was designed by cooperating organizations across the United States and was part of the Milk and Dairy Beef Quality Assurance Program.[10] Participation in the program varied by state, and states with the highest producer participation were those where creameries compelled producers to participate. In California, compliance was low, largely because of producer and veterinarian perception that the program was designed and promulgated without input from producers who would have to comply with the resultant guidelines. The dairy workgroup from the University of California Cooperative Extension prepared an Animal Care Series, the first of which was the Dairy Care Practices.[13] This publication was prepared to inform people in the dairy industry as well as government officials about accepted practices for dairy animal care. Recently, California dairy producers, through the California Milk Advisory Board, have formed the California Dairy Quality Assurance Program, which consists of 3 modules: environmental, food-safety, and animal health and welfare. Work on the animal health and welfare module is beginning this year. The American Humane Association is sponsoring another US program that is underway.[12]

In this paper, I will discuss management of the cow from the time she calves and starts lactating until she is ready to calve again. The areas of cow welfare that I will emphasize will be those most critical from the cow's perspective. I will also point out areas I believe are potential problems.

Calving

Late gestation and early lactation (the periparturient period) are especially critical times for a cow. During these periods, the cow must increase energy intake to finish growing the unborn calf and must prepare her metabolism to begin lactation. Heifers have the demand of growth in addition to gestation and lactation. This is the period of the cow's life that is the most risky in terms of health and, therefore, when the cow needs the closest observation.

Close-up cow management—Cows are moved from the dry (nonlactating pregnant) cow pen to the close-up (impending parturition) pen about 3 weeks prior to the calculated calving date. The close-up pen is usually placed in a location that makes it more convenient for dairy personnel to observe the cows. It is at this time that the ration begins to change from the high roughage, low concentrate dry-cow ration to the higher energy, lower roughage lactating-cow ration. Ration changes should take place as gradually as possible, because rapid increases in plane of nutrition can lead to metabolic problems for cows. Also, at this time the cow's appetite is usually less than after calving, which makes it critical to ensure that the ration fed is palatable to the cow.

Calving area or maternity pens—When calving is imminent, the cow is moved to the calving area or a maternity pen for calving. If cows are calved in a group pen, it is important for the pen to be big enough for the cow to isolate herself when she is calving, because her natural tendency is to move away from the main herd to calve. All calving areas should be kept as clean as possible to avoid contamination and disease problems for the cow and calf.

Individual calving or maternity pens allow the cow to be isolated but still in visual contact with other cows and also permit dairy personnel to assist with calving when necessary. Maternity pens should be large enough for the cow to move around comfortably and to facilitate cleaning of the pens between calvings. The general recommendation is that there be 1 maternity pen/35 cows, which may be more than necessary on a large dairy. If about 1,000 cows are being milked in a dairy, then we would expect about 3/day to be calving. If we then figure that cows will be in an individual pen for 3 days, we would need about 9 pens for an average day. If we double that number for days when more than an average number of cows calve, then 15 to 20 pens should be adequate for a 1,000-cow herd.

Maternity pens should be at least 100 ft^2 so that cows can move around freely and should be bedded with comfortable, clean bedding. Pens should be constructed to permit easy cleaning between cows. Cows should be observed frequently, especially after they enter the first stage of parturition. If a heifer or cow needs assistance, it should be given early, before she becomes exhausted. Each maternity pen should have a head restraint, or there should be a calving chute near the maternity pens that will allow a person to move and assist the cow safely.

Obstetrics—When cows or heifers enter the first stage of parturition, they will isolate themselves from the herd and will appear to be uncomfortable. At this time the uterus is beginning to contract to position the calf or calves for birth. The second stage of parturition is when the calves are born. For heifers, this may take up to 2 hours for a normal, uncomplicated birth. For cows, the time will be about half that for heifers. General guidelines are for heifers to be checked and assisted if they have started to calve and are not making progress for 2 hours (for cows, after 1 hour). Normally, calving difficulty is not life threatening for the cow, but calf mortality increases as time from the start of calving increases. Cows assisted early in labor are less likely to have postpartum complications and are more likely to have live, healthy calves. When it is apparent to the observer that a cow or heifer needs assistance, she should be restrained and examined to determine the problem and how to proceed. The obstetrician should be trained in assisting cows with calving difficulty (dystocia) and should know when to call for veterinary assistance. Usually, the herd veterinarian is in a good position to train people on dairies to assist cows with dystocia.

Hygiene is crucial to minimize the likelihood of postpartum uterine infections. When assistance is rendered, the obstetrician should work with the cow (ie, apply traction to the calf when the cow is pushing). To avoid tearing the birth canal, the calf should be delivered without undue haste.

Colostrum and navel dipping—High quality colostrum should be fed to the calf within 2 hours of birth if at all possible. Feeding can be via a bottle with nipple or an esophageal tube. If colostrum quality is monitored and the colostrum is high quality, then 2 L of colostrum within 2 hours of birth will be sufficient. If the colostrum quality is not known, then 4 L of colostrum is recommended. Calves should be dried off, and the navel should be dry (dip in tincture of iodine) to avoid navel ill, which can lead to arthritis and other infections. Separating the calf from the cow shortly after birth causes less distress to the cow and calf,[18] and it also allows dairy personnel to make sure the calf gets adequate colostrum. Many calves left with cows for a few hours fail to nurse adequately. The calf's gut is able to absorb large immunoglobulin molecules from the colostrum intact from the first feeding only, which is why the first feeding is so critical. Immunoglobulins confer passive immunity to calves, which helps protect calves from disease until their own immune systems are fully competent. After the first feeding, the immunoglobulins are digested and will not confer passive immunity to calves.

A potential problem area on large dairies is the bull calf. Many bull calves are not given proper neonatal care (colostrum and navel dipping), because the bulls are generally worth far less than heifers and are not needed in the dairy. Calves, whether bull or heifer, should receive proper neonatal care. Many bull calves are sold within a day of birth. The mortality rate for bull calves sold without adequate colostrum when they are a day old is high. It has been recommended that calves not leave the dairy until they are able to nurse and walk by themselves, and it has been suggested that this does not happen before 5 days of age.[7]

Lactation

Milk accounts for more than 90% of income for dairy enterprises. The dairy producer has 2 years of investment in a heifer calf before the calf starts producing income.

Monitoring cows after calving—Cows that have had periparturient problems such as calving difficulty, milk fever, twins, or retained placenta should be considered high risk for further problems and observed more carefully than cows that have had no periparturient problems. One veterinarian has proposed a monitoring program that includes taking the temperature on all cows for the first 10 days after calving.[19] This allows close observation and prompt treatment for cows during this crucial period.

The goal of the herd health program should be to prevent disease whenever possible. When disease does develop, prompt treatment will shorten the duration of the illness and lessen the costs associated with the disease.

Milking procedure—Cows are milked 2 or 3 times/d by hired milkers. The cows walk to the milking parlor and are kept in a holding pen until they are milked. Often they are washed from beneath with sprinklers to make sure their udders are clean. The goal is to milk cows with clean, dry udders. With dairies being larger and pens of cows containing from 100 to 200 cows, sometimes the cows are forced to stand on concrete for long periods of time. It is generally recommended that cows should not be standing on concrete during the milking process for longer than 1.5 hours. During the walk from the pen to the milking parlor, cows should be allowed to move at their own pace to avoid having the cows at the back of the group pushing the cows in front of them. If dairy personnel push the cows from behind, there will be an increase in the incidence of lameness. Some producers are putting rubber belting down on the walkways to the parlor. If the cows are left to wander to the milking parlor on their own, they will walk on the rubber belting rather than the concrete even if the belting is only wide enough for 1 cow. If we watch cows' behavior, they will usually let us know their preferences.

As mentioned earlier, cows are creatures of habit. If they are milked at certain times of the day, they are conditioned to respond to moving up to the parlor and to certain premilking procedures. Cows are held in a pen while they wait to be milked. When they are at the front of the holding pen and the gate opens to let them into the milking stalls, they will move in on their own volition even if no feed is given to them in the milking parlor. If milkers routinely go up into the holding pen to hurry the cows into the empty milking stalls, the cows will not move in on their own but will learn to wait for a milker to chase them into the stalls. In the end, it probably takes the same amount of time and costs more in labor, because 1 milker always has to go get the cows to be milked instead of preparing the cows to be milked as they come in on their own. Normal milking procedure is that the cow's teats are wiped off with a single service towel to make sure that they are clean and dry, and a few squirts of milk are milked by hand (premilking) into a paddle or onto the floor to detect whether the milk is normal and also to clean out the teat canal. Cows with abnormal milk are identified as mastitic cows and are milked into separate containers, segregated to the hospital pen, and treated for mastitis. Premilking will also signal the cow to let her milk down. The milking machine should be applied to the teats within 60 seconds of premilking. The machine stays on the cow until her milk flow reaches a low level, at which time the vacuum is cut off and the machine disengages from the cow. Before releasing the cows, their teats are dipped in a disinfectant to prevent mastitis.

Sick cows are milked last, and their milk is discarded or fed to calves. Hospital milk fed to calves should be pasteurized to decrease the number of potentially pathogenic bacteria in the milk. Often, when dairies increase the size of their herd, they will build a new milking parlor and use the old one for milking freshly calved cows and sick cows. This allows the person milking the cows to treat the cows at the

same time. To facilitate recuperation, hospital pens should be separated from pens for freshly calved cows, be kept clean, and contain comfortable bedding.

Cow Comfort

Housing and walking—Most large dairies in the west have loose housing (open dirt corrals with shades) or freestalls (individual stalls with bedding). Freestall dairies are more common where precipitation is greater because the cows are always under a roof, concrete flooring is easier to keep clean by scraping or by flushing with water, and it is easier to contain manure for environmental stewardship.

One of the potential problems in large freestall dairies is that if freestalls are not designed or managed correctly, the cows will spend little time resting and more time idling (just standing). Not only should freestalls be comfortable, but there should be 1 freestall for every cow in the pen, because overcrowding will increase lameness.[20] Time standing on concrete has a detrimental effect on hoof horn health,[21-23] which is the leading cause of lameness in dairy cows.

There are many bedding materials for freestalls, of which sand is often the bedding of choice because it is comfortable, does not form a hard pack, and is inorganic.[24] Notably, it can play havoc with manure pumping machinery if not managed correctly. The most important attributes for bedding are that it is comfortable for the cow, kept clean to avoid mastitis, and properly maintained. Freestalls are labor intensive if they are properly managed. Some companies have devised mats or mattresses that can be installed on top of the freestall base to form the soft layer for the cows to lie on.[24-26] Some of these are particularly comfortable for cows, and the cows will readily use them. They are lower maintenance than sand or other bedding that has to be replenished, but they still must be cleaned, and some types will require bedding material on top of them. The abrasive cover material of mattresses can cause hock lesions.[27] The Swedish have a soft rubber mat that is approximately 2.2 cm thick and has an additional layer of softer composite matting under the central part of the stall. Cows seem to find this type of bedding quite comfortable and will readily use it.

The amount of labor needed to keep freestall bedding clean and comfortable depends to a large extent on freestall design. Many producers have devised machinery to distribute new bedding and to fluff up and even out bedding material. Stalls that are too long will permit cows to defecate and urinate on the bedding, which will increase the labor requirement and can lead to increased incidence of mastitis. Cows in freestalls of the proper length will urinate and defecate into the freestall alley, which should be cleaned up several times a day by flushing or scraping.

Lactating cows need to have constant access to feed, and most modern dairies provide fresh feed for cows several times per day. High-producing cows will spend several hours per day eating, which means they stand on concrete during that time. Some producers provide rubber for the cows to stand on that is more comfortable for the cows' feet and facilitates higher feed consumption, higher milk production, and decreased lameness.

During hot weather, various methods have been developed to help cows cope with heat stress. The most common cooling methods are fans, misters, showers, or combinations that allow evaporative cooling of cows.[28] Methods will vary for hot and humid versus hot and dry climates.

Lameness—Lameness is 1 of the top 3 diseases that cause premature culling of dairy cows and is therefore a major animal welfare concern.[29,30] Some factors that contribute to lameness are nutrition, walking surface and distance, freestall management, corral management, hygiene, hoof trimming, and stockmanship.[20,27,31-36]

One of the primary goals of functional hoof trimming on dairies is balancing hoof wear and growth. When cows are housed on concrete, their hooves wear differently than they do when they are on pasture or even in dirt corrals. Trimming should restore the feet to proper balance and conformation. Recently, programs have been developed to help educate producers, veterinarians, hoof trimmers, and nutritionists about lameness causes and prevention. Some examples are 3-day hoof-trimming courses in the southeast,[a,b] half-day lameness workshops on dairies in California,[c] and 1-week hoof-trimming schools.[d,e] Also, the American Association of Bovine Practitioners has recently formed a Lameness Committee, and veterinarians from the United States and Europe have been involved in the educational programs with the Hoof Trimmers Association. Currently a 3-part educational tool[f-h] is being developed to teach a locomotion scoring system developed in Michigan and to help people monitor lameness in individual herds, compare herds to each other, and identify individual cows for hoof trimming before they become severely lame.[37]

Tail docking—Tail docking is a controversial issue in the United States but is a long established practice in New Zealand and Australia.[38-41] Proponents claim that docking helps keep cows cleaner and the manure-laden tail from contacting milking personnel or getting in the way when cows are milked from between the rear legs (parallel parlors). Opponents claim that it disfigures cows unnecessarily, causes pain, and that there is no good evidence that it will help milking hygiene. There is no clear-cut scientific evidence to support the efficacy of tail docking.[39,42]

Removing the tail will definitely get it out of the way when the cow is milked from between the rear legs and will also prevent the switch from becoming manure laden. There are, however, alternative practices that accomplish the same results. The most obvious alternative is to trim the switch 2 to 3 times/y,[39] and another is to make sure that freestall management (good hygiene) is such that the cow's tail does not lie in the manure. A recent study[43] examined behavioral, immunologic, and endocrine responses to tail docking in heifers. The researchers concluded that tail docking in heifers 1 month before calving (using banding) caused little acute pain but that pain management may be useful after banding.

Breeding

Breeding on most large dairies is done by artificial insemination (AI). Cows are bred, using frozen semen for several breedings, and if not pregnant by a certain number of breedings, they are then bred with a bull. The cows are put in a pen with 1 or more bulls (bull pen), or they are taken to an individual pen with 1 bull (hand mated). If the cow does not come into estrus for about 35 days after being bred, the herd veterinarian checks it for pregnancy. If pregnant, a projected calving date is calculated so that the producer knows when to stop milking the cow to allow her udder time to involute before the next lactation.

Artificial insemination versus natural breeding—Artificial insemination allows more rapid genetic improvement than using bulls to breed cows, because only the top 1 to 2% of bulls are needed to provide semen to breed cows. Also, the size and temperament of bulls, especially dairy breed bulls, are a liability for workers on the dairy. Before the advent of AI, bulls caused the highest proportion of human death and injury on dairy farms. Some dairies do not keep bulls on their premises because of the liabilities.

Estrus detection—The major problem with AI is estrus detection. The dairy bull has an obvious interest in the job. Humans can do an excellent job of detecting estrus in cows if they are interested, good cow observers, and patient. This is not a job to be hurried. Estrus detection has 2 major components: efficiency and accuracy. If cows are accurately detected in estrus and the AI technique is good, then the conception rate is as good as when cows are bred by natural service.

Dry Off (End of Lactation)

About 2 months before the projected calving date, the cows are no longer milked and are put in a separate pen from lactating cows. Although some producers will milk these cows once per day for a few days to decrease milk flow, the most common method is to abruptly cease milking. It is not uncommon for a high-producing cow to be producing 32 to 36 kg (70 to 80 lb) of milk prior to being dried off.

After the last milking of the lactation, cows are treated with intramammary antimicrobials (dry cow treatment). The rationale for doing this is to prevent mastitis during the early dry period when the cow is most susceptible to infection. It also allows treatment with a high dose of antimicrobials, because the cow will not be producing milk for the next 60 days. At the time the cow is moved to the dry cow pen, its ration is changed from a lactating ration (higher concentrates) to a mostly or all roughage ration. Changing the ration to a lower plane of nutrition helps the cow cease lactating and does not cause metabolic problems. Metabolic problems from ration changes are much more likely to develop when the cow is changed to a higher plane of nutrition. Cows are kept in the dry cow pen until they are close to their calculated calving date, and the cycle starts over again.

Conclusions

Cows kept in large dairies are subject to similar management practices as cows in smaller dairies. Well-managed dairies will attain high and economical milk production, and management decisions will be based on the herd (production medicine). Having said this, herd production practices will only work if individual cows are taken care of. Most well-managed dairies take good care of their cows, but astute managers are always looking for better ways to do things and will always keep the cows' health in mind when making management changes. There are some areas of cow management that represent potential for animal welfare concern; most concerns are being evaluated by scientists and refined by empirical means by herd managers.

[a]Shearer J, University of Florida, Gainesville, Fla: Personal communication, 2000.
[b]Van Amstel S, University of Tennessee, Knoxville, Tenn: Personal communication, 2000.
[c]Berry S, University of California, Davis, Calif: Personal communication, 2000.
[d]Burgi K, Dairyland Hoof Care Institute, Baraboo, Wis: Personal communication, 2000.
[e]Kopperud B, Dairyland Hoof Care Institute, Baraboo, Wis: Personal communication, 2000.
[f]Guenther D, Zinpro Corp, Eden Prairie, Minn: Personal communication, 2000.
[g]Carrica J, Zinpro Corp, Eden Prairie, Minn: Personal communication, 2000.
[h]Socha M, Zinpro Corp, Eden Prairie, Minn: Personal communication, 2000.

References

1. Grandin T. Farm animal welfare during handling, transport, and slaughter. *J Am Vet Med Assoc* 1994;204:372–377.
2. Seabrook MF, Wilkinson JM. Stockpersons' attitudes to the husbandry of dairy cows. *Vet Rec* 2000;147:157–160.
3. Pajor EA, Rushen J, de Passille AMB. Aversion learning techniques to evaluate dairy cattle handling practices. *Appl Anim Behav Sci* 2000;69:89–102.
4. Lewis NJ, Hurnik JF. The effect of some common management practices on the ease of handling of dairy cows. *Appl Anim Behav Sci* 1998;58:213–220.
5. Breuer K, Hemsworth PH, Barnett JL, et al. Behavioural response to humans and the productivity of commercial dairy cows. *Appl Anim Behav Sci* 2000;66:273–288.
6. Rushen J, de Passille AMB. Behavior, welfare and productivity of dairy cattle. *Can J Anim Sci* 1998;78:3–21.
7. Albright JL. Dairy cattle husbandry. In: Grandin T, ed. *Livestock handling and transport*. New York: CAB International, 1993;95–108.
8. Albright JL, Arave CW. *The behaviour of cattle*. New York: CAB International, 1997;1–306.
9. Rollin BE. *The new ethic for animals and the dairy industry*, in *Proceedings*. 2nd Large Herd Dairy Manage Conf 1995;179–190.
10. Malloy NB. *Reference guide for the care of dairy animals*. Stratford, Iowa: Dairy Quality Assurance Center, 1994;1–32.
11. Peart B, Lessard JR, Munroe JA, et al. *Recommended code of practice for the care and handling of dairy cattle*. Ottawa: Agriculture Canada, 1990;41.
12. American Humane Association. *Welfare standards for dairy cows*. Englewood, Colo: American Humane Association, 2000.
13. Arana M, Bath DL, Berry SL, et al. *Dairy care practices*. Davis, Calif: Dairy Workgroup, Cooperative Extension, University of California, 1998;1–54.
14. Albright JL. Dairy animal welfare: current and needed research. *J Dairy Sci* 1987;70:2711–2731.
15. Grommers FJ. The animal welfare movement—European perspective. *Anim Human Health* 1988;1:5–10.
16. Broom DM. Animal welfare: concepts and measurement. *J Anim Sci* 1991;69:4167–4175.
17. Algers B. Farm animal welfare: a challenge to Swedish agriculture, in *Proceedings*. Farm Anim Welfare 1994;57–68.

18. Weary DM, Chua B. Effects of early separation on the dairy cow and calf 1. Separation at 6 h, 1 day and 4 days after birth. *Appl Anim Behav Sci* 2000;69:177–188.

19. Upham L. Managing the post-partum cow. *The Western Dairyman* 1997;78:20–26.

20. Leonard FC, O'Connell JM, O'Farrell KJ. Effect of overcrowding on claw health in first-calved Friesian heifers. *Br Vet J* 1996;152:459–472.

21. Vermunt JJ, Greenough PR. Sole hemorrhages in dairy heifers managed under different underfoot and environmental-conditions. *Br Vet J* 1996;152:57–73.

22. Galindo F, Broom DM. The relationships between social behaviour of dairy cows and the occurrence of lameness in three herds. *Res Vet Sci* 2000;69:75–79.

23. Galindo F, Broom DM, Jackson PGG. A note on possible link between behaviour and the occurrence of lameness in dairy cows. *Appl Anim Behav Sci* 2000;67:335–341.

24. Jacobsen KL. The well-being of dairy cows in hot and humid climates. Part I. Housing and effects of heat stress. *Compend Contin Educ Pract Vet* 1996;18:S137.

25. Herlin AH. Comparison of lying area surfaces for dairy cows by preference, hygiene and lying down behavior. *Swed J Agr Res* 1997;27:189–196.

26. Chaplin SJ, Tierney G, Stockwell C, et al. An evaluation of mattresses and mats in two dairy units. *Appl Anim Behav Sci* 2000;66:263–272.

27. Weary DM, Taszkun I. Hock lesions and freestall design. *J Dairy Sci* 2000;83:697–702.

28. Jacobsen KL, The well-being of dairy cows in hot and humid climates. Part II. Reducing stress. *Compend Contin Educ Pract Vet* 1996;18:S242.

29. Blowey RW. Welfare aspects of foot lameness in cattle. *Ir Vet J* 1998;51:203–207.

30. Whay HR. Pain in the lame cow. *Ir Vet J* 1997;50:603–609.

31. Bergsten C, Frank B. Sole hemorrhages in tied primiparous cows as an indicator of periparturient laminitis—effects of diet, flooring and season. *Acta Vet Scand* 1996;37:383–394.

32. Bergsten C, Herlin AH. Sole hemorrhages and heel horn erosion in dairy-cows—the influence of housing system on their prevalence and severity. *Acta Vet Scand* 1996;37:395–408.

33. Haley DB, de Passille AMB, Rushen J. Assessing cow comfort: effects of two floor types and two tie-stall designs on the behaviour of lactating dairy cows. *Appl Anim Behav Sci* 2001; 71:105–117.

34. Faull WB, Hughes JW, Clarkson MJ, et al. Epidemiology of lameness in dairy cattle—the influence of cubicles and indoor and outdoor walking surfaces. *Vet Rec* 1996;139:130–136.

35. Haley DB, Rushen J, de Passille AMB. Behavioural indicators of cow comfort: activity and resting behaviour of dairy cows in two types of housing. *Can J Anim Sci* 2000;80:257–263.

36. Haley DB, Rushen J, de Passille AMB. Effects of softer flooring on the behaviour, health and productivity of dairy cows in tie stall housing, in *Proceedings*. 33rd Int Congr Int Soc Appl Ethology 1999;33:127–128.

37. Sprecher DJ, Hostetler DE, Kaneene JB. A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. *Theriogenology* 1997;47:1179–1187.

38. Matthews LR, Phipps R, Verkerk GA, et al. *The effects of tail-docking and trimming on milker comfort and dairy cattle health, welfare and production*. Hamilton, New Zealand: Animal Behavior and Welfare Research Centre, 1995;1–25.

39. Loveridge A, Bagshaw C, Matthews L. *Taildocking of cattle: adoption of alternative practices*. Hamilton, New Zealand: Animal Behaviour and Welfare Research Centre, 1996;1–35.

40. Gregory N, Matthews L. *Tail docking of dairy cattle*. Hamilton, New Zealand: Animal Behaviour & Welfare Research Centre, 1998;1–51.

41. Barnett JL, Coleman GJ, Hemsworth PH, et al. Tail docking and beliefs about the practice in the Victorian dairy industry. *Aust Vet J* 1999;77:742–747.

42. Tucker CB, Fraser D, Weary DM. Tail docking dairy cattle: effects on cow cleanliness and udder health. *J Dairy Sci* 2001;84:84–87.

43. Eicher SD, Morrow-Tesch JL, Albright JL, et al. Tail-docking influences on behavioral, immunological, and endocrine responses in dairy heifers. *J Dairy Sci* 2000;83:1456–1462.

Dairy heifer replacements—caring for the future

Thomas Fuhrmann, DVM

Husbandry methods have changed as the number of livestock farms has decreased and the number of animals per farm has increased.[1] Data from the 1996 National Animal Health Monitoring System (NAHMS) collected by the USDA Animal and Plant Health Inspection Service indicate a large portion of the US dairy cattle inventory is shifting to large herds (Table 1).[2]

Unofficial but recent trends in dairy herd sizes in Arizona indicate that whereas dairy ownership has declined (from 176 producers in 1985 to 104 in 2000), herd size has grown from approximately 900 cows/herd to more than 1,400 cows/herd. As diary herds grow in size, their owners tend to implement new technology and improve management systems for greater productivity (Tables 2 and 3).[2,3]

From DairyWorks, 51 W Elliot Rd #106, Tempe, AZ 85284.

Table 1—Percentage of US milk cow inventory by herd size, 1991–1995*

	No. of cows				
Year	1–29	30–49	50–99	100–199	200+
1991	39.8	22.8	25.9	11.5†	†
1992	38.9	22.1	26.0	13.0†	†
1993	37.2	22.2	26.9	9.3	4.4
1994	35.8	22.0	27.7	9.9	4.6
1995	34.4	22.2	27.9	10.5	5.0

*National Agriculture Statistics Service (NASS) data. †The 100–199 size group includes those operations with 200 or more cows.

Husbandry methods used to produce replacement animals for larger dairies have also changed and improved. The simple fact is that dairy farmers need healthy and productive replacements to continually expand their dairy herds. Cull rates (the

Table 2—Changes in US milk production, 1991–1995

Year	Annual lb of milk/cow	Percentage of 1991
1991	15,031	100.0
1992	15,574	103.6
1993	15,704	104.5
1994	16,175	107.6
1995	16,451	109.4

Table 3—Changes in Arizona milk production, 1989–1999

Year	Annual lb of milk/cow	Percentage of 1989
1989	18,706	100.0
1994	21,162	113.1
1999	21,899	117.1

rate at which older or less productive animals leave herds) approximate 30%. That means that of every 10 animals in the US dairy herd today, 3 or more will be replaced by young, healthy, and genetically superior replacement heifers each year. Where do these animals come from? How do dairymen guarantee continued herd growth and increased milk production?

Dairymen are motivated to raise replacement heifers for maximum health, growth, and productivity for at least 3 reasons. First, they need to guarantee uniformity and consistency in the supply of replacement animals for their dairy herds. Dairymen's best options to accomplish this are to raise replacements themselves or to have specific contractual relationships with associates who guarantee good, healthy, and productive heifers. Animal scientists and veterinarians have studied growth patterns of Holstein heifers, and review articles describe methods and programs that will ensure maximum growth and productivity of heifers to calving.[4] The Professional Dairy Heifer Growers Association is dedicated to producing high-quality dairy replacements and holds annual conferences to share current scientific and management information with its members who produce heifers for dairymen. Entire issues of popular dairy magazines such as *Western DairyBusiness* consider the topic of heifer raising.

Dairymen genetically improve their herds by replacing older animals with genetically superior heifer replacements. When analyzing milk production records, scientists have attributed approximately 30% of the increase in milk yield over time to genetic improvement. Artificial insemination, especially when superior bulls are mated to dairy heifers, produces offspring with the greatest genetic merit and opportunity for increased milk yield for the future of US dairy herds.

Finally, dairy farmers minimize risk of disease to their dairy herds through controlled heifer replacement programs. Biosecurity is the term used to identify and mitigate disease risk to cattle herds. According to this concept, dairy owners have 2 options with regard to dairy replacements. The first: raise their own replacements within the context of a sound herd health program. Risk of disease exposure is minimal because exposure to foreign animals (and therefore disease) is low. The second: apply the Quality Assured Replacement Concept suggested by Tomsche to a custom calf-raising enterprise. The concept requires that a heifer raiser and dairy producer be in complete agreement and willing to cooperate toward the goal of a disease-free heifer returned to the dairy owner.

Today's dairy owner, through the ever-changing landscape of a progressive and modernizing dairy industry, is applying better calf and heifer management practices to already proven husbandry principles. The principles can be simplified by explaining them within the context of raising children:

1) Birth—Generally in a hospital with supervised medical specialists.

   Calving—Generally in a clean designated calving area with vigilant employees trained to render assistance and react to obstetrical emergencies. Incidence of emergency problems is monitored, and corrective action is implemented through veterinary intervention.

2) Mother's milk—Fed to the newborn whenever possible. Substitute milk formulas are prescribed when necessary.

   Colostrum—Fed to newborn calves at a rate of 4 qt within 12 hours after birth. Much more important in calves than babies, because it is the only method by which they acquire the disease-fighting antibodies that babies are born with.

3) Individual care, protection—Intensive care, feeding, bathing, attention to illness, and isolation and protection from harm.

   Individual hutches, supervision—Separation from other calves to maximize individual calf attention and minimize disease risk. Sanitation levels are high; illness is identified quickly and treated promptly.

4) Milk feeding, soft foods, healthy diet—Feeding times, quantities, and types of nutrients are changed according to the age and development of the infant's system.

   Weaning and growing rations—Weaning from milk or milk substitutes generally takes place between 6 and 10 weeks of age. Grain diets provide nutrients for growth as well as for rumen (stomach) development. Health status of calves is monitored daily, and trained staff apply veterinary prescribe treatments as needed.

5) School and social interaction—Children socialize and learn together. They are exposed to others' germs as well as to other growing experiences.

   Calves are grouped together after weaning—Calves are moved from individual hutches to small group pens. Vaccinations are administered and higher nutrient diets are fed; social interactions and grouping by size allow for maximum feed intake and growth.

6) Adolescence and high school—New experiences, growth through awkward adolescence years, sexual maturity.

   Growing heifers—Larger groups feed for maximum growth (weight and height). Puberty is reached at approximately 1 year, and heifers are inseminated before they are 16 months old.

7) Maturity and motherhood—Physical maturity, male-female partners, maternal instincts, and pregnancy.

   Pregnant and growing heifers—Pregnancy occurs. Development to physical maturity through adjusted feed rations readies the heifer for calving and milk production.

The owners of America's dairy herds are implementing management strategies that produce healthier and happier replacement heifers. Dairy farmers are the keenest of animal welfare proponents—they are caring for their future. Animals are their livelihood, and dairy farmers are applying sound husbandry principles to replacement rearing better today then ever before. Their businesses and consumers demand it.

References

1. American Veterinary Medical Association. *AVMA Promotional brochure: 2000 Animal Welfare Forum.* Schaumburg, Ill: American Veterinary Medical Association, 2000.
2. United States Department of Agriculture. *National animal health monitoring system. Part II: changes in the U.S. dairy industry: 1991–1996.* Washington, DC: United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Sciences, 1996;5–6.
3. Arizona Dairy Herd Improvement Association. *Arizona DHIA annual reports.* Tempe, Ariz: Arizona Dairy Herd Improvement Association, 2000.
4. Selected issues in dairy heifer management. *Compend Contin Educ Pract Vet* 2000;22(suppl).
5. Wiggins GR. Genetic evaluation systems in the United States, in *Proceedings.* 32nd Int Symp Anim Prod 1997.
6. Tomsche D. Commingling: a herd time bomb?, in *Proceedings.* 4th Western Dairy Manage Conf 1999;20–26.

Veal calf TLC

Russell L. Schnepper, DVM

Today's veal industry has a win-win situation. The more comfortably a calf is raised, the more feed-efficient and healthy it will be. As everyone knows, when a person has a baby, it is important to treat that baby with **tender loving care** (TLC). The same concept applies to veal calves. When you treat calves with kindness and provide proper nutrition, a good health program, and appropriate housing, they grow strong and healthy in a humane fashion.

We start with a 100-lb baby calf and pamper it for 20 weeks. We feed it a balanced ration with all natural milk proteins. We place it in an environmentally controlled, exceptionally clean, well-lighted, and well-ventilated building. We provide it with a safe environment where it can stand, stretch, groom itself, and lie down in a natural and comfortable position. And finally, a proactive health program prevents disease. Using TLC, we end up with a 450-lb fancy milk-fed veal calf.

Veal Quality Assurance

The **American Veal Association** (AVA) has an Issues Management Team whose duty it is to detect problems in the veal industry and take positive action before a problem becomes more difficult to manage.

The AVA put a **Veal Quality Assurance** (VQA) program in place in 1996 to address the veal consumer's perception of the veal industry. The US special-fed veal industry had made extraordinary advances, most notably in decreasing violative chemical residues from 0.86% (approx 1 carcass/100) in 1989 to 0.075% (< 1/1,000) in 1996. However, the AVA knew that more had to be done to assure consumers they were receiving a wholesome product that had been raised humanely. The VQA program evolved.

The VQA program is a joint effort between the veal producers, their veterinarian, feed suppliers, pharmaceutical suppliers, and the veal packer. This is a voluntary program; however, veal packers will not accept calves from producers who are not certified under the VQA program. This guarantees near 100% compliance. The VQA program was designed by a committee of veal producers, veterinarians, veal experts from the University of Pennsylvania, veal packers, and the Executive Director of the American Association of Bovine Practitioners.

Certified veal producers must sign a contract, and their veterinarian must certify that a valid **veterinarian-client-patient relationship** (VCPR) exists. The veal producer agrees to the following:

1) A valid VCPR has been established.
2) Complete calf health and treatment records are maintained.
3) Medications, other **animal health care products** (AHCP), and the equipment and supplies needed to administer these products are properly cleaned, sanitized, stored, and not out-of-date.

From Schnepper International Inc, 3162 Hwy B, Platteville, WI 53818.

4. Instructions on use and withdrawal times for all AHCP have been obtained from the veterinarian, and withdrawal times will be abided by.
5. Sufficient nutritional supplements (eg, iron, electrolytes) will be provided to maintain acceptable calf health.
6. Calves that do not qualify as sources of quality wholesome veal or that potentially may accumulate violative residues will be identified and culled.
7. High-quality supplies manufactured and distributed by reliable AVA-certified suppliers will be used in the conduct of the operation.
8. The physical facilities in the operation—ventilation and heating system, alternative power source, waste removal or storage, and stalls—will be periodically checked to ensure that they do not impair the health, well-being, or carcass quality and wholesomeness of calves.
9. Calf feeding, treating, handling, care, moving, and transportation methods will be frequently reviewed personally and with all others who have responsibilities for any aspect of caring for the calves.
10. An annual farm plan evaluation and self-assessment with be conducted with a veterinarian or other accredited experts.
11. Violative residues or other regulatory infractions will be reported to the Producer Certification Program Coordinator so that assistance in identifying voids in the program may be provided.
12. Annual participation in an accredited Quality Assurance Educational Program (enrollment and completion of seminar must be officially recorded).

Certified VQA producers are provided with a standard operating procedure manual with more than 70 pages of checklists and guidelines. The manual covers use of health care products, barn preparation, biosecurity, feeding, facilities, management, and marketing. The VQA program has benefited producers and has provided packers and consumers with a wholesome humanely raised veal calf.

Feeding

Calves are started on an all-milk protein milk replacer (a few may contain some plasma) and a blended fat diet that usually comprises 20% coconut oil, 40% tallow, and 40% lard. Whey protein concentrate is the dominant ingredient. It has been stated that veal milk replacers supply essentially every known nutrient required by the "preruminant" calf. The nutritional needs of the calf and the need for a high rate of feed conversion and growth performance, as well as the deposition of some fat tissue within the muscle, require that a large number of nutrient sources be added to the milk replacer. Nutrients added include calcium; phosphorus; magnesium; cobalt; iodine; selenium; zinc; manganese; iron; copper; vitamins A, C, D, E, K, and several B-complex vitamins; niacin; folic acid; biotin; and an array of protein and energy sources that contribute to proper development of the calf's body and that are economical. The calf's hemoglobin concentration is monitored by periodic blood tests to ensure adequate iron concentrations are maintained. Water is provided free choice.

Facilities

Veal calves are housed in environmentally controlled buildings. Temperature is maintained between 60 and 75 F; very young calves are housed in warmer surroundings, and as the calf grows the temperature is decreased. I work with a veal producer whose barn is next to a golf course, and the operators use ozone generators to control odors inside and outside of the barn. Humidity is optimized at 50 to 70% to provide a comfortable environment (calves release approx 0.22 lb of moisture/100 lb of body weight/h into the air). Rooms are well-lighted. Many barns have sprinkler systems for hot weather cooling. Most rooms contain 100 or more calves. Veal producers follow all-in/all-out procedures. Rooms are pressure washed or steam cleaned between groups.

Newer calf stalls are 26 in wide X 48 (or more) in long, which meets the current European standard of 24 X 48 in. In these stalls, the calf has room to stand, stretch, groom itself, and lie down in a natural and comfortable position. Holstein calves appear to feel safer in an individual stall. Most calves are tethered for the first few weeks. Tethering the calf to the front of the stall assists it in finding its milk and prevents it from defecating in its feed. Calves that have had their tethers removed after a couple of weeks continue to stand as they were trained and do not move around any differently than do tethered calves. Newer barns also have stalls with rubber-covered metal floors that are comfortable and easy to clean.

Commingling of baby calves has been shown to adversely affect their health as well as the economics of the veal operation. Morbidity and mortality rates for commingled calves are several-fold greater than those for calves maintained in individual housing.

Calf Health Program

Veterinarians prescribe preventive health and treatment programs. Calves usually are acquired from a wide geographic area and have been exposed to most of the pathogens found in the surrounding states. Calf health programs include intranasal and intramuscular or subcutaneous vaccination against infectious bovine rhinotracheitis, parainfluenza virus, bovine virus diarrhea, bovine respiratory syncytial virus, and gram-negative endotoxins. Preventive measures against pasteurella are sometimes included. Veterinarian-prescribed antibiotics may be provided during the first week of the feeding program; however, this practice is gradually being discontinued. Immunoglobulin or plasma-type products and probiotics are being substituted quite successfully. A well-run veal operation only requires occasional antibiotic use after the first week the calves spend in the barn.

Challenge

The greatest challenge for veal producers is procurement of a good quality calf. A successful veal pro-

ducer needs to fill a room with calves within 3 days of the first calf's entry, and filling within 1 day is best. Sale barns or large dairies must be used to obtain the number of calves required. Approximately a third of calves have received adequate colostrum, one third have received none, and one third have received some colostrum. The source of the calves appears to have little effect on the amount and quality of colostrum a calf receives.

Summary

Today's veal producer provides a wholesome product consumers can have confidence in and know was raised in a humane fashion.

The ethics of livestock shows—past, present, and future

Jeff L. Goodwin, PhD

The analysis of the ethics of livestock shows must be broken down into 4 distinct time periods: the distant past, the recent past, the present, and the future.

The Distant Past

The distant past includes the origins and development phases of agriculture-based activity. In the early 1800s livestock began being exhibited in Europe and the United States. Agricultural fairs in the United States have come a long way since Elkanah Watson exhibited his 2 Merino sheep on the public square in Pittsfield, Mass, in 1807. The Massachusetts-born Watson was without question, "the father of American Fairs." The Berkshire Agricultural Society was incorporated on Feb 25, 1811, and the first fair held in this country was in Pittsfield, Mass, in 1814.

In September 1841, the first state fair was held in Syracuse, NY. After 1841, hundreds of state and local fairs were held throughout the nation, and by 1868, there were 1,367 state, county, and district fairs each year—a period referred to as "the golden age of the agricultural fair." New York's first state fair was soon followed by 1 in New Jersey, and other states followed suit—Michigan in 1849; Pennsylvania, Ohio, and Wisconsin in 1851; Indiana in 1852; Illinois in 1853; and Iowa in 1854.

Livestock exhibitions at agricultural fairs during the late 1800s and early 1900s focused on the genetic improvement of livestock and the diffusion of improved animal husbandry practices of that time period. The early part of the 20th century brought the establishment and growth of the 4-H program, which was the product of corn, pig, cotton, and canning clubs in the South. The initial purpose of these clubs, and later the 4-H program, was to teach farmers and ranchers these new and improved agricultural practices through the young people of their community. After the 4-H program became well established, the new focus of livestock exhibitions at county and state fairs became youth development. The 4-H member exhibiting his or her livestock project animal at the county fair became an endearing symbol of Americana.

From the State 4-H Office, University of Idaho, Moscow, ID 83844-3015.

The Recent Past

The recent past, for the purposes of this presentation, is identified as the decade of the 1990s. The recent past is marred with incidents of unethical activity. As youth livestock shows became more and more competitive with larger and larger cash prizes for top placing animals, unethical activities such as physical manipulation of animals, false ownership of animals, and the hiring of professional fitters to manage and groom the animals of youth exhibitors became more common.

A 1990 study[1] was conducted to determine the extent of fraudulent fitting and showing practices used by exhibitors in youth livestock shows in Texas. Of 797 students, parents, and project supervisors who participated in the study, 25% had knowingly used illegal drugs in preparing market animals for show ring competition, and 37.5% said they had falsified registration papers or knew of someone who had.

A watershed year in the exhibition of livestock at youth livestock shows was 1994. Some refer to 1994 as a year of wake-up calls, with the following events occurring across the United States[2]:

September 1993—An animal science graduate student from Oklahoma State University is caught on videotape beating a lamb to cause swelling and make the lamb feel firmer to the judge.

Fall 1994—At the Ohio State Fair, carcasses of 7 of the top 10 steers are condemned because of clenbuterol residue or vegetable oil injections under the skin. The champion lamb carcass is also condemned for clenbuterol residues.

Fall 1994—At the North American International Livestock Exposition in Louisville, Ky, 3 of the top 6 placing animals are found to have clenbuterol residues.

Fall 1994—At the Tulsa State Fair in Tulsa, Okla, 6

of the top placing animals are found to have clenbuterol residues.

September 1994—A Future Farmers of America (FFA) member at the Tyler County Fair in Woodville, Tex, puts a water hose down the throat of his pig to fill the animal with water so that it will make a minimum weight requirement. The pig drowns, and columnist Ann Landers publishes a series of letters nationwide regarding the incident. The public is outraged.

January 1995—The champion and reserve champion steer carcasses at the National Western Livestock show in Denver, Colo, are condemned for clenbuterol residues.

Clenbuterol[4] is a β-agonist drug that affects lung and heart function. It is also a partitioning agent, which at high doses converts nutrients to muscle instead of fat. In the 1990s, it was sometimes used illegally on livestock to add unnatural muscle to meat-producing animals.

The FDA's main concern with the use of clenbuterol in food-producing animals is the possible adverse effect its residues may have on public health. In 1990, there were reports from Spain of illness in 135 individuals (including some who were hospitalized) who consumed beef liver from treated animals. These individuals exhibited symptoms such as increased heart rates, muscle tremors, headache, dizziness, nausea, fever, and chills. In 1991, there was a similar outbreak of food poisoning reported from France involving 22 people who consumed beef liver with clenbuterol residues.[3]

With an estimated 0.6% of meat-producing animals (beef, sheep, swine) in the United States being marketed through youth livestock show auction sales, the clenbuterol issue attracted the attention of many in the agricultural community. This was a number large enough to cause a major food safety concern in the general public yet small enough for the agriculture sector to completely disown the youth livestock program.

Because of increased commitment on the part of livestock shows, agricultural commodity groups, and the Land Grant University System to enforce FDA laws and promote greater quality assurance of food-producing animals, the illegal drug residue situation is greatly improved today. Thanks to the clenbuterol wake-up calls of 1994, the taboo issue of youth livestock show ethics could finally be discussed in public.

The Present

The present-day situation regarding the ethics of livestock exhibition finds many states across the nation engaged in aggressive ethics education and quality assurance programs. These programs are directed toward youth livestock exhibitors not only as issues of animal science but also as issues of ethics. The purpose of addressing the ethics of livestock shows today is to help young people learn to make good ethical decisions—both in the show barn as 4-H members and in the real world as adults.

One example of a widely used and effective ethics education effort is the Line in the Sand educational program.[5] This ethics educational effort is centered around 3 questions regarding livestock showing practices. Participants ask themselves the following questions: 1) does the practice violate FDA law? 2) does the practice compromise the welfare of the animal? 3) is the practice a fraudulent misrepresentation of the animal? If any of these answers are yes, the practice falls on the unethical side of the equation. Coupled with an innovative educational video that makes use of humor and memorable visual examples, this program has helped to fill a void in the livestock show ethics education field.

Instead of giving the participant a list of rules to memorize, conceptual programs such as this give people the tools to sort out ethical and unethical practices. When people are able to arrive at their own decision of what is right and wrong, they are more apt to see that decision through with the appropriate action or behavior supporting that decision.

There is controversy in the agricultural community concerning what is the most effective and appropriate method for addressing ethics related to livestock shows. Many professionals in the field of animal science have proposed that educational efforts must only focus on the quality assurance for the food being produced. It is understandable why animal scientists would propose to focus only on the animal science-related issue of quality assurance. However, quality assurance programs do not address ethical issues such as false ownership of animals, excessive adult or professional fitter involvement in youth livestock projects, or fraudulent misrepresentation of animals.

Other professionals who address livestock show ethics issues see the need to address ethics education and quality assurance for food-producing animals as a 2-pronged approach. Many states have implemented mandatory ethics and quality assurance educational programs for 4-H and FFA students.

The Manitoba 4-H Council has developed and implemented an effective ethics educational effort aimed not only at the exhibitors of livestock projects but at all 4-H members. The program, titled The Quality Equation, addresses 3 areas: quality people (ethics education), quality projects (quality assurance of animals), and quality programs (ensuring that the entire educational effort is based on sound youth development).[5] This is the most comprehensive program developed within a framework that addresses all issues associated with youth livestock shows.

Another ethics education effort in use is the Showing Character program[6] developed by Louisiana State University in 1999. This program uses the 6 pillars of character development of Character Counts! (trustworthiness, respect, responsibility, fairness, caring, and citizenship) to educate livestock exhibitors in the ethical use of animals at such events.

All these efforts focus on education as a means of addressing ethical issues. The other critical component that must be in place to ensure ethical behavior at livestock shows is enforcement. Livestock shows must be willing to enforce the rules of ethical conduct and responsible stewardship of livestock animals—otherwise these rules are useless.

The North American Livestock Show and Rodeo Managers Association (NALSRMA) implemented an

innovative and effective enforcement program in June of 1995. The Rule Infraction Database (RID) collects, stores, and distributes information concerning rule violations to other member shows. The NALSRMA member shows then reserve the right to refuse entry of any exhibitor who has been barred from another show on the basis of unethical practices.[7] The RID program as well as stricter residue avoidance procedures implemented at many major livestock shows during the past 5 years has reduced unethical activity at livestock shows, but vigilance is still required to protect food safety and promote responsible stewardship of the animals exhibited at livestock shows.

The Future

I have focused on youth programs, such as 4-H and FFA, in addressing the ethics of livestock shows. Perhaps the example of the corn and pig clubs of the first decade of the 1900s, which taught adults modern agricultural practices through their children, can be applied as an approach to ethics education in the first decade of the new millennium. If young people who exhibit livestock today are taught to use sound ethical principles to guide their actions in the show ring of the future, progress will have been made. One of the most effective methods to get adults thinking about the ethical use of animals at livestock shows is to reach them through their children.

Just because we've done something a certain way in the past does not mean that is the way we should do it in the future. Two innovative educational efforts presently being used give us a glimpse into the future of livestock exhibition.

Ultrasound—The use of ultrasound to identify carcass characteristics of junior livestock show market animals has been aggressively implemented at fairs throughout Idaho. Educational workshops help participants understand what ultrasound measurements mean and how they apply to market animal industry standards. Animals are scanned at the fair, and youth receive information about their animal at the time of scanning. The information is available for the judges to use at their discretion. Youth are rewarded for raising animals that meet industry standards. Each year youth and leaders look forward to this data collection to determine how well their animals compare with industry standards.

Systems Approach of Livestock Evaluation—The Systems Approach of Livestock Evaluation uses a scorecard that provides youth livestock producers with feedback about all aspects of production. It evaluates the total project rather than only the live animal as it appears on show day. When project success is based entirely on the visual evaluation of the animal on show day, traditional livestock shows can (unintentionally or intentionally) promote the physical manipulation of animals to meet that visual ideal. The Systems Approach rewards youth for their effort during the entire year. If we teach FFA and 4-H members proper selection, care, and nutrition, we should reward them for their successes in those areas.

On the basis of industry standards, the Systems Approach scorecard assigns points in several categories that contribute to a composite score. Members can excel in 1, 2, or all 3 areas on the scorecard and be successful without winning in the visual evaluation class.

A survey[8] of county extension programs in Idaho revealed 62% of county 4-H programs use real-time ultrasound during the evaluation or educational processes at county fairs. Results of this survey also indicated that 69% of county fairs in Idaho used the Systems Approach at youth livestock shows. This survey also reveals that more than 85% of counties in Idaho use at least 1 of the educational methods described.

These 2 educational approaches may appear to focus excessive attention on the animal and on the real world of animal agriculture. The purpose of the animal-centered and real world focus is to keep youth livestock programs on valid tracks. This on-track approach also provides many opportunities to measure the success of youths who exhibit animals while extending the educational scope of FFA and 4-H programs.

In conclusion, the ethical success of future livestock shows depends on adherence to the following principles:

- Protecting the well-being of animals exhibited.
- Ensuring the quality of food produced.
- Using livestock shows as a vehicle for youth development.
- Providing a window into the world of agriculture.

If the livestock shows of the future cannot guarantee the well-being of animals exhibited and the quality of the food produced from those animals, the general public may be displeased as they peer through that window into the world of agriculture. If livestock shows of the future teach young people to be less than honorable, the endearing symbol of Americana and the 4-H member at the county fair will be but a memory.

[a]Clenbuterol hydrochloride, Ventipulmin, Boehringer-Ingelheim Animal Health, St Joseph, Mo.

References

1. Murphy TE, Norwood JS, Dubes R. Unethical fitting and showing practices in junior livestock shows. *Tex J Agric Nat Res* 1992;5:99–106.
2. Goodwin JG. The line in the sand: an ethical test of livestock showing practices, in *Proceedings*. 2nd Natl Youth Livestock Program Ethics Symp 1997;71–75.
3. Rodriguez RR. The role of FDA in residue avoidance, in *Proceedings*. Natl Youth Livestock Program Ethics Symp 1996;114–117.
4. Goodwin JG. *The line in the sand educational video*. College Station, Tex: Instructional Materials Service, Texas A&M University, 1996.
5. Beilby K, McCracken M, Dowsett K, et al. The quality equation. In: Beilby K, McCracken M, Dowsett K, et al, eds. *4-H leader training manual*. Winnipeg, Canada: Manitoba 4-H Council, 1999.
6. Hammatt D. *Showing character*. Baton Rouge, La: Louisiana State University State 4-H Office, 1999.
7. Sylvester C. Rule infraction database, in *Proceedings*. Natl Youth Livestock Program Ethics Symp 1996;93–95.
8. *Idaho livestock show survey*. Moscow, Idaho: Idaho State 4-H Office, 2000.

Forum continued on next page.

Rodeo cattle's many performances

James W. Furman, DVM, MS

My purpose is to convey an understanding of the care given to bovids that participate in the sport of rodeo. Rodeo actually has its roots in the work of the everyday cowboy, offering a means by which he can show off his talents for handling the daily challenges he faces on the ranch. Rodeo is a means of demonstrating that livelihood, and if not preserved, it will be lost in the past forever. The history of rodeo, the general care of cattle as it relates to their cowboy caretakers, a description of bovine rodeo events, and a look at the rules and regulations that protect the welfare of bovine athletes on the rodeo circuit will help us understand this popular sport.

It is not by happenstance that the sport of rodeo exists today. It is a product of our heritage: cattle ranching. Cattle ranching and its natural environment are much the same today in the United States as they were at the end of the 1800s. This is because grass is still the main nutritional requirement in a cattle production operation, which necessitates the use of cowboys and horses to manage the range. Cowboys are slightly competitive and aggressive, befitting their occupation. It usually takes younger men to meet the strong physical demands and work skills of a western cowboy. However, it is not unusual to see 70- or 80-year-young cowboys in western Nebraska, doing what they know how to do best: riding horses, roping, and caring for their cattle. Being a cowboy, however, is fast becoming a lost art and occupation. Today, it is difficult to find employees who want the rough and tough life of a beef cow wrangler who is keeper of the livestock. The long hours from dawn until dusk, with even longer days during calving season, are often exhausting. Roping and riding horseback are skills needed almost daily in a beef cattle operation. Even physically wrestling younger cattle to the ground in order to provide medical treatment or brand them is part of production management today.

The most effective and stress-free way of working cattle seems to involve a cowboy and his horse moving them from place to place, whether on the ranch, in the corrals, out on pasture, or in the feedlot. Cattle appear to be more at ease with cowboys riding horseback than with people on foot or on a 4-wheeler or motorcycle. Often, individual cattle need to be handled or restrained, and this is not efficiently accomplished with pick-up trucks or other mechanized equipment. When cattle need to be moved from pasture to pasture, using a horse and cowboy ensures that the pace fits the cattle. Motorized vehicles often hurry and exhaust cattle.

Treating a sick animal out on the range, miles from the nearest penning facility, requires the ability to rope an animal well the first time with little running involved. Occasionally it is necessary to rope an animal that got mixed with the wrong pen of cattle at a feed yard for placement back in the proper owner's pen. Recently, I was asked to treat a broken leg and laceration incurred by an animal in a pasture that was far from a corral or handling facility. In this case, it was important for the cowboys to be able to rope the animal smoothly and efficiently so as to effect a treatment out in the pasture without causing further harm to the animal. Trailing with a broken leg, bleeding foot, or bleeding side would not be advantageous. Roping is a must in these situations.

Branding and vaccinating can also require a bit of cowboy finesse. The entire cattle-owning family usually gets involved with this operation, and if you think for 1 minute that anything other than gentle treatment of young calves is tolerated when mom and the kids are involved, you are mistaken. Welfare is the name of the game when handling young calves, sometimes at the expense of cowboys or veterinarians. Each and every livestock owner takes pride in his or her stock, whether horse or cattle, because it literally means their livelihood. This is simply the way of the west, or to quote a line from a recent movie, "It's the cowboy way."

As many of you may know, rodeo is a Spanish word meaning roundup. The first organized rodeo was the Prescott Frontier Days Rodeo in Prescott, Ariz, on Jul 4, 1888. Cattle were used in these early contests in such events as steer roping and tying. Steer riding debuted in 1889, the precursor to today's bull riding, and in 1917, the first calf-roping contest was held at Prescott. Team roping, which was actually called team tying and varies a bit from today's team roping, was introduced in 1919. Hereford range bulls were used in the early contests; steers replaced the bulls in 1920.[1]

Rodeo has developed into an athletic sports event. Cowboy athletes work hard at staying in shape so that they are able to perform the many cattle and horse events, which all require strength and agility for success.

Calf roping is fast and seemingly effortless when viewed from the grandstand. Cowboys start their horse from a complete stop, run to the calf, rope him, dismount the horse, run down the rope approximately 30 ft, flank the standing calf to the ground, and tie 3 legs together so as to totally restrain the calf. All this is done in a matter of 7 to 10 seconds, much more quickly than it took me to describe the performance. Steer wrestling is a similar event: the cowboy actually leaves his horse, stops a fast running steer with horns, turns the steer over, and lays it on the ground. This is typically done in less than 5 seconds.

Team roping, on the other hand, involves 2 cowboys working together on horseback. They give the steer a head start, run to him, and then 1 cowboy ropes the horns to slow the steer down and turn him while

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the other cowboy rides to the hind end of the steer and ropes the 2 hind legs. They let the rope become snug to restrain the steer while they turn their horses and face each other at the end of the run. Most of the time the steer doesn't even trip or fall down during this event. This entire performance takes anywhere from 7 to 12 seconds.

The final cattle event of rodeo involves bulls. This is a judged event where the cowboy is required to stay on top of the bull for 8 seconds to make a qualified ride. This event involves an approximately 2,000- to 2,500-lb bull, starting with a 5/8-in cotton rope placed around its flank area, which is comparable to a human waist where a belt would be worn. This rope is used on the bulls because it serves as a tickler or training device that indicates when the bull is to perform his best. The 150- to 200-lb cowboy is allowed a braided rope that is simply laced through a self loop and pulled snug around the bull. The rope tail is pulled back over itself, and the cowboy has to hold it tight with 1 hand. If the cowboy lets go at anytime during the ride, the rope simply loosens and slides back through the loop and falls off the bull.

Bulls, as professional performers, often stop bucking when either the rider or the rider and the bull rope fall off. Many bulls know to stop bucking when the 8-second ride is up and the whistle blows. They then look for the gate that opens, because they know it leads back to the pen area where feed, water, and rest await them until the next performance. These bulls know that when they are turned out of the chute in the arena, they are to stay close to the chutes. The bulls are often walked through a practice walk, which involves going out the chute gate without a cowboy on their back, around through the arena, and back in the home gate that goes back to the rest pens. This is often done whenever they arrive at a new facility or if the setup is slightly different. It is the bull's practice performance before the crowd arrives and the cowboys ride. These stars are given every opportunity to become familiar with the facility in which they will be asked to perform. When conditions permit, most timed-event stock will also be run through event chutes and the arena prior to the start of contests.

That brings us to the subject of animal welfare for these bovine athletes. The care and handling of cattle in their natural outdoor environment looks rather crude and sometimes cruel to someone not familiar with bovids. However, just the opposite is most often the case. It is my hope that after hearing this presentation, you will understand how compassionate the people involved with the production, protection, and care of cattle really are. These people actually spend time learning to understand their animals' needs and habits in order to better work together for the mutual benefit of animal and human.

The Professional Rodeo Cowboy's Association (PRCA) is the gold standard by which all rodeo, whether backyard, high school, or amateur, is measured. Everyone who competes in rodeo aspires to be like the pros competing annually in the world championship events of the PRCA in Las Vegas, Nev, in early December.

The first rules for the humane care and treatment of rodeo animals were established by the PRCA in 1947, 7 years before the founding of the Humane Society of the United States.[1] Recently, the American Humane Association requested that the PRCA allow them to use PRCA rules as a part of their guidelines for the use of animals in motion pictures that include rodeo action.[2] The PRCA approved their request and accepted it as an appreciation of the extensive animal welfare rules the PRCA has enacted over the years. Many of these rules appear to be common sense to livestock people but may not be as straightforward to those unfamiliar with cattle.

The PRCA employs a full-time animal welfare coordinator to oversee internal and public education programs. Their Humane Advisory Committee meets twice each year to discuss pressing animal welfare issues, review rules, and make recommendations regarding animal welfare to the PRCA Board of Directors. One of the current PRCA rules requires veterinarians to be on site for all rodeo performances and sections of slack (individual competitive performances held at times other than during a regular rodeo performance in order to keep the number of runs down during a crowd-paying performance). Failure to have a veterinarian present at such a competition results in a fine. Animals for all events are inspected before the draw (pulling animal numbers out of a hat to see which 1 performs in each event) to ensure that no sore, lame, sick, or injured animals are permitted in the draw at any time. The stock contractor or committee is also required to have a conveyance available that is capable of removing an injured horse or bull from the arena. Injured livestock are humanely removed from the arena before continuing the rodeo contest or performance.

Rowels on spurs used by cowboys and worn on their boots must be dulled. No sharp or cutting objects in flank straps are permitted. In bull riding, a soft cotton rope with at least a 5/8-in diameter is acceptable as a flank strap. Rodeo chutes must be constructed so as to prevent injury to any animal. The performance arena must be free of rock, holes, and unnecessary obstacles. No stimulant or hypnotic may be given to any animal used for contest purposes. Any animal that becomes excessively excited and lies down in the chute, tries to jump out repeatedly, or in any way appears to be in danger of injuring itself will be released immediately. No stock can be confined or transported in vehicles beyond a period of 24 hours without being unloaded, properly fed, and watered. Failure to comply will result in a fine. If a participant abuses an animal by any unnecessary noncompetitive action, he or she may be fined and disqualified for the remainder of the rodeo. The penalty will double with each offense thereafter. Any participant guilty of mistreatment of livestock anywhere on the rodeo grounds will be fined.

At all rodeos, fresh calves may be tied down no later than 2 hours prior to their performance or section of slack. The tie-down must be witnessed by the judge of that rodeo, the calf roping event representative, or a duly appointed designee. The event representative may

declare particular animals unsatisfactory. The stock contractor will be notified, and the animal will be eliminated from the competition draw.

Other rules for the protection and welfare of performing cattle in rodeo competition are that plaster and rebar must be placed around the horns of cattle used for steer roping before the contest, and all steers should have horn wraps that extend 4 in down the jaw from the base of the horns. The horns of all cattle used for team roping must be protected by wraps. Animals that are used in contest events of a PRCA rodeo may not be used in any other way until after the last time that animal participates in contest events.

The PRCA rules also address minimum and maximum weights for performing bovids (calves for roping, 220 and 280 lb, respectively; steers for wrestling, 450 and 750 lb, respectively; team roping cattle, 500 and 650 lb, respectively). There are also time limits by which cowboys must abide: no more than 25 seconds for calf roping, 60 seconds for steer wrestling, and 30 seconds for team roping. Contestants may not run cattle around and around the arena until they are tired in order to rope or wrestle them. Through its rules and actions, the PRCA is committed to ensuring that rodeo events are as safe as possible for animals and cowboys.

The National High School Rodeo Association is also concerned with animal welfare and "has as its mission to promote the positive image of rodeo, preserve the Western Heritage and maintain the highest level of regard for livestock."[3] The International Professional Rodeo Association states, "Animal use is deeply ingrained in our society, benefitting the health of people, supporting commerce, and enhancing our enjoyment of life. The International Professional Rodeo Association acknowledges the valuable role of animals in rodeo and our responsibility to provide a proper environment for the animals in competition, in transport, and at rest. Through example and education, we strive to emulate professional standards of animal handling and to demonstrate sensitivity to the perceptions of the public."[4]

Many veterinarians and other animal experts believe that professional rodeo bucking animals enjoy what they do, and studies indicate timed-event cattle experience little or no stress as a result of rodeo activity.[5] The injury rate for professional rodeo livestock is extremely low, and treatment of the animals outside the arena is second to none. Cattle travel in trucks specially designed for their protection and are separated from horses while traveling and while in pens. They are unloaded, fed, and watered at least every 24 hours, and most contractors do this more often. These animals become used to traveling and, therefore, experience little stress during transport, according to Dr. D. C. Lund, a Canadian veterinarian.[5] The pens in which bovine athletes are kept allow for ample exercise, and contractors rotate their stock to prevent overuse burnout.

These animals represent a huge investment for stock contractors, who will not be in business long if their animals are not in top condition. These athletic animals become known and loved, not only by the contractors who own them but also by the cowboys who compete and make their living with them. Humane care and treatment of these animals is more than economics—it is a way of life. Many contractors even have cemeteries on their ranches designated for the great bovine and equine livestock that provide their living. Men like Harry Vold and Mike Cervi have been in the business of producing rodeo stock for more than 30 years. Mike is even a second-generation rodeo stock contractor. These men have established sophisticated cattle breeding programs on their ranches. Bucking animals are bred to buck and they appear to enjoy what they do. Extensive breeding programs involve selling semen from the best bucking bulls for $250 to $400/straw. Semen is artificially collected from bulls during the off-season or after they are retired; the process is similar for rodeo horses.

Many top bucking bulls have more economic value than beef breeding bulls. Because of their relatively simple life, many bucking bulls are still active at 15 years old, whereas a normal breeding bull used for beef production has exhausted its usefulness in 5 to 7 years on the ranch. Bulls that make the rodeo circuit work between 5 to 10 min/y and are cared for like stars. Several of the top bucking bulls have sold for $50,000 or more in recent years.

Steers are mostly Mexican-bred cattle called Corientes that have large stout horns, are leaner than most beef animals, and can run well. Sometimes Longhorn cattle are used, because they also have large horns, but they are not as consistent in their performance or stamina over time. Calves used in rodeo often reflect southern breeding influence. For example, the Brahman breed is quick, wiry, and able to run fast with lots of stamina. In addition, they are not as beefy as most other breeds and don't gain weight as rapidly; this permits them to have a longer performing life in the rodeo circuit.

Not all animals used in rodeo, however, are superheroes that end up buried on the ranch. The reality is that many cattle finally get too heavy or simply stop running or bucking and move on to their next professional performance as meat animals. These animals, most of which have rather short rodeo performing careers, do end up in the feedlot somewhere, finishing out their lives in a well-groomed feed yard with cowboys watching them for health problems and giving them ample space and all the best feed they can eat. To me, it's not such a terrible way to end your life. Someone brings you all the best food you can possibly eat whenever your plate is empty and watches over you for any sign of disease so that necessary medical attention can be provided.

In 1906, the state veterinarian began attending the Cheyenne Frontier Days Rodeo in Wyoming to oversee the humane aspects of the competition. This was the beginning of a long and prosperous alliance between large animal veterinarians and the sport of rodeo. In 1955, the PRCA began requiring an on-site veterinarian for all rodeo performances and sections of slack. On-site veterinarians not only provide veterinary care for all livestock but also conduct injury surveys. These surveys continue to provide data supporting claims that injury to rodeo livestock is rare. For these surveys, injury is defined as "a significant change, incurred

while performing, that would affect the animal's well being, general health and/or ability to perform."[6] The sport of rodeo and its relationship with the animal welfare community has changed as the animal rights movement has melded with the humane movement. The PRCA relies heavily on veterinary organizations such as the American Association of Equine Practitioners, the American Association of Bovine Practitioners, and the American Veterinary Medical Association to provide guidance on animal welfare issues.

A survey was conducted between August and September 1994 by on-site veterinarians at PRCA-sanctioned rodeos in the state of California.[6] During 915 runs of calf roping, only 1 minor injury occurred, and the animal fully recovered. Another study was conducted during 1998 and 1999 at 19 rodeos (small and large).[6] Of 27,767 animal exposures, 15 injuries occurred for an injury rate of 0.00054. In a more recent survey conducted by on-site independent veterinarians at 21 PRCA-sanctioned rodeos involving 26,584 animal runs, 15 injuries were documented, which constitutes an injury rate of 0.00041 or four-hundredths of a percent.[6] These figures refute critics' claims that livestock participating in rodeos are at great risk for injury.

Rodeo is becoming increasingly popular throughout the United States. Thanks to its exposure on television and sports networks, rodeo had more than 26 million viewers this past year in addition to the 20 or so million spectators that attended those rodeos. The membership of the PRCA is also increasing at a steady rate. This year 1 of its most successful cowboys, Roy Cooper, reached the $2 million in earnings mark for his career. In comparison, professional golfers may win as much as $1 million/game. As you can see, it is not the possibility of large monetary rewards that keeps cowboys competing. What keeps them competing is the thrill of competition and love for their livestock.

I hope you now have a better understanding of rodeo and its cowboys and that you recognize that cowboys genuinely care about the welfare of the livestock with which they compete. Rodeos and rodeo cowboys are governed by an organized body of individuals dedicated to overseeing the consistent enactment of rules set to preserve the safety of cowboys and their livestock. There is a strong bond between cattle that perform in rodeos, their stock contractors or owners, and cowboy competitors. This bond can be as strong as that between an owner and his or her pet. The health and well-being of animal rodeo performers are addressed daily, so that these animals can give their best performance and live the longest lives possible. Before anyone draws conclusions about rodeo, he or she should attend a live rodeo performance and experience the feeling of man and beast in competition, watching as they demonstrate their natural, inherited, and learned abilities. Animal welfare is and will continue to be a top priority for those who participate in rodeo.

*Compton S, Professional Rodeo Cowboys Association, Colorado Springs, Colo: Personal communication, 2000.

References

1. Jordan B. *Rodeo history and legends*. Montrose, Colo: Rodeo Stuff, 1994;2–35.

2. Schonholtz CM. Animals in rodeo—a closer look. *J Am Vet Med Assoc* 2000;216:1246–1249.

3. National High School Rodeo Association. *Rules, by-laws, and constitution*. Denver: National High School Rodeo Association, 2000.

4. International Professional Rodeo Association. *Bylaws and rules: IPRA policy on animal use*. Oklahoma City: International Professional Rodeo Association, 2000;34.

5. Professional Rodeo Cowboys Association. *Animal welfare: the care and treatment of professional rodeo livestock*. Colorado Springs, Colo: Professional Rodeo Cowboys Association, 2000.

6. Professional Rodeo Cowboys Association. *Animal welfare fact sheets*. Colorado Springs, Colo: Professional Rodeo Cowboys Association, 2000.