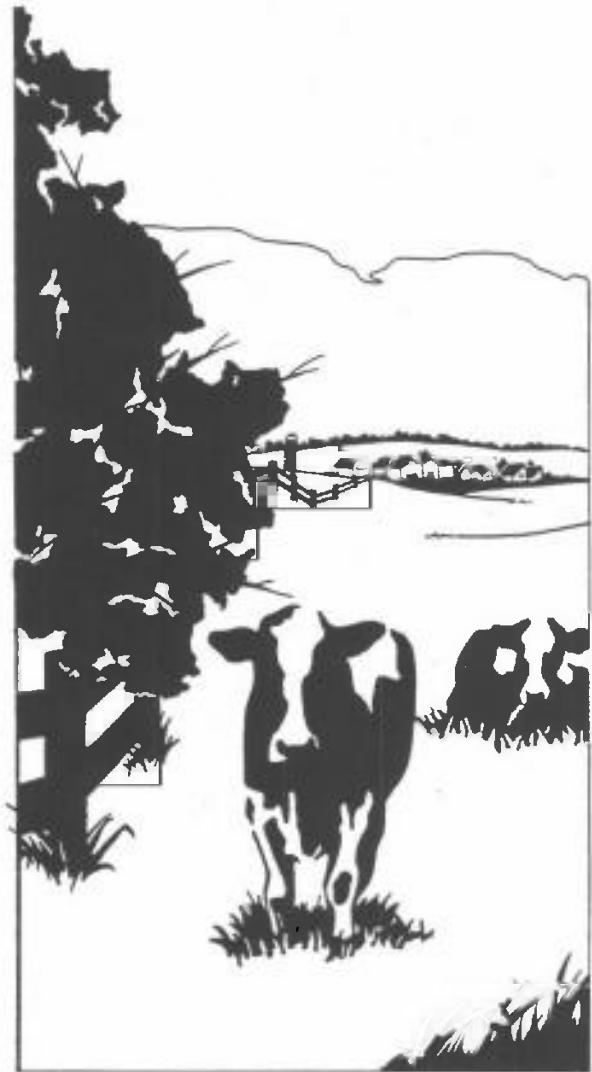


AVMA Animal Welfare Forum: The Veterinarian's Role in Farm Animal Welfare

November 5, 1993, Rosemont, Illinois



The following papers were submitted by the speakers at the 1993 AVMA Animal Welfare Forum, held at the Hyatt Regency O'Hare in Rosemont, Ill. The Forum concluded with the presentation of the 1993 AVMA Animal Welfare Award to Dr. Bernard Pinckney of Tacoma, Wash.

Contributions from the following sponsors ensured the success of the Forum: Hoffmann-LaRoche, Inc; Hartz Mountain Corp; Merck AgVet; SmithKline Beecham Animal Health; Idexx Laboratories, Inc; Eastman Kodak Co; The Upjohn Co; and Pitman-Moore, Inc.

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Dr. Richard C. Swanson
Executive Board

The theme of the fourth annual AVMA Animal Welfare Forum, "The Veterinarian's Role in Farm Animal Welfare," is indeed timely. Given this generation's increasing sensitivity to farm animal well-being, it is imperative that we address this issue head-on. The agriculture community is actively seeking advances in livestock production that will enhance the image of a caring, animal-welfare-concerned industry. This is where the food animal veterinarian must take a leadership role. The food animal veterinarian is viewed by those outside the profession as the ultimate advocate for animal well-being. This position requires that we take a leadership role in the development and implementation of acceptable humane standards in farm animal agriculture. Proper environmental conditions also must be stressed. This advocacy position ultimately leads to the task of improving communication and understanding among those with divergent views. Whether real or perceived, abusive or negligent care of food, companion, or exotic animals on the farm will no longer be tolerated. Veterinarians, as described in the AVMA Positions on Animal Welfare, "are obligated morally, ethically, and philosophically to promote the welfare of all animals." Veterinarians are at the right place at the right time. We must not default.

As a food animal veterinarian, however, I am confronted daily by two major animal welfare dilemmas. One is the conflict with the Federal Food, Drug, and Cosmetic Act. I cannot alleviate the pain and suffering of a food animal with the use of a sedative or analgesic drug, because there are no effective approved drugs available for that purpose. Even though I am permitted limited use of drugs for this purpose, this use is still outside the strict interpretation of the law. Another conflict is the economic reality of food animal production. Items that add to the producer's cost of doing business without providing direct economic benefit cannot be tolerated in most livestock operations. Therefore, the choice of performing a minor surgical procedure with or without sedation and analgesia or the decision to build or modify costly facilities must be economically justified to be acceptable to the industry.

We must strive to use a scientific basis for determining animal comfort. Judging comfort of animals by human standards is misleading. We can all identify with the discomfort of an obviously painful procedure, but acceptable environmental conditions vary with animal species, age, temperament, and physical condition. A cow adapted to the winter conditions, with her back to the subfreezing wind and still chewing her cud, is okay. We must not confuse human discomfort with sympathy for the cow. Conversely, when the crop duster's plane flies low over the barnyard, we know there is no danger, but horses quite likely will become extremely frightened. They may even crash the corral fence. Let us not project human psychologic characteristics on animals.

Some perceive that farm animal veterinarians, especially food animal veterinarians, may have a somewhat callous and cavalier approach toward animal well-being. I disagree. Certainly, people who handle thousands of animals can become numb. This Forum may well be a stimulus to their conscience. Farm animal veterinarians are indeed concerned about animal well-being, and accept the role and responsibility of leadership in farm animal welfare enthusiastically.

A special relationship: The coevolution of human beings and domesticated animals

Stephen Budiansky

Is mistreatment of farm animals pathologic or congenital? Is it an aberration that reflects the occasional ignorance or brutality of individuals, or is exploitation and abuse inherent in animal agriculture? Is it a few bad apples or is the barrel rotten?

The horror story has always been a staple of the humane movement, but of late, there has been a subtle shift. The stories increasingly portray the horror as inherent in the very act of confining animals, of using them for human ends, of denying them the opportunity to live out their lives free from human interference. The villain is not some sadist with an electric prod, but Farmer Jones—or rather, Farmer Jones, Inc—because the villain is invariably cast as some faceless, multinational corporation engaged in “factory farming” in its insatiable appetite for profit. Thus, Dr. Michael W. Fox of the Humane Society of the United States (a Washington lobbying organization not to be confused with the similarly named groups that operate local animal shelters) writes, “The meat industry is just one segment of the American agribusiness food production system that violates others’ rights in its monopolistic game of control.” Dr. Fox sees in animal agriculture—which he terms “the maintenance of life under wholly unnatural conditions”—not just specific abuses, but a sweeping “subjugation of life to the industrial system” and “the subordination of individual rights and autonomy to goals of efficiency and productivity.” Raising farm animals is a crime not just against animals, but against rights, nature, Mother Earth, indigenous peoples, the environment, migrant workers, spiritual growth, “transspecies democracy,” biodiversity, holism, and perhaps several other things that I have missed. Mere “animal welfarists” are hypocrites because they “accept the mass slaughter of animals for human consumption . . . with the patronizing proviso that the animals should be treated as humanely as possible.” Finally, Dr. Fox calls for the termination of all veterinary research into diseases

of what he terms “exploited animals,” because this only enables the exploitation to continue. (Somewhat inconsistently, Dr. Fox argues elsewhere that modern science and medicine are largely a hoax, have only compounded our ills, and have failed to cure diseases at all.)

Likewise, Peter Singer, the Australian philosopher who is sometimes called the father of the animal rights movement, writes in his book *Animal Liberation* that even with the best of care, keeping animals in captivity for human ends is akin to the institution of human slavery. “The steady supply of food on a farm is not an unmitigated blessing,” he writes, “since it deprives the animal of its most basic activity, the search for food. The result is a life of utter boredom . . . Surely the life of freedom is to be preferred.” Singer also argues that seeking to improve the care of farm animals is basically a futile exercise, because killing animals for food inevitably makes us think of them as nothing but objects, and that in turn makes mistreatment inevitable.²

That the domestication of animals is tantamount to their subjugation or exploitation is an idea that most of us, and by no means just animal rights, have come to accept without much thought. It seems obvious that we “invented” domestication, just as we invented fire, the wheel, plastic wrap, and power steering.

But, it is an idea that recent research in evolutionary biology and animal behavior has taken serious exception to. This research suggests strongly that domestication represents a coevolved relationship, analogous to many other mutualistic partnerships in nature, in which loss of defensive and self-sufficient behaviors in a species is more than compensated for by the gain of food, protection, or shelter afforded by close association with another species.

Let me be clear about what this idea does not imply. To point out the natural, evolutionary character of our relationship with domesticated animals is not at all to say that abuse does not occur, or to deny that some modern farming practices raise troubling questions about animal welfare.

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But, it does strike to the heart of the sweeping claims of anti-farming extremists, such as Dr. Fox and Singer, who seek to cast all animal agriculture as unnatural in its very essence, and who have, with mounting success, used those claims to establish a false standard for humane care. If the reference point for what constitutes acceptable treatment is what an animal in the wild would want—or, more precisely, what we in our naive, romantic, late 20th-century view of nature think an animal in the wild would want—then those whose real agenda is abolition of animal agriculture have a fairly easy time making their case that any treatment of an animal in captivity is cruel. We have seen that happen already. Many pamphlets that I have seen from animal rights groups aim their appeal in this direction. They talk about the cruel animals are supposed to suffer, not from what we usually think of as mistreatment, but rather from being denied the chance to smell fresh air, or to graze green grass. This is a way to be sure that the stock of “horror” stories never runs low.

This argument is wrong on biological and evolutionary grounds, but I think it is also wrong on moral grounds. That using animals for our ends inescapably leads to brutalization is an idea that would strike most of the farmers, veterinarians, and even hunters that I know as odd. People who have an understanding of the natural world from real experience, who perhaps are less squeamish than most of us about death and less romantic than most of us about life, have never found anything contradictory about caring for and respecting animals, even when these animals are ultimately destined for death at our hands. Yet today, fewer and fewer of us have these experiences; for example, fewer than 2% of Americans live on farms today. It is on the other 98% that these arguments, which cast domestication and animal agriculture as exploitative and even unnatural, fall with some success.

How have we come to see domestication as artificial and at odds with nature, something totally the work of human beings? Being only human, we all are guilty of wanting to cast ourselves as the stars of our own drama, and 20th-century views of progress have only reinforced this unfortunate tendency.

Even many scientists have tended to accept this view, at least tacitly. Archaeologists and anthropologists studying the rise of agriculture have rarely doubted that human beings made it happen; these scientists have focused their research on asking why human beings chose to develop agriculture when they did.³ Even zoologists have tended to dismiss domesticated animals as degenerates, molded by human beings.

But, there are a number of contradictions in the idea that the domestication of animals was just something that happened one fine Mesolithic morning when a cave man suddenly got the bright idea of bringing home a wolf pup. In fact, there are

plenty of good reasons why no hunter/gatherer would have adopted a life of raising crops and tending stock by free choice, and fundamental biological obstacles would have thwarted any hunter/gatherer determined to ignore good reason.

First, there is the extremely high failure rate of human beings as domesticators. Domestication involves a great deal more than just going out and grabbing an animal from the wild. Early European travelers to North America reported, for example, that American Indians kept raccoons and even bears and moose as pets, but none ever became domesticated species. Likewise, we know from ancient Egyptian records and pictures that that society, well-versed in animal husbandry—in fact, their entire civilization was really built on cattle herding—tried but failed to domesticate gazelles, ibexes, and even hyenas.⁴ By contrast, thousands of years earlier, the first agriculturists, woefully inexperienced by comparison, somehow managed to domesticate virtually every species that, even today, occupies a place of importance in our homes and fields. So, human intentions alone are not enough to explain what happened.

Second, some fundamental biological differences exist between domesticated species and their wild counterparts. Domestic species have, as a matter of innate behavior, and not just by training or socialization, a relative lack of fear, a docility, a high reproductive rate, and a number of juvenile characteristics that persist into adulthood, especially submissive food-begging and care-soliciting behaviors. Face-licking by adult dogs echoes the food-begging gesture of wolf pups; the way my sheep will nudge me or bleat at feeding time is strikingly similar to the behavior of nursing lambs. Where did these characteristics come from? Many people have raised raccoons, skunks, and wolves in human households, but even such tame animals are far from domesticated. They show a degree of aggressiveness, territoriality, and unpredictability, especially on reaching sexual maturity, that sets them apart from dogs and cats, for example. There is a paradox here: domesticated behavior is what makes domestication possible. It would seem that at least some of these domesticated traits somehow had to be in place before domestication could come to fruition.⁵⁻⁷

Finally, a wealth of recent archaeological research has undermined the idea of the rise of agriculture as a brilliant invention that made our lives easier. Human intention is not only insufficient to explain domestication; in some ways, domestication seems to run directly counter to human intention. Studies of human skeletons have chronicled a sharp increase in malnutrition, disease, and injury, and a drastic shortening of life span with the rise of agriculture. Of course, agriculture ultimately triumphed as a way of life, but that triumph appears to have been really only by force of numbers. An agricultural society can produce more food in a

given area than a hunter/gatherer society, and so support more people, but the quality of that life was initially much inferior. The work was much harder, the food was nutritionally inferior, and farming led to a sedentary way of life that provided the perfect medium for epidemics to spread. This sort of life was not something that an individual would have selected by choice.^{8,9}

What does this all mean? It means that if human beings are to make sense of how domestication occurred despite such enormous obstacles, we need to ask more than just what was in it for us. We need to look through the eyes of the animals and ask what was in it for them.

At this point, it is useful to cast our eyes about the animal kingdom. Our ideas about farm animals and their relation to us are so set that most people instinctively rebel at this notion. They find it absurd, or even quasi-mystical, to suggest that the animals could have taken the initiative, could have sought us out, as it were. But countless examples of mutual relationships in nature are just as remarkable, or even much more remarkable. It is just pure arrogance on our part to believe that domestication is so special that only human ingenuity could have come up with it, that nature could not possibly have fashioned it. One intriguing analogy involves a mutualistic relationship between aardvarks and a species of gourd in the wilds of southern Africa. This gourd is regularly found growing around the entrance to the aardvarks' tunnels. The gourd is the primary source of water for the aardvarks during the dry season; the aardvarks are thus saved a dangerous trip to the water hole. The seeds of the gourd germinate poorly unless they have passed through the gastrointestinal tract of an aardvark; because this animal buries its feces as does a cat, the seeds that are eaten are planted and fertilized in the bargain. The most interesting thing about this symbiosis is that this species of gourd is the only member of the melon and gourd family found in the wild that lacks a naturally occurring and quite bitter toxin. How did this happen? When we look at domesticated members of this plant family, like melons or cucumbers, we say that, of course, humans selectively bred these wild plants to eliminate the toxin. Was the aardvark so smart? Or maybe it was the plant that was so smart? The point is that you do not need to invoke volition and an external source of intelligence to explain the natural evolution of mutualistic relationships. Those wild plants that, through natural variation, produced slightly less bitter gourds—in other words, that dropped some of their defensive mechanisms—were more likely to be eaten by aardvarks and their seeds were more likely to be planted and fertilized. Thus, these plants were more likely to survive to the next generation.¹⁰

Human beings might well ask, what is in it for dogs and cats and sheep and cattle to associate with us? Again, a glance at nature is instructive. Many

nondomesticated species gain an advantage by associating with us. Raccoons, white-tailed deer, starlings, barn swallows, chimney swifts, house mice, black rats, and Norway rats gain food or protection from predators through their association with us. We did not take the initiative in any of these cases, and certainly not in the case of mice and rats, yet they are now supremely well-adapted to the environment of our houses. House mice and black and Norway rats have spread throughout the earth in the company of human beings, despite our best efforts to eradicate them. So dependent on us are they that, in most parts of the world, they compete poorly with local indigenous small mammals outside our houses. However, the loss of the defensive characteristics that allowed these animals to do well in the wild is more than made up for by the food, warmth, and incidental protection from other mutual predators afforded by their association with us.

By the same token, it is not at all hard to imagine wolves scavenging our garbage dumps, cattle and sheep raiding our grain fields, and cats invading our granaries in search of mice.¹¹ Again, individuals within the wild populations that, through natural variation, were less fearful and had less well-developed defense mechanisms were the animals that would reap the benefits with higher survival and reproduction rates. In effect, the niche created by human settlements was a fruitful and unoccupied one, ripe for invasion and exploitation.

Just as house mice have, over thousands of years, become adapted to this niche and have grown dependent on it, so too have farm animals. They are supremely well-adapted to this new environment that has been fashioned, to a large degree, by human beings. They have lost the traits they need to survive in the wild,¹² but they have gained much more. In evolutionary terms, these animals have been a brilliant success. Wild horses and wild cattle are extinct, and wild sheep are nearly so; yet their domesticated counterparts flourish and now cover the entire planet. Raymond Coppinger, a biologist at Hampshire College who has given this whole question a great deal of thought, puts it very well in "The Domestication of Evolution": "The fittest strategy of the future may be a system of more cooperative, interdependent relationships among

¹⁰This loss of survival skills is closely linked to the retention into adulthood of juvenile traits, an evolutionary process known as neoteny. All domesticated animals have a whole suite of juvenile traits. Adult dogs, for example, have much more puppy-like heads (domed heads, shorter muzzles, floppy ears) than have adult wolves; they also display many juvenile behaviors (playfulness, curiosity, care-soliciting, food-begging) that disappear in the wild type with maturity and with the activation of adult hunting and courtship behaviors. Neoteny may have begun in sheep, wolves, cattle, and other animals that would later be domesticated as an adaptation to the rapidly fluctuating environmental conditions of the ice ages, which would have placed a premium on flexibility and a willingness to explore new terrain; such neotenic traits could have "preadapted" these animals for their subsequent close association with man.

species that are more efficient and more reproductive than the highly specialized self-sufficient competitors which we used to imagine were nature's fittest. The King of Beasts will have been outcompeted by the house cat."⁷

This domestic alliance happened because it meant a real improvement, in evolutionary terms, over the alternative. Human beings tend to see nature—wild nature—as serene and perfect, whereas that which is touched by man is artificial and tainted, if not altogether ruined. Yet, the evolutionary forces that gave rise to domestication are testimony to the privation of life in this supposedly serene and pristine wild. These forces are the answer to Peter Singer's claim that "surely the life of freedom is to be preferred." Tell it to evolution; freedom is a profoundly mixed blessing, if by freedom we mean a life of self-sufficiency in the wild. You do not see parasitism and disease and predation and starvation very often in coffee table books or zoos or along the nature trails in the park, yet they are a real and terrible fact of nature. We should never forget just how remarkable and wonderful it is that, in a natural world full of stress, violence, and competition, nature should have fashioned a solution to the problem of survival that is based on co-operation.

The other lesson has to do with the evolved dependence of domestic animals on us. I have always been bothered by the way philosophical discussions about our relationships with animals get bogged down in what I find the sterile and pedantic terminology of rights. I try to be a natural historian in the old sense, in that I have always drawn insight and inspiration from nature, and I find the story of our shared evolutionary heritage with domesticated animals an inspiring one. To feel that

one is a part of this remarkable covenant that nature has fashioned gives it a meaning that is missing for me in arid discussions of rights. I think it means that we have a profound obligation to live up to our side of the bargain. We have gained immeasurably from this relationship; so, too, have domesticated species. But we can never forget that these animals that have cast their lot with us, depend on us to provide what they can no longer obtain on their own. Unquestionably, we have the means to abuse this relationship. I do not have any neat answers about where to draw the lines, but I am convinced that we need to start by understanding the biological and evolutionary realities that brought us to this point.

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Realities of contemporary livestock production

Gregg W. BeVier, DVM, MBA, and Beth Lautner, DVM, MS

Changes are occurring in agribusiness today that will restructure our livestock production industry. The primary factors responsible for these changes are capital and technology. The successful livestock producers in the future will be those who utilize these factors to assemble value chains that are based on quality. A value chain refers to the vertical cooperation among the participants in an industry. This cooperation may be in the form of a strategic alliance or integration. This type of association creates synergism to the benefit of all parties. Value chain cooperation can become a self-propagating series of events (Fig 1). The global pork industry is an appropriate model for illustration of some of the factors affecting contemporary livestock production.

The Competitive Frame

Global—Globalization of the competitive market place is reality. Communication technologies and the proposed reduction of trade barriers (eg, the North American Free Trade Agreement and the General Agreements on Tariffs and Trade) have accelerated this process. In addition, magnitude of international acquisitions, joint ventures, cross-licensing agreements, research pooling, and joint-marketing agreements among companies is increasing.

Pork represents 44% of all the meat protein consumed around the world. This makes pork the meat of choice, with beef a distant second at 31%.¹ The United States is ranked second in world pork production (Table 1). We have a strategic advantage with inexpensive feed, land availability, good animal health control, and adoption of key technology.

Economic—Three key macroeconomies appear to be in the process of evolution; the Americas (North, Central, and South), Europe, and Asia. Within each of these, we are beginning to see some evidence of market power by livestock producers. Market power refers to the ability, by a seller or a buyer, to affect the price of a good.² The opposite

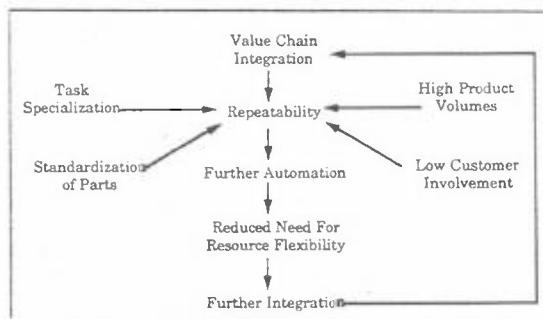


Figure 1—Driving forces in a value chain.

Table 1—World pork production and consumption

Rank	Country	Annual pork production (tonne $\times 10^6$)	World production (%)	Per capita pork consumption (kg)
1	China	28.00	41.8	23.3
2	United States	8.09	12.1	32.0
3	Germany	3.35	5.0	49.8
4	Spain	1.97	2.9	50.3
5	France	1.97	2.9	37.0
6	The Netherlands	1.57	2.3	42.4
7	Denmark	1.52	2.3	66.0
8	Japan	1.42	2.1	17.0
9	Italy	1.34	2.0	31.4
10	Brazil	1.20	1.8	7.0
Total			75.2	

of market power is perfect competition, which means that a single seller or buyer cannot affect the price of a good. There is evidence that the US poultry industry no longer represents a perfectly competitive market. Livestock production in the future may no longer qualify as a perfectly competitive market (Appendix).

Examples of failure of competitive markets are numerous. From a microeconomic perspective, these include monopoly (eg, toothpaste and soft drinks); oligopoly (eg, airlines and automobiles); and cartel (eg, Organization of Petroleum Exporting Countries and the National Collegiate Athletics Association). These changes can be caused by increasing market power with several key producers. For example, in commercial swine production, the 20 largest producers are responsible for about 10%

From Premium Standard Farms, Princeton, MO 64673 (BeVier), and the National Pork Producers Council, Des Moines, IA 50306 (Lautner).

of the total production. The percent market share for this segment is expected to grow over the next decade. In addition, information about market prices or product quality may be incomplete. This is true in markets with asymmetric information; the sellers of a product have better information about its quality than the buyers have. As value chains emerge, sellers are concentrating on process design to realize the value of quality. Integrated sellers understand the true market value of their products. Vertical cooperation will emerge in livestock agriculture as a component of quality and competitiveness.

Strategic—Various models help to describe the nature and degree of competition in an industry. The Porter Model (Fig 2) describes the forces that collectively determine the ultimate profit potential of an industry.³ These forces are the threat of new entrants, the bargaining power of customers, the bargaining power of suppliers, the threat of substitutes, and the key players in an industry. The forces that have the greatest impact on the competitive frame today are customers and regulations.

US Pork Production

Today's livestock producer is a food producer, obliged to provide a healthy, safe, quality product to meet the expectation of consumers. Over the past 20 years, the pork industry has shifted from a production-driven culture to a consumer-driven approach (Fig 3; Table 2). This cultural shift challenges producers to respond. Contemporary pork producers deal with muscle protein production at best cost. In general, quality meat production and cost to produce are directly related. Within an integrated system of operations, incremental quality improvements along each phase of product assembly can have extraordinary value creation in the end product (Fig 4).

Producers are developing value chains to assure consumers that the food they eat is safe and nutritionally valuable. Contemporary livestock producers are dealing with some key issues that have modified a number of historically accepted production practices. These issues include welfare practices, environmental practices, and systems designed for food safety.

Animal welfare is an important consideration as the livestock industry develops production systems and practices. In larger, integrated systems, there is more specialization and less opportunity for people to perform outside of given standards. Simply put, livestock producers care about animal well-being and are constantly striving to develop systems and practices that provide the best environment to meet the needs of the animal. Regardless of size or scope of operation, good production practices are possible. In the Veterinarian's Oath, veterinarians pledge "to use our scientific knowledge and skills for the benefit of society through the

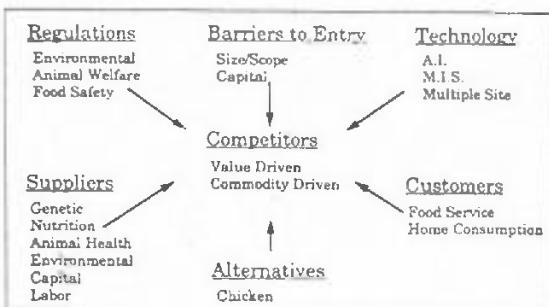


Figure 2—Competitive forces model for the swine industry. AI = artificial insemination; MIS = Management Information Systems.

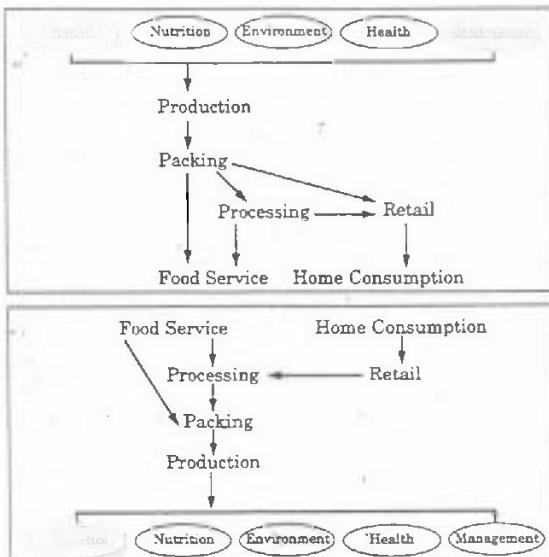


Figure 3—Components of a production-driven approach (top) and of a consumer-driven approach (bottom) to swine production.

Table 2—Characteristics of US swine production

Variable	Prior to 1970	After 1990
Genetics	Purebreds	Synthetic lines
Health care approach	Individual animal	Population
Environment	Extensive	Intensive
Nutrition	Least-cost weight gain	Best-cost lean gain
Management practices	Historical basis	Scientific basis
Veterinarians' role	Treatment	Prevention
End product	Commodity animal	Lean cut
Information	Unrecorded	Computer models
Research	Production efficiency	Production quality
Culture	Way of life	Food business

protection of animal health, the relief of animal suffering, the conservation of livestock resources."⁴ Veterinarians and animal scientists understand that the health and productivity of livestock depends on sound animal husbandry practices and humane care.⁵

The environment is a precious resource, and the industry has a responsibility to sustain its integrity to the best of its ability. Contemporary livestock producers understand their obligation to

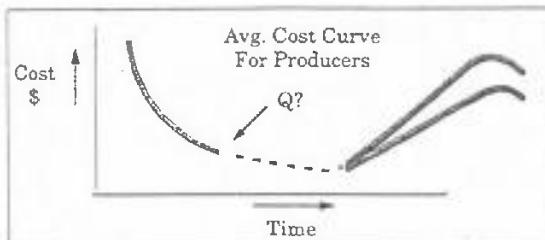


Figure 4—Comparison of commodity (curve on left) vs value-added (curves on right) approaches. Avg = average; Q = quality.

proper environmental practices; many are providing leadership to state and federal regulatory agencies in this regard. Environmental education is a key component to ensure that producers are implementing the best possible environmental strategy.

Preharvest food safety is important to provide a safe food supply to society. Food safety begins on the farm, and contemporary livestock producers devise production practices that optimize meat quality. Veterinarians are involved as an important link between producers and consumers in preharvest food safety.⁶

Conclusions

Livestock agriculture is evolving into a food business. Vertical cooperation, fueled by capital and technology, is a key factor responsible for this change. In addition, global market consumers are

stimulating the reconfiguration of livestock agriculture. Consumers want agribusiness to produce a safe, healthy, nutritious product, while maintaining acceptable environmental practices in conjunction with humane treatment of animals. There are numerous examples that agribusiness is responding to consumers. These responses must have a solid scientific foundation for adequate investigation of these difficult issues.

Appendix

Requirements for perfect competition

1. All firms produce an identical product.
2. Each firm is small in relation to the industry.
3. Easy for new firms to enter the market.
4. Existing firms can stay in business even if they start losing money.

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Farm animal welfare during handling, transport, and slaughter

Temple Grandin, PhD

The three major causes of welfare problems during handling, transport, and slaughter of livestock are poor management, equipment problems, and genetic problems. Examples of poor management are rough handling, abuse of nonambulatory (downer) animals, transport of day-old Holstein calves, and overloading of trucks. Equipment problems include sharp edges that cause bruises, back injuries on horses caused by transporting them on double-deck cattle trucks, and shackling and hoisting prior to ritual slaughter. Some examples of genetic problems are stress-susceptible hogs that have higher death losses during transport and nervous, excitable hogs, which are difficult to handle in a calm manner.

Management Attitude

Observations on several hundred ranches, farms, feedlots, and packing plants indicate that the single most important factor that determines how animals are treated is management attitude. Operations with humane livestock handling almost always have a manager who insists on humane handling, and operations with poor handling almost always have lax management or a manager who actually participates in animal abuse.¹ People who handle hundreds of animals can become numb. A strong manager acts as their conscience. To be effective, a manager must be involved enough in daily animal handling to care, but not so involved that numbness develops.

During the past 15 years, there have been definite improvements in animal handling in feedlots and packing plants. The percentage of operations that have good or excellent handling has doubled. However, the percentage with really bad handling has stayed at about 10%. At two of these operations, the manager thought that humane slaughter was stupid. One manager said, "It is just an animal." These problems can be observed in large and small operations. The size of an operation has little effect on the quality of animal treatment.

Management Problems

Rough handling—Rough handling is the most

important welfare problem. It is a major cause of injuries, bruises, and stress. Handlers and managers need to learn livestock behavior principles so they can move animals quietly and efficiently. Some of the most important principles are working on the edge of the flight zone and standing behind the point of balance at the shoulder to make an animal move forward.²⁻⁴ The flight zone is the animal's personal space. The size of the flight zone varies from 0 m for a halter-broke show steer to >30 m for wild cattle. Handlers who understand these principles can move all types of livestock calmly and quietly. In many cases, electric prods can be replaced with gentler driving aids, such as solid push boards for hogs and wands with plastic streamers on the end for cattle. Maintaining high handling standards requires sustained management commitment to continual incremental improvement of procedures. For example, employees must be constantly reminded not to overload crowding pens on ranches, feedlots, and slaughter plants.

Nonambulatory animals—Nonambulatory (downer) cattle are a major problem area. Less than 1% of the cattle handled and transported are downers, but these animals may suffer greatly. Dairy cattle are 75% of the downers.⁵ Downed cattle are often abused when they are dragged from trucks or scooped up with bucket loaders or forklifts. Several people from England and Denmark told me that they were shocked by the rough treatment of downed animals. It is absolutely impossible to humanely move a downed cow from the center compartment of a double-deck cattle truck unless the truck is equipped with side doors. Further information on handling of nonambulatory animals is available.⁶

The Humane Slaughter Act of 1978⁷ forbids dragging of conscious nonambulatory animals. Animals must be stunned prior to dragging. This law applies only to downed animals that are on the premises of a USDA-inspected slaughter plant. In a few slaughter plants, these regulations are rarely enforced. Interviews indicated that most western European countries, Australia, and New Zealand have much stricter regulations. In Denmark, producers have to pay to have a rendering truck

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remove downers. Such animals are not allowed at the slaughter plant. In Australia, downed cattle that arrive at the slaughter plant at night are often euthanatized and sent to rendering. In New Zealand, a downed animal cannot be sent to a slaughter plant until it is inspected on the farm by a veterinarian. In Canada, large slaughter plants have stopped accepting downers. Unfortunately, this practice may cause downer handling and slaughter to be done in uninspected facilities. Mobile on-farm slaughter units can solve welfare concerns of moving downed cows, but they will need stricter licensing and inspection to avoid food safety problems.⁵ From a welfare standpoint, euthanatizing downers on the farm would be ideal, and transporting them a short distance to a slaughter plant would be the next best solution. Transporting downed animals to auction markets is a bad practice, because the animal is subjected to a second stressful loading and unloading procedure. During the past two years, many auctions have stopped accepting nonambulatory animals.

The emphasis needs to be on preventing downer animals. I estimate that 75% of all downed cattle are preventable by good management. It is likely that 10% of the bad dairies are responsible for 90% of the downers. Observations by the author indicate that cattle with broken limbs are a small percentage of downers, and many downed cattle are weak and emaciated. Calving difficulties are a common cause of downers. Data from the USDA indicate that 26% of all dairy cow losses are attributable to calving problems.⁸ Another cause of downed and trampled animals is overloading of trucks. If a truck is overloaded, a downed animal is not able to get up because the other cattle will stand over it.⁹ Trucks should be loaded according to Livestock Conservation Institute guidelines.¹⁰ The incidence of downed cows can be reduced by use of ease-of-calving information, proper use of calf pullers, trimming hooves, nonslip floors, gentle handling, good nutrition to prevent metabolic problems, and prompt treatment of hypocalcemia (milk fever).

A survey conducted in New York indicated that 33% of the bob veal calves arriving at auctions were too young to walk.¹¹ This resulted in calves being thrown and dragged. Some people transported calves in the trunks of their cars. In Canada and England, the sale of day-old bob veal calves is forbidden.^{12,13} Abuse of such calves is a problem that may require legislation to correct. Legislation should specify that calves must have a dry hair coat and dry umbilical cord and be able to stand and walk without assistance before they can be transported or sold. Thousands of calves that have not been fed colostrum are traveling up to 24 hours to calf-rearing facilities. Mortality may reach 40%, and 10% mortality is considered usual. The dairy industry must stop this abuse.

Economic incentives.—Economic incentives can be powerful motivators to improve handling and transport practices. Rough handling and overloading of trucks will increase bruising. When producers switched from live-weight selling, in which the slaughter plant pays for bruises, to a carcass-based selling system, in which the feedlot pays for bruising, bruising was halved.³ The Japanese pork export market motivated slaughter plants to improve handling of hogs to reduce the prevalence of pale soft exudative (PSE) meat. When packers saw a Japanese grader rejecting >50% of their pork loins, they became motivated to reduce electric prod use and to rest their hogs in the stockyards prior to slaughter. These practices improve pork quality. A segmented market in the cattle industry causes many losses from shipping fever and stress. Producers are not motivated to vaccinate, dehorn, and castrate their calves if they do not receive a premium price. Observations indicate that in the southern United States, large numbers of 200- to 300-kg cattle are castrated at the feedlot. Horns on cattle double the amount of bruising.¹⁴ Cutting (tipping) horns at the feedlot is painful for cattle and does not prevent bruises.¹⁵ Removal of a large portion of the horn is stressful and reduces weight gain.¹⁶ To reduce stress, calves should be dehorned and castrated at the ranch of origin.

Calves transported directly to a feedlot are much healthier than commingled calves from an auction or order-buyer yard. Interviews in Australia indicate that shipping fever prevalence is much lower, compared with that in the United States, because cattle from different ranches are seldom mixed prior to transport. A recent National Cattlemen's Association Strategic Alliance study revealed that commingled cattle from different sources had double the death loss, compared with that of cattle from a single ranch. Vertical integration of the industry will help prevent some of these losses. When a ranch is under contract with a feedlot, all calves will receive vaccinations and be dehorned and castrated.

Unfortunately, economic pressures are often a disincentive to reduce problems, such as over-crowding of swine in a finishing pen. Even though the performance of each pig may decrease, over-crowding may increase the overall income from a confinement building. There is also little economic incentive to humanely handle nonambulatory animals and newborn Holstein bull calves. Insurance policies for livestock transporters should pay only for catastrophic losses. If the policy pays for all livestock losses, the transporter has no economic incentive to reduce losses.

Equipment and Procedures

Handling facilities—Great improvements have been made in the systems for handling cattle at

³Grandin T. Bonuses on southwestern feedlot cattle (abstr). *J Anim Sci* 1981;53:213.

ranches, feedlots, and slaughter plants. Curved chutes and round crowd pens with solid sides facilitate cattle movement because they employ behavioral principles.¹⁷⁻²¹ Cattle and sheep will move calmly and quietly through a well-designed, single-file chute for veterinary procedures or for slaughter. Proper layout is essential. Layout mistakes, such as bending a curved chute too sharply where it joins the crowd pen, can cause balking. Hogs handled in single-file chutes in large slaughter plants often become excited when they have to wait in line to enter the restrainer. These hog handling problems can be solved with two to four parallel, single-file chutes leading to several electric stunners,²⁰ or with stunning of small groups of hogs in CO₂. A prototype system built by the Danish Meat Research Institute has shown that 800 hogs/h, in five-hog groups, can be moved quietly into an elevator for CO₂ stunning.

Lighting can be used to improve animal movement. Animals will move from a darker place to a brighter place, provided the lights are not shining in their eyes. Lights can be used to attract animals into trucks at night or into chutes or restraint systems.²² Changes in flooring surface or shadows can cause animals to balk.²³ Animals balk at shadows or reflections of puddles because they fear novelty. In existing facilities, animal movement can often be improved by removing distractions that cause balking. In new facilities, mistakes in the placement of lights can ruin the performance of the best equipment. Addition of solid sides to single-file chutes and crowd pens will often facilitate movement. Cattle and swine movement can be facilitated by installing shields to prevent approaching animals from seeing people ahead. Equipment should be designed to minimize noise. High-pitched sounds and sudden loud noises, such as air hissing or metal clanging, are more disturbing to livestock than is a continuous low-pitched noise.

Nonslip flooring is essential to prevent injuries caused by falls. Quiet humane handling is impossible on slick floors. Animals can be handled humanely in older facilities, provided they are well-maintained and have nonslip floors. I have conducted humane audits of slaughter plants and research laboratories; slick floors were the most important equipment problem. Fences and other equipment must be free of sharp edges. Edges with a small diameter, such as angle and channel irons, are most likely to cause bruises. Bumping into a flat wall or a large round post will seldom cause bruising.

Restraint equipment—Cattle squeeze chutes must be operated carefully. In one study,²⁴ 1.6 to 7.8% of feedlot cattle were bruised when they were moved through a squeeze chute. On hydraulic squeeze chutes, the pressure relief valve must be properly adjusted to prevent severe injuries. Hydraulic squeeze chutes, when they are operated

correctly, are actually safer for cattle and people than are manual squeeze chutes.²⁵

Incorporation of behavioral principles into the design of restraint equipment will keep animals calmer and will prevent attempts to run or lunge through the device. The principles are preventing the animal from seeing people deep inside the flight zone; blocking the animal's vision of an escape route; slow, steady application of pressure; and optimal pressure. Blocking the animal's vision until the animal is completely restrained is important, especially for wild cattle with a large flight zone; this is much less important for totally tame animals.²⁶ Solid drop-down sides could be easily installed on existing squeeze chutes. Observations of a state-of-the-art upright restraint device in a slaughter plant indicated that slow, steady movement of the apparatus had a calming effect, and that sudden, jerky motion excited the cattle. A basic principle of restraint is that a restraint device must apply enough pressure to give an animal the feeling of being held, but excessive pressure that causes pain or discomfort must be avoided. A common mistake by animal handlers is to apply more pressure when an animal struggles.

Excellent restraining devices exist for holding livestock during stunning and slaughter.^{18,26-29} Research is needed to improve squeeze chutes used in large feedlots. Conveyored restraint chutes that are used in large slaughter plants could be adapted for feedlot use. These devices could almost eliminate neck and back injuries that occur in conventional squeeze chutes. They also provide the advantage of the calming effects of cattle constantly touching each other as they move through the restrainer.

Development of a good sow restrainer to replace snout snaring for blood testing also is needed. Use of a halter during blood testing will reduce discomfort to cattle. Nose tong use should be discouraged. Whole-body restraint with an electronic immobilizer is highly aversive and should not be used.^{30,31}

Transport—The four major problem areas in livestock transport are transport of large horses on double-deck cattle trucks, rest stops for long-haul feeder calves, transport of downer animals, and shipment of cull ewes to Mexico. Horses are often transported to distant slaughter plants in double-deck cattle trucks that have insufficient clearance. Large horses should be carried on single-deck vehicles. Possible abuses of cull ewes transported to Mexico for slaughter need to be investigated. Plants in Mexico that slaughter livestock from the United States should be required to comply with the Humane Slaughter Act.

For cattle and hogs, transport distances to slaughter plants are usually less than four hours. However, many feeder calves from ranches in the Southeast may be transported 2,000 to 3,500 km

to a feedlot. Regulations in Canada require a rest and feed stop every 48 hours for cattle and every 36 hours for swine.³² Too many rest stops can increase stress. The stress of loading and unloading has to be balanced against the benefits of rest and feed. Practical experience under US conditions indicates that feeder calves arrive in better condition if they can be delivered within 34 hours without rest stops.³³ An area that needs further research is rest-stop schedules.

Livestock trucks provide a rough, bumpy ride. Installation of pneumatic suspensions may help reduce stress and fatigue. In Australia, pneumatic suspensions have reduced stress and limb problems in long-haul cattle.

Stunning for slaughter—Properly applied captive bolt and electric stunning methods render animals instantaneously insensible to pain. Recommendations on the proper use of these methods are available.^{34,35} New electric stunning equipment developed in New Zealand for cattle is working well.^{36,37} The most common welfare problems associated with stunning are poor maintenance of captive bolt guns, improper placement of electric stunning electrodes, and low amperage. Sufficient amperage must pass through the brain to induce an epileptic seizure.^{35,38-40} Stunning with CO₂ provides the advantage of improved handling systems for hogs. However, there have been concerns about humaneness.^{38,41} Forslid⁴² found that the Yorkshire breed reacts well to CO₂. Humane concerns about CO₂ can probably be solved by careful monitoring of gas concentrations, and possibly, by avoiding use of CO₂ with certain genetic types of swine.⁴¹

Ritual slaughter—When ritual slaughter is being evaluated, the variable of restraint method must be separated from the actual slaughter procedure. In kosher slaughter, the animal's throat is cut without prior stunning. Some US slaughter plants that conduct kosher (Jewish) or Halal (Muslim) slaughter use cruel methods of restraint, such as shackling and hoisting a fully conscious animal by a chain wrapped around a hind limb.⁴³ In Europe, cattle are placed in a Weinberg casting pen that tilts them onto their backs. This method is more stressful than is an upright restraint device.⁴⁴ Casting pens are now banned in England and Denmark. In the United States, the industry is gradually removing shackle hoist systems and converting to upright restraint.

Many upright restraint boxes apply excessive pressure; separating reactions to restraint from reactions to the throat cut is impossible. Improved upright restraint devices have been developed.^{27-29,41,45} When these devices are operated gently, it is possible to observe the animal's reactions to the cut. In kosher slaughter, a special long, straight, razor-sharp knife is used. Observations of hundreds of animals indicated that cattle and

calves stood still during the cut. Cattle have a greater flinch reaction during ear tagging. Bager et al⁴⁶ made similar observations in calves. The incision must be held open during the cut to prevent the animal from reacting. With Halal slaughter of cattle, however, there are problems because special knives are not required. Cattle often reacted violently to multiple hacking cuts made with a knife that was too short. Fortunately, most Muslim religious authorities accept head-only reversible electric stunning or concussion stunning of cattle. In New Zealand, electrical head-only stunning is used on all Halal-slaughtered sheep and cattle. The meat is exported to Middle Eastern countries with the most stringent religious requirements.

Sheep lose consciousness within two to 15 seconds after both carotid arteries are cut.^{47,48,b} Cattle sometimes have periods of prolonged sensitivity.⁴⁹ Problems with prolonged consciousness can usually be corrected by making a rapid, fast, deep cut close to the mandible.⁴⁵ A slow, less decisive stroke greatly increased delayed onset of unconsciousness. Rapid loss of unconsciousness also can be facilitated by loosening the head holder and restraint of the body immediately after the cut. Ritual slaughter can be done humanely, but it will require more management attention to details of the procedure than with regular slaughter.

Handling and restraint stress—How stressful is handling, restraint, and slaughter? Tame animals are less stressed by handling procedures than are wild animals with a large flight zone. Dairy cattle had lower blood cortisol concentrations after restraint than had extensively reared beef cattle.⁵⁰ Animals with previous experiences with gentle handling will be less stressed than will animals with previous experiences with rough handling. Previous experience had a significant effect on temperament ratings in cattle.⁵¹ Animals can be trained to voluntarily enter a restraint device for a feed reward.⁵²

A review of the literature of blood cortisol concentrations during restraint, handling, and slaughter indicated that cortisol responses can be grouped into three categories: baseline values, farm handling values, and extreme stress values, which can be double or quadruple over farm handling values. Cortisol readings should be viewed in terms of these three ranges, instead of comparing absolute numbers. To fully evaluate stress, other measures should be made, such as heart rate, behavior, and other stress-related substances such as β -endorphin. Baseline values for cattle are 2 to 9 ng/ml.^{53,54} In two studies,^{56,57} values for on-farm handling and for restraint were 25 to 33 and 63 ng/ml for cattle^{54,55} and 73 and 72 ng/ml for sheep. In two studies,^{54,58} carefully conducted slaughter of cattle in a commercial plant induced values of 25 to 42 and 24 ng/ml. *Slaughter in a quiet research*

^aNangeroni LL, Kennett PD. Department of Physiology, Cornell University, Ithaca, NY. Unpublished data, 1993.

abattoir induced values of 15 ng/ml.⁵⁹ Cortisol concentrations can increase to 93 ng/ml in a Weinberg casting pen⁴⁴ and to 162 ng/ml in a cattle slaughter plant with poorly designed facilities.⁶⁰ The median value in that plant was 63 ng/ml.

In Europe, there is much concern about the stressfulness of head restraint devices for stunning and ritual slaughter. Use of a poorly designed head restraint device, with > 30 seconds required to catch the animal's head, resulted in greatly increased cortisol values.⁵⁸ However, low cortisol readings of 15 ng/ml were obtained in a head restraint device.^{59,c} To minimize stress, head restraint devices must be designed so that the animals will enter them without balking. Stunning or ritual slaughter must be done immediately after the head is caught.

When extensively reared, semiwild cattle are restrained in a head stanchion for husbandry or veterinary procedures, squeeze sides, pusher gates, or other body restraint devices should be used. Welfare concerns about restraint devices for cattle and sheep can be alleviated by proper design and operation. Up to 400 cattle/h will calmly walk into a well-designed restraint system. However, it is almost impossible to calmly and quietly move 1,000 hogs/h into a single restraint device for stunning. A well-designed restraint device is well tolerated by swine. Swine will sleep in a sling.⁶¹ Pressure on the sides of a pig will cause it to relax.⁶²

Genetic Problems

Overselection of animals for rapid weight gain and other production traits can cause welfare problems during handling and transport. Hogs with porcine stress syndrome (PSS) are more likely to die during transport and handling. At a single slaughter plant, swine from one genetic line were 10% of the daily production and 90% of the dead-during-transport. Hogs that are carriers of the recessive PSS (halothane) gene are leaner and have larger loin eyes, but they have the disadvantage of a higher incidence of lower-quality meat.⁶³ Marketing systems reward production of these hogs because slaughter plants pay on the basis of lean/fat thickness and loin eye size. Electronic systems for assessing pork carcasses for producer payment are unable to detect PSE. Research dollars should be allocated to develop accurate, quick methods for detecting PSE carcasses on the slaughter line. This system would make it possible to pay producers a premium for low prevalence of PSE. This economic incentive would motivate producers to stop breeding hogs with PSS and other genetic problems.

Other genetic problems include nervous, excitable hogs that are difficult to handle.⁶⁴ Fortunately, breeders are beginning to correct this problem. Excitability during handling can also be

^cShaw F. CSIRO Meat Research Laboratory, Brisbane, Australia: Personal communication, 1993.

reduced by providing environmental enrichment, such as straw or rubber hose toys, during growing and finishing.

Conclusions

Management attitude is the single most important factor in determining the quality of animal handling, transport, and slaughter. Good equipment provides the tools that make maintaining welfare easier, but such equipment is worthless unless good management is concurrent. Livestock handling has improved during the past 10 years, but further improvement is still needed.

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Welfare of companion livestock: Keeping large animals as pets

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Traditionally, livestock animals have been the primary focus of the US animal-based agriculture industry. Farmers and ranchers from all parts of the United States considered their farm animals as a source of income, whether that be a primary or supplementary source. In my area of veterinary practice in Texas, there are beef cattle, dairy cattle, and swine that provide food and clothing, as well as horses that are used as tools necessary for handling livestock and for additional sources of income. Over the past several decades, the number of horses obtained primarily for pleasure has increased, and more recently, an increasing number of farm livestock are being obtained for companionship and pleasure. There is evidence of this movement spreading throughout suburban areas across the United States.

As more attention is focused on maintaining large animals for pleasure and companionship, veterinarians and others concerned with animal welfare must acknowledge the human/animal bond between livestock animals and their owners. This bond has been well documented with respect to dogs, cats, and more recently, horses, rodents, and exotics. We can easily recognize the bond between young people and their show animals involved in 4-H and vocational agriculture programs. The closeness that develops between a young person and the show animal is a result of the care and time spent with the animal preparing for livestock shows. However, a similar relationship has existed between farmers and ranchers and their livestock for years. Veterinarians observe the bond between farmers/ranchers and livestock, as evidenced by the care given the animals during adverse conditions, or when attempting to cull an "open" (non-pregnant) cow that holds a special place, or when euthanizing a dairy cow when all available treatment has failed. Understanding this human/animal bond between livestock and farmers/ranchers aids veterinarians tremendously in communications with these clients. It also prepares us for the trend of raising livestock animals as pets that is developing in nonrural areas.

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In this time of decreasing populations in rural areas, many young people with farm or ranch backgrounds are moving into more suburban areas. A great number of these people prefer livestock, rather than the more traditional domesticated animals, as companion animals. This trend can be viewed as one of people bringing a little piece of their background and including it in their current lifestyle. We also are seeing this trend as an increasing number of urbanites move into suburbia and enjoy the fascination of having livestock animals as pets.

Veterinarians who consider themselves general practitioners are now in an unaccustomed position. They have become advisers on housing, space and feed requirements, public health concerns, and more modified health considerations of livestock as pets. In addition, veterinarians may become involved in the designing of backyard facilities necessary for restraint during examinations and/or treatment. Restraint often becomes the main obstacle in attending to these animals. Most horses can be handled without much effort in a backyard situation; however, a 450-lb bull calf tied to a picnic table is a perplexing and challenging situation when examination and/or treatment is necessary. These considerations of housing, nutrition, public health, and handling are essential when bringing free-roaming animals into a more confined living space, forcing veterinarians to become client educators in untraditional areas.

Ideally, educating clients about raising livestock as companion animals should begin prior to obtaining the animal, but unfortunately, this is not possible in many cases. All too often, veterinarians are faced with owners who have already purchased the animal and have taken it home. Whether the animal is a beef or dairy calf, a full-grown cow or bull, a miniature horse, pygmy goat, llama, or pot-bellied pig, the owner now seeks advice on immediate concerns, such as feed requirements and housing. In almost all instances, an on-site visit is necessary before providing proper recommendations. After the owners' initial questions are answered, they should be informed of local zoning and animal ordinances, of which they may be un-

aware. Many local governments are attempting to redefine and broaden these ordinances to include livestock animals, and this is an area in which veterinarians can become involved in an advisory capacity for city governments. Many of the owners' problems of facilities and housing can be resolved, as can be the cities' concerns of neighbor disputes and public health questions, as long as the maintenance of the animal's welfare under these circumstances is realized by the owners. Working with companion livestock owners and city governments is essential to the success of livestock in

suburbia, with the welfare of the animal being the binding force.

Keeping livestock animals in suburban environments is seen more frequently today. With the strength of the human/animal bond, unsolvable obstacles that would keep these animals from leading normal lives in a safe and well-cared-for environment are few. Issues of animal welfare will always exist; however, they can be held to a minimum as long as veterinarians continue to educate clients on all aspects of raising the animal as a companion.

Practices of concern

Ian J. H. Duncan, PhD

This review lists and discusses several practices in animal agriculture that are of concern from an animal welfare point of view. First, it is necessary to say what is meant by "animal welfare." In fact, it is probably impossible to give welfare a precise scientific definition. It has been suggested¹ that a broad working definition would be one that included the ideas of the animal in physical and mental health, the animal in harmony with its environment, the animal being able to adapt to the provided environment without suffering, and the animal's feelings being considered. A loose working definition of "suffering" is a wide range of unpleasant emotional states. More recently the idea has emerged that welfare mainly² or solely³⁻⁵ depends on what the animal feels.

In animal agriculture, the practices that cause most concern are those that lead to animal suffering, and such practices are dealt with in this paper. Perhaps in the future, we might strive to go further than this and actually promote positive emotional states in our farm animals. However, this day is probably some way off and, in the meantime, we can do a great deal for animal welfare by attempting to eliminate, or at least reduce, suffering.

Transportation and Preslaughter Management

This area of concern has been dealt with comprehensively earlier.⁶ It is listed here deliberately to reinforce the point that transportation and preslaughter management is responsible for a big decrement in welfare.

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I would go as far as to say that, of all the things we do to our farm livestock, the things we do in the 24 hours prior to slaughter reduce their welfare the most.

Elective Surgeries

By "elective surgeries," I mean procedures such as castration, mulesing, tail docking, debeaking/beak trimming, dehorning, toe removal (detoeing), teeth trimming, snood removal (desnoodling), dubbing, branding, ear notching, and ear tagging. Many of these procedures are performed to improve the long-term welfare of the animals involved (or at least to reduce the risk of sudden decrements in welfare later in the animals' life). For example, male swine and cattle are castrated to reduce aggressiveness between animals, which could lead to injury. Of course, castrated animals also are easier to manage, and there is probably a secondary welfare advantage because of the type of relationship that develops with the human caretaker. Tail docking and mulesing are performed on some breeds of sheep in some locations to reduce the risk of blowfly strike, a condition that would greatly reduce welfare. Dehorning of cattle, teeth trimming of pigs, and debeaking and detoeing of poultry serve to remove a potentially dangerous part of the anatomy of these animals, which under certain circumstances, could inflict injury on others. Tail docking in pigs, dubbing in chickens, and desnoodling in turkeys take the other route; parts of the anatomy that are at risk of injury are removed. It is taken for granted that these practices are justified because of the obvious decrement to welfare when

they are not performed and disease or injury develops. The other procedures listed, namely branding, ear notching, and ear tagging, are simple ways of identifying animals, and any deleterious effects are usually assumed to be minimal.

However, detailed examination of one of these procedures, debeaking or beak trimming of poultry, reveals that welfare costs, as well as benefits, may be involved. Feather picking and cannibalism have been problems for poultry keepers for many years and these behaviors are not confined to intensive husbandry conditions. Feather picking in gallinaceous birds consists of pecking directed at the feathers of other birds, and can range from gentle nibbling to vigorous pulling and removal of feathers. It may result in severe damage to the skin of the pecked bird, and may develop into frank cannibalism. Another, probably unrelated, form of cannibalism can be a problem when pullets reach sexual maturity; this starts as pecking at the vent and ends with the abdominal contents being pecked out. Feather picking and cannibalism obviously reduce the welfare of pecked birds by causing injury, pain, and eventual death. The poultry industry combats this vice by the practice of debeaking or beak trimming, in which in growing or adult birds, about a third of the upper beak is removed and the stump is cauterized by use of a heated-blade debeaker. A similar amount or less is removed from the lower beak. More recently, beak trimming has been performed routinely on newly hatched or several-day-old chicks. Precision machines are used, in which the end of the upper beak is pushed through a hole of precise dimensions in a metal plate and a powerful electric arc or laser beam burns a tiny hole through the tip of the beak. After about six to eight days, the end of the beak sloughs off. Outbreaks of feather picking sometimes are observed with birds that have had their beak trimmed at an early age, and repeating this procedure is then necessary. One study⁷ has revealed that beak trimming does not decrease feather picking; it makes the pecking much less efficient and so reduces the damage caused. Beak trimming is effective in preventing the worst of the damage caused by feather picking and cannibalism, suggesting that there are great welfare benefits to be gained from this procedure. However, evidence is now mounting that there may be costs as well.

Anatomic studies have revealed that the beak of domestic fowl is well innervated,^{8,9} and contains mechanoreceptors and nociceptors.¹⁰ Mechanical and thermal injury to this region might therefore be assumed to result in acute pain. However, neurophysiologic evidence does not support this assumption. Abnormal spontaneous activity was not observed in sensory afferent fibres in the trigeminal nerve after partial amputation of the lower beak by use of a heated blade, from immediately after surgery until 90 minutes later.¹¹ Abnormal pattern of response to cutaneous stimulation also was not

observed up to 4.5 hours following surgery. On the other hand, there is evidence for chronic pain following beak trimming. Neuromas have been shown to form in the amputated beak stump and afferent fibers running from the stump in the intramandibular nerve have abnormal spontaneous activity.¹² This activity is remarkably similar to the discharges originating from stump neuromas in human amputees and implicated in acute and chronic (phantom limb) pain syndromes. Moreover, when the behavior of the birds in that study before and after beak trimming was compared with that of a sham-operated control group,¹³ the behavioral changes that lasted at least 5 weeks after trimming were concluded to be almost certainly caused by pain. This finding was confirmed in a later study.¹⁴ Studies on the practice of beak trimming with a precision machine in day-old chicks are urgently required to determine if this process is less painful.

This neural and behavioral evidence suggests that the idea of beak trimming, being a short-lived discomfort for the bird, may be far from accurate; beak trimming causes a reduction in welfare through causing pain. The problem is that beak trimming is performed for the good reason of preventing or controlling feather picking and cannibalism, which can themselves cause great suffering. The producer is thus in a dilemma: Do I trim the beaks and cause pain or do I leave the birds' beaks intact, but risk an outbreak of feather picking and cannibalism? The evidence suggests that it is not possible to control feather picking completely by keeping hens in other, more natural, environments. The long-term solution will almost certainly be to select birds with a low tendency for feather picking and cannibalism. Primary breeders are reluctant to include selection against feather picking into their genetic programs because they would have to relax selection on other commercially desirable traits, which would put them at a disadvantage, compared with their competitors. However, there has been some success recently in selecting against feather picking by use of a kin selection procedure, which might appeal to the breeders as having less financial cost.¹⁵

What about the other elective surgeries that are routinely performed on farm livestock? Do they cause pain? Are there other welfare costs besides pain? The growing realization that there may be costs to the animal has meant that researchers are now starting to look for effects and, not surprisingly, are finding some. For example, when castration and tail docking of young lambs by use of tight rubber rings were studied,^{16,17} good correlations were found between physiologic and behavioral indicators of distress, and between these indices and the presumed intensity of the noxious stimulus. Castration plus tail docking caused marked distress for about 60 minutes, whereas tail docking alone caused mild distress for about 30 minutes. In a subsequent study¹⁸ in which the responses to castration by use of tight rubber rings were com-

pared in lambs, kids, and calves, good correspondence was found between physiologic and behavioral indicators of distress. The results also suggested that the distress caused by castration was greatest in lambs, intermediate in kids, and least, but not necessarily absent, in calves. In swine, surgical castration caused changes in behavior that were indicative of pain, which lasted for 30 minutes in two-week-old pigs; more severe behavioral changes, which lasted for six to eight hours, were observed in seven-week-old pigs.¹⁸ Moreover, local anesthesia prevented the pain-induced behavioral changes for two-week-old, but not for seven-week-old, pigs. In a later experiment,²⁰ pigs had similar behavioral responses to castration, whether castrated at one, five, 10, 15, or 20 days of age. There was evidence from weight gains that favored castration at 14 days, rather than one day, of age. None of the analgesics evaluated in this study was effective in influencing the behavioral changes associated with castration.

These studies suggest that the animal must pay a welfare cost when castration or tail docking is done. The cost may differ, depending on species, age when the procedure is performed, and method that is used; if these procedures are to be continued, it behooves us to find the combination of factors that entails the least cost to the animal. However, in the long term, perhaps we should be questioning whether the procedures are necessary at all. There is great interest in Europe in trying to achieve market weight in male swine and cattle before there are behavioral and boar taint problems. The cattle and swine industries may follow the example of the poultry industry, in which males are no longer castrated. I am not suggesting the immediate abandonment of these procedures; in general, they are performed to protect long-term welfare. Instead, some sort of cost-benefit analysis is needed. If the welfare costs are found to be minimal, then perhaps we should allow the procedures to continue. If, on the other hand, the welfare costs are substantial, then we should be seeking alternative solutions.

What of elective surgical procedures that are performed for some reason other than improving long-term welfare? An example would be tail docking in dairy cows to improve hygiene and the comfort of human milkers.²¹ Because there is no obvious long-term welfare benefit to cows having their tails docked, I would suggest that this procedure would only be justified if the welfare costs were zero or minimal. Further, it might be prudent to refrain from performing this procedure until it is properly investigated and the costs are measured.

The costs associated with marking animals, particularly with branding, also have been investigated. For example, in experiments with calves²² and with cows,²³ freeze branding caused less short-term pain than did hot-iron branding. Freeze branding also caused only mild reactions in horses.²⁴

The cost-benefit analysis that I am advocating will not be easy. Cost-benefit analysis is anything but an exact science. However, if we do not admit that these routine surgical procedures have costs and at least attempt the exercise, then we will continue to deceive ourselves.

Designing Husbandry Systems to Suit the Animals

The aspect of animal agriculture that has been most severely criticized by animal rights and protection groups is the artificial and intensive nature of the husbandry systems that are provided.²⁵⁻²⁸ This single topic could occupy volumes, which is not to say that a lot of good, objective information is available. However, it has become increasingly obvious that some husbandry systems currently in use probably reduce welfare. The systems that have received the most attention are battery cages for laying hens; individual stalls, with or without tethers, for pregnant sows; and crates for veal calves. An examination of one of these systems, battery cages for laying hens, will reveal how complicated this topic is.

The extreme artificiality, physical restriction, and degree of crowding provided by the cage have all been condemned. Often ignored is that battery cages, for all their faults, actually have some welfare advantages, such as small group size and hygiene. A good argument can be made for trying to retain the advantages of the cage, while modifying it to overcome its shortcomings. One of the major criticisms has been that much of the natural behavior of the bird will be frustrated by caging.²⁹ Later research³⁰ established how hens respond behaviorally when they are subjected to frustrating situations in the laboratory. Surprisingly, these behavioral signs of frustration are not generally seen in battery cages. However, there is one notable exception; many hens, particularly those of light hybrid strains, had signs of severe frustration in the hour before they laid an egg.^{31,32} Therefore, with regard to frustration, the biggest problem with the battery cage is that it does not provide a satisfactory nesting environment for many hens.

It is possible (but highly unlikely) that a hen with signs of frustration may be acting rather reflexly and may not be feeling frustrated in the same way that a human being would feel under similar circumstances. However, techniques have been developed to "ask" a hen that is about to lay an egg how important a nest site is. These techniques involve placing a hen in the prelaying phase in a runway where she can see a nest box at the far end. To reach the nest box, she has to work by pushing open a weighted swing door. In experiments of this type,³³ hens worked extremely hard, as hard as they would work to reach food after 24 to 30 hours of food deprivation, to reach the nest box.

Considering this evidence, the frustration responses and the hens' readiness to work for access

to a nest site, the major short-coming of the battery cage seems to be its lack of a nesting place. The problem of how to modify the cage to take account of frustrated nesting is now being tackled by various groups in Europe.³⁴⁻³⁶

Of course, the battery cage may be less than ideal for other reasons (eg, it may cause injury or lead to discomfort, it may frighten hens or lead to boredom, or it may crowd birds uncomfortably close). These problems can be, and are being, researched in a similar way to that used to study frustration. For example, projects are ongoing on the effects of cages on injury,^{37,38} fear and ways of alleviating it,³⁹ and spacing behavior.⁴⁰⁻⁴³ There is no reason why the results of all these studies could not be used to modify the cage to make it much more acceptable to hens and to the general public.

Nesting behavior has been discussed in some detail and has been shown to be extremely important to domestic fowl. However, other behavioral systems (eg, foraging, dust bathing, sexual activity, and perching) may be constrained by intensive housing, and these behaviors require investigation. A start has been made, but much remains to be done.⁴⁴

The method described earlier, of asking animals what they prefer and measuring their strength of preference, augurs well for the future. The best way of gaining insight into what animals feel (which is what welfare is all about) will be by the preference test and by developments of the preference test. There are pitfalls in this method, but when these problems are recognized, steps can be taken to avoid them.⁴⁵⁻⁴⁷

Veterinarians are well trained to make judgments on welfare on the basis of evidence dealing with the health and physiologic condition of the animals in question. They are much less well-equipped to make judgments on the basis of animal behavior. Veterinarians must keep abreast of the latest findings on the causation and motivation of animal behavior if they are to provide leadership in this area; for example, they should know something of the theoretical background of behavioral needs.^{48,49} Drawing conclusions about whether or not a particular husbandry system will allow the performance of certain behavior patterns is fairly easy. Knowing whether the animal actually wants to behave in that way is another matter entirely. The latter knowledge is just as important as the former.

Fast-growth Problems

"Fast-growth problems" include such conditions as ascites, sudden death syndrome (flip-over), deep pectoral myopathy (Oregon disease), and various skeletal disorders that are becoming increasingly common in poultry species selected for fast growth rate. If the genetic selection procedures that are currently practiced on poultry species for meat production are adopted by other sec-

tors of animal agriculture (and there is no reason to think that this will not happen), then we may expect to see similar problems in other classes of livestock selected for fast growth. These disorders (apart possibly from sudden death syndrome) will likely reduce welfare, through causing pain or causing the animal to feel unwell.

An increasing incidence of skeletal disorders in poultry used for processed meats has been reported.⁵⁰ In chickens, these skeletal abnormalities are diverse,⁵¹ whereas in turkeys, they are mainly limited to degenerative hip lesions.^{50,52} These degenerative hip disorders in adult male turkeys have been shown to result in a state of chronic pain, which inhibits locomotor and sexual activity.⁵³

The problem of ascites also has received much attention in recent years.⁵⁴⁻⁵⁷ There have been no investigations into whether or not these syndromes are accompanied by suffering, but it would seem likely that they are. Attempts to solve the problem by manipulating the environment have been only partially successful, and the long-term solution seems likely to be in selecting birds for heart and lung function.

The ultimate solution to these fast-growth problems must lie in the hands of the breeders. Many of them are now paying much more attention to the birds' legs and walking ability and to growth-plate quality in their breeding programs, and these efforts should soon be reflected in a reduction in leg problems. Perhaps with a little ingenuity, they could also consider heart and lung function, and thus try to reduce the incidence of sudden death syndrome and ascites.

Conflicts Between Short-term and Long-term Welfare in Breeding Stock

This problem is related to the previous one except that, rather than being a problem of production animals, it manifests itself in breeding stock. For broiler breeders and breeding sows to reach and maintain good reproductive condition, they have to be kept under severe food restriction, which means that they are hungry for much of the time. There have been several reports⁵⁸⁻⁶² of food-restricted broiler breeders having behavioral and physiologic signs, which probably indicate reduced welfare. A similar story appears to be emerging with regard to breeding sows. In fact, hunger appears to be one of the main causes of stereotypes in pregnant sows kept in stalls.^{63,64}

Rather, like some of the elective surgeries, food restriction is performed for a good reason, to keep the animals in good reproductive condition and to prevent them becoming obese, a condition that would itself reduce welfare. Once again, the producer is in a dilemma: if the animals are fed to satiate their appetite, they will become obese and long-term welfare will be reduced; if they are restricted, they have signs of extreme hunger and

stress. An interim answer may be to reduce the nutrient density of their diet so that they spend more time in feeding each day. Another solution (at least with poultry) might be to use intermittent lighting schedules, which would mean that more of the available light period would be occupied with important maintenance behavior. However, animal breeders will have to realize that they cannot proceed indefinitely to select for growth rate and appetite without running into problems with the breeding stock, which have to be maintained in a nonobese state. Once the breeders recognize this is a problem, they hopefully will seek some means of remedying it.

Conclusions

Some practices in animal agriculture reduce welfare. However, knowledge about how to recognize states of reduced welfare and about procedures and conditions likely to induce these states is increasing. I am therefore confident that the science of animal welfare is progressing at a satisfactory rate. I am less sanguine about the application of this knowledge, particularly in North America. We can do better. Let us hope that animal producers will realize that a responsible industry will do better.

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Animal welfare in Europe

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The importance of animal welfare in Europe is illustrated by the participation of all European Community (EC) member states (and many non-EC countries) as contracting parties to the Council of Europe Convention for the Protection of Animals Kept for Farming Purposes.¹ The general principles embodied in that convention, therefore, constitute a common welfare policy throughout Europe. This policy has been implemented by means of recommendations that establish common welfare standards for individual species. The EC, being a contracting party in its own right, is obliged to implement the recommendations by means of Community law.

The EC became a party to the Council of Europe Convention for the Protection of Animals Kept for Farming Purposes

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rope Convention for the Protection of Animals during International Transport² in 1979. Welfare at slaughter is the subject of Council of Europe and EC policy.³ In fact, the Council Directive⁴ of Nov 18, 1974 on stunning animals before slaughter was the first Community law on farm animal welfare. The reasons for such legislation were that disparities in national legislation concerning protection of animals may directly affect function of the common market, and that the Community ought to take action to avoid, in general, all forms of cruelty to animals.

A Commission of the European Community budget is now specifically voted for animal welfare studies, which are commissioned from consultant experts. In 1987, commissioned studies included the keeping of pigs and calves, transport, stunning, and information exchange among EC countries in

farm animal welfare, resulting in proposals to the Council in 1990.⁵⁻⁷

The Commission's objectives are clear: "The improvement of the welfare of animals from which we profit and for which we bear the responsibility of care."⁸ However, in the past year or so, proposals from the Commission have been delayed by consideration of the vexed question of subsidarity. However, a proposal on transport is anticipated, and discussions about EC controls for the welfare of animals on farms and at the time of slaughter will hopefully continue.

Many other national organizations contribute to the improvement of animal welfare within Europe. The more important ones are represented on the Eurogroup for Animal Welfare, which serves as a two-way channel of communication between these organizations, the Institutions of the EC (Council of Ministers, Commission, European Parliament, and Economic and Social Committee), and the Council of Europe.

The policy of the Eurogroup is to bring together, in friendly cooperation, the leading welfare organizations of the EC, to participate in public policy decisions via the legislative process, and to encourage humane treatment of animals by increasing public awareness and encouraging responsibility toward fellow creatures. Policy, of course, has finally to be formulated and effected by governments, increasingly acting together in an EC context, and some mechanism must exist for deciding what constitutes welfare improvement.

The EC countries differ in the extent to which they have a designated body with responsibility for animal welfare. The UK government, for example, does not have a single organization with overall responsibility for the welfare of all animals. The Agriculture Departments have the responsibility for farm animal welfare, whether the animals are on the farm, in transit, at markets, or at slaughter.

The Farm Animal Welfare Council (FAWC), an independent body that is serviced and funded by the Ministry of Agriculture, Fisheries, and Food, advises the UK Agriculture Departments. The Belgian Ministry is advised by an independent council, and, within the European Community, similar bodies exist in Denmark, France, Germany, and The Netherlands. Advisory bodies of this kind assess issues of animal welfare, and because considerable resources are needed to examine systematically and comprehensively all the major issues, the natural tendency is to focus on those issues of greatest public concern. The EC countries vary widely in the organizational manner in which these matters are considered (Table 1).

All these bodies are advisory, and governments are free to consult widely and to take or reject the advice offered by these groups. Pressure groups, some representing welfarists and some the parts of

⁵MacSharry R. Speech presented to the Parliamentary Intergroup on Animal Welfare, Feb 13, 1990.

Table 1—Animal welfare organizations established in European countries by their governments

Country	Name of welfare organization	Ministry
Belgium	The Animal Welfare Council	Agriculture
Denmark	The Ethical Council Concerning Animals	Agriculture
France	No council; several commissions	Agriculture and Forestry
Germany	Commission on Animal Welfare	Food, Agriculture, and Forestry
Iceland	Committee on Animal Welfare	Not known
The Netherlands	Council on Animal Matters	Welfare, Public Health, and Culture
Sweden	Standing National Committee for Animal Welfare	Agriculture
Switzerland	No council; division for animal welfare	Federal Veterinary Office
United Kingdom	Farm Animal Welfare Council	Agriculture, Fisheries, and Food

the livestock industry most affected, exert their influence.

Increasingly, governments' actions are harmonized throughout the EC-member countries, but there are concerns about the extent to which agreements, directives, and regulations are implemented, monitored, and enforced in various countries. A powerful European Inspectorate must be the ultimate answer to this kind of problem but, although discrepancies develop, there is resistance to controls being applied that would put livestock producers in one country at a competitive disadvantage with those of countries not following the rules. In fact, the concern that advances in animal welfare may impose costs not borne by competitors, whether within the EC or from outside it, is one of the major constraints on progress in this area.

Economic Issues

No nation can easily put its own producers at an unfair disadvantage, and the economic consequences of welfare regulations, therefore, have to be considered carefully. It does not follow that advisory bodies should consider these consequences, partly because it requires other skills and partly because ministers need to have advice about action that is in the interest of welfare, unclouded by attempts at economic forecasting. However, economic consequences cannot be totally ignored; they are bound to influence the extent to which recommendations are accepted and implemented, and the survival of those on whom controls are imposed.

A major issue, therefore, is whether better animal welfare necessarily involves higher costs or lower profit. Clearly, some improvements to animal welfare incur additional costs, especially if there is already heavy capital investment in the existing system.

For example, whatever the merits or demerits

of battery cages for laying hens, most hens are kept this way, and major changes would mean fresh capital investment on a massive scale. Of course, no equipment lasts forever, so there are opportunities for changing the form of inevitable reinvestment. This is a separate issue from whether the new system has higher operating costs or not. Extra costs do not necessarily lead to lower profit, however, particularly when better welfare leads to increased performance, lower disease incidence, or reduced mortality.

A problem has always existed, however, in relation to individual animals. I pointed out some time ago that veterinary attention to individuals could only be afforded for very valuable animals.⁸ Hens and sheep do not fall into this category unless they are special breeding stock. This point emphasizes the welfare advantages of disease prevention, but the problem of individual treatment, even if sick or injured individual animals are identified, still exists in situations in which more and more animals are being kept per unit of labour.

These problems reinforce the idea that animal welfare improvement really does need common action throughout Europe (though this action does not solve the problem of imports from non-European countries with lower costs because of less attention to animal welfare). In any event, production costs are often only a small proportion of the retail price, and consumers may increasingly decide not to purchase animal products from poor welfare systems.

Production Systems

The temptation may, therefore, be to label animal products as having come from good welfare systems but, apart from all the usual problems of labeling and the difficulties and costs of the inspection and monitoring necessary to give credibility to such labeling, there are almost insuperable difficulties in the concept. Take, for example, the common public perception that "free-range" egg production represents a good welfare system. To ensure this was true, such a system would have to be prescribed in enormous detail (eg, how many pop-holes, facing in what direction, shelter in the range area, floor space, design of nest boxes, perches, flooring). But any such system could be rendered a poor welfare system by too high a stocking rate or by poor stockmanship. Such a detailed description cannot be put on a label, so the short description would have to relate to detailed standards, available in written form and confirmed by inspection.

Some systems can be regarded as fundamentally bad, but few can be considered as good, unless they can be shown to embody all the accepted welfare criteria and to be well-operated. The UK FAWC gives considerable attention to specifying such criteria, and UK Agriculture Departments publish Codes of Practice based on these criteria (Appendix 1).

The Farm Animal Welfare Council

The FAWC is an independent council of about 23 members appointed by the Agriculture Ministers. The Council's remit is "to keep under review the welfare of farm animals on agricultural land, at markets, in transit and at the place of slaughter, and to advise the Minister of Agriculture, Fisheries, and Food and the Secretaries of State for Scotland and Wales of any legislative or other changes that may be necessary."⁹ The FAWC is authorized to investigate any topic falling within its remit.

The FAWC's advice is based on scientific evidence whenever possible. When this evidence is unclear or lacking or when more than one interpretation is possible, there may be doubt; in such cases, the animal is generally given the benefit of the doubt.

The FAWC operates through working groups (of council members), currently including Research and Development Priorities, New Husbandry Methods and Equipment, Extensive Husbandry, Promotion and Education, Turkey Production, Fish Farming, and a Review of the Government's Welfare Codes. Some of these groups are more or less permanent, reporting regularly to the FAWC; others study a topic (for months or years), then make a report. The FAWC may decide to publish a report as a result of this activity (Appendix 2). Increasingly, the FAWC has been interacting with similar organizations in the rest of Europe.

Liaisons with Other European Countries

To improve links between European animal welfare councils (distinct from pressure groups and campaigning organizations), the FAWC and the Belgian Animal Welfare Council have launched a newsletter, to which all councils are invited to contribute. This letter publishes lists of past, present, and future work, so that each council can make use of past work by others whenever they wish to do so. Examination of this list should save each council from having to start a study from the beginning, in ignorance of existing reports.

The newsletter also makes cooperation and collaboration possible, whenever appropriate, but each council normally has, as its first duty, giving advice to its own ministers. A need for such a publication will continue, if only because conditions and degree of care vary from one country to another.

Even so, there are strong arguments for the EC to ensure that animal welfare standards are uniform across all member states and that these standards are uniformly applied, monitored, and enforced. As mentioned earlier, this is already EC policy. Such standards have to be based on agreement between member states, and this agreement might be eased if advice came from a single European body. The views, conclusions, and recommendations of such a body also would carry more weight outside the EC, as well as within each member state.

Perhaps a first step would be to explore the possibility of collaborative study by the advisory councils of the EC. If ever there are to be internationally recognized standards, they are more likely to arise from agreement between groups of countries who already have agreement within them.

Conclusions

It would be too much to claim that there is, as yet, discernible progress in coordinating advice from the advisory councils of member states; it is not even certain that this coordination is necessary or desirable. But the mechanisms for concerted EC action already exist and operate. These actions are regarded with varying degrees of support in various countries and between the people within those countries. It is hard to say how important animal welfare is considered to be by the public in each country, but the trend appears to be toward increasing concern.

A distinction must be made, however, between "positive" welfare (the aim of the FAWC) and the avoidance of cruelty (already against the law in the United Kingdom). "Positive" welfare for the FAWC is based on trying to achieve the "Five Freedoms" for farmed animals (Appendix 3). Public feeling about cruelty would certainly be much stronger than feeling about failure to achieve all these freedoms.

Understandable differences of view also exist with regard to various animal species, even within the so-called "sentient" animals, and views are colored by whether animals are attractive, useful, harmful, disease risks, or pests. These differences suggest that a coordinated advisory body also might have a useful role in clarifying and informing public debate in this area.

Appendix 1

Publications that were based on advice from the Farm Animal Welfare Council (FAWC)

Year	Code
1979	Code of Practice for the Welfare of Horses, Ponies and Donkeys at Markets, Sales and Fairs
1981	Code of Practice for the Care and Feeding of Farm Animals in Government Approved Export Lobbies
1983	Code of Practice for the Transport by Air of Cattle, Sheep, Pigs, Goats and Horses
1983	Livestock Shipments on Roll on/Roll off Vessels
1983	Codes of Recommendations for the Welfare of Livestock: Cattle
1983	Codes of Recommendations for the Welfare of Livestock: Pigs
1987	Code of Practice on Abattoir Slaughter of Farmed Deer
1987	Codes of Recommendations for the Welfare of Livestock: Domestic Fowl
1987	Codes of Recommendations for the Welfare of Livestock: Turkeys
1987	Codes of Recommendations for the Welfare of Livestock: Ducks
1987	Codes of Recommendations for the Welfare of Livestock: Rabbits
1989	Guidelines for the Transport of Farmed Deer
1989	Codes of Recommendations for the Welfare of Livestock: Farmed Deer
1989	Codes of Recommendations for the Welfare of Livestock: Goats
1990	Codes of Recommendations for the Welfare of Livestock: Sheep
1990	Code of Practice for Animals in Livestock Markets
1991	Code of Practice on the Welfare of Poultry at Slaughter
1992	Code of Practice on the Welfare of Red Meat Animals at Slaughter
1992	Code of Practice on the Construction and Layout of Red Meat Slaughterhouses in Relation to Animal Welfare

Appendix 2

Publications of the FAWC

Year	Publication
1980	Report on the Animal Welfare Implications of Harvesting of Deer Antlers in Velvet
1981	Advice to the Agriculture Ministers of Great Britain on the Need to Control Certain Mutilations on Farm Animals
1982	Report on the Welfare of Poultry at the Time of Slaughter
1984	Report on the Welfare of Livestock (Red Meat Animals) at the Time of Slaughter
1985	Report on the Welfare of Farmed Deer
1985	Report on the Welfare of Livestock when Slaughtered by Religious Methods
1986	Report on the Welfare of Livestock at Markets
1986	Regulations Working Group Interim Statement
1986	Egg Production Systems—An Assessment
1988	Report on Priorities in Animal Welfare Research and Development
1988	Advice to Agriculture Ministers on Transportation of Unfit Animals
1988	Assessment of Pig Production Systems
1990	Report of the Enforcement Working Group
1990	Advice to Ministers on the Handling and Transport of Poultry
1991	Report on the European Commission Proposals on the Transport of Animals
1991	Report on the Welfare of Laying Hens in Colony Systems
1992	Report on the Welfare of Broiler Chickens
1993	Report on Priorities for Animal Welfare Research and Development

Appendix 3

The FAWC "Five Freedoms"

1. Freedom from hunger and thirst
 - by ready access to fresh water and a diet to maintain full health and vigor
2. Freedom from discomfort
 - by providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease
 - by prevention or rapid diagnosis and treatment
4. Freedom to express normal behavior
 - by providing sufficient space, proper facilities, and company of the animal's own kind
5. Freedom from fear and distress
 - by ensuring conditions and treatment that avoid mental suffering

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The veterinarian's role in farm animal welfare: Directions in production and practice

A. D. Crook, DVM, and Lawrence E. Heider, DVM

In past decades, the major producer/consumer concern has been the economic production and availability of food. That concern, in turn, drove the development of production systems toward greater and greater efficiencies. Perhaps without any collective realization, this system placed concern for animal welfare at a low priority. Now there is an increasingly strong public perception that animals have rights, however loosely those rights may be defined, and this perception is causing a reawakening to issues of animal welfare. Strong polarity of opinion exists between those at one end of the spectrum, who advocate that people become vegetarians, and those at the other end, who are unwilling to change the way they raise animals. The challenge for those of us involved in food production and interested in animal welfare is to find the common ground that exists somewhere between those two views, recognizing that most people want to continue to eat meat, but also want to have some assurance about the existence the animal has led before reaching their table. We know that middle ground exists, because those who care for animals throughout their lives, as well as consumers, all have an interest in good animal care. We also know that increasing use of intensive animal-rearing practices has decreased the quality of life for animals in many circumstances; this is unacceptable to many consumers, nor should it be acceptable to anyone. The challenge before us is to find a way to modify intensive practices that cause distress and health problems, and to ensure that food can be produced economically.

The economic question is obviously central to this issue. Production systems that give a higher priority to animal welfare are being developed and used. How does the adoption of such systems affect the cost of food animal production? These questions about efficiency and productivity are still unanswered. If we force systems into use that are less productive and efficient, we know food costs will increase. The cost may be worth the price of better

animal care. Efficiency or productivity may not be lost in systems that give priority to the concern for animal comfort, care, and welfare. But what if this is not the case, and increased costs reduce the availability of food or access to food for poor people? Certainly, this complicates the ethical issues. The resolution to these issues must be that we seek better practices to increase animal comfort that are efficient as well as effective. Only by careful development, study, and monitoring of such systems will we be able to answer these questions about economics.

The problems with many of the practices to increase productivity that have been implemented over the past several decades have been amply documented. The areas that have received the most public attention have been confinement rearing of veal calves and swine, raising of hens in battery cages and some associated practices such as beak trimming, and transportation and handling of livestock, especially livestock that is or becomes disabled. Professionals in the livestock industry have seen an increase in health problems associated with intensive rearing practices, such as joint problems in swine and respiratory disease in feeder cattle. Increases in the size of operations also have led to situations in which individual-animal problems go unobserved.

The challenge for the livestock industry has been to integrate the emerging body of knowledge about clinical ethology in food animals, which attempts to document and quantify animal distress and suffering, into efficient production practices. This integration has not been easy because there is definitely an emotional side to the debate that sometimes overshadows logic. For example, consumers may be paying premium prices for so-called "barn" eggs under the misconception that the label guarantees that the hens live in a spacious and bedded barn, when in fact the hens may be crammed into a deep-litter house at virtually the same density as in battery cages.¹ Any regulations that address the raising of livestock in confinement also must set standards for alternative housing, or else the process is virtually meaningless.

A concept that is known as the "Five Freedoms

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of Animals" has evolved from various sources in applied ethology. These freedoms have been accepted as essential to animal welfare by Great Britain's Farm Animal Welfare Council, the European Commission, and the World Veterinary Association, which lists them as follows in the policy statement on animal welfare, well-being, and ethology²:

- (1) freedom from hunger and thirst;
- (2) freedom from physical discomfort and pain;
- (3) freedom from injury and disease;
- (4) freedom from fear and distress; and,
- (5) freedom to conform to essential behavior patterns.

Housing

Housing is undoubtedly the variable of major public concern in intensive production systems, comprising as it does issues of ventilation, lighting, and space for animals and resultant restriction of movement. The Swedish Ministry of Agriculture enacted the most stringent legislation in the world regarding farm animal welfare in 1988.³ The Swedish legislation bans the use of battery cages for egg-laying birds (although cages in use in 1988 need only be phased out by 1998) and the use of tether stalls for sows and gilts, and stipulates the use of bedding for calves and pigs up to one month of age. Other western European jurisdictions are considering or have enacted similar legislation. The focus is clearly on requiring housing methods that provide opportunities and space for the animals to exercise normal behavior. In fact, section 1 of the Swedish legislation specifically states: "The premises shall be so designed as to allow the animals to behave naturally."³

Clearly, the economic impact of such regulations in North America would be most important, given our current investment in large intensive farming operations. On this continent, producers' groups have attempted to address many of these concerns through recommendations to be followed by individual producers. For example, the National Pork Producers Council published the *Swine Care Handbook* in June 1992.⁴ This is a comprehensive guide to swine husbandry, including specific guidelines on husbandry systems and management practices, environmental management, facilities and equipment, feeding and nutrition, and herd health management. It begins with a "Pork Producers Code of Practice" and ends with a "Summary of Producer Responsibilities," which, if integrated into every pork farmer's operation, would do much to ensure the freedom of swine from hunger and thirst, from physical discomfort and pain, and from injury and disease.

However, the other two freedoms, that from fear and distress and that to exercise essential behavior patterns, are not addressed in this handbook, except for some philosophical statements

about the detrimental effects of stress on the animals. Minimization of such effects is stated to result in economic benefits for producers, consumers, and the entire pork industry, but consideration is not given, for example, to concerns about the paucity of stimuli in the typical farrowing stall environment.

In Canada, the recommended codes of practice for care and handling of swine and other farm animals, published by Agriculture Canada, have been coordinated by the Canadian Federation of Humane Societies.⁵ Throughout the process, there was direct input from many different groups, including producers, veterinarians, animal scientists, the Canadian Council on Animal Care, and truckers' associations. For each type of animal, there is an introduction in which current public concerns, which are generally related to confinement practices whether in pigs, poultry, or veal calves, are discussed. For each animal, the current confinement systems are ultimately endorsed, albeit guardedly, and guidelines are given for their best operation. As with the swine producer's handbook already mentioned, these codes of practice are entirely voluntary, unlike the much stricter European stipulations, which are in the form of legislation.

Alternative housing has been shown to be economically feasible in, for example, feeder pig production. Jacobson et al⁵ compared a conventional intensive unit with an alternative system comprised of two gestation pens and a farrowing pen. The sows could move in and out of the farrowing cubicles in the farrowing pen, but the small pigs were confined to individual creep areas by a roller threshold. After seven to 10 days, the cubicles were removed and sows and pigs could commingle. The objectives of the study were to compare relative performance between the two systems under similar management conditions, to provide an economic comparison of the two systems, and to observe behavioral responses in the two groups of sows.

The sows were followed through three gestations, over approximately 1.5 years. Preweaning mortality from crushing in the alternative system was significantly higher, as might have been expected. On the positive side, however, initial and operating costs were substantially lower in the alternative system. As well, body condition was improved in the sows in the alternative system; they

²Agriculture Canada. Recommended code of practice for the care and handling of poultry from hatchery to processing plant. 1989; recommended code of practice for the care and handling of beef cattle, 1991; recommended code of practice for the care and handling of dairy cattle, 1990; recommended code of practice for the care and handling of ranched fox, 1989; recommended code of practice for the care and handling of mink, 1988; recommended code of practice for the care and handling of pigs, 1984; recommended code of practice for the care and handling of special fed veal calves, 1988; recommended code of practice for the care and handling of sheep, in progress.

also exhibited less aggressive behavior and fewer abnormal behaviors than did sows in the conventional, nonbedded unit.

This study is only one example of the research being done that endeavors to quantify the advantages and disadvantages of intensive rearing practices and potential alternative systems. In this case, the study was done through collaboration between agricultural engineers and veterinarians.

Housing is also the subject of much debate in the poultry industry. The Swedish ordinance makes no specific recommendations for housing of birds in colonies, but all buildings designed to house poultry and other livestock must be approved before use with respect to animal protection and health, and there are general stipulations about noise, climate, and light.

The British Farm Animal Welfare Council has examined this issue in a 1991 report.⁶ Similarly, the European Commission is in the process of setting new standards for housing of laying hens kept in colonies, rather than in battery cages. In North America, most birds used for egg production are raised in battery cages, with approximately 350 cm² of floor space/bird.⁷ Birds used for meat are raised in floor pens in flocks of between 5,000 and 40,000. These systems have been indisputably economical for producers and consumers; however, the severe restriction in movement prevents expression of normal behaviors and results in abnormal behaviors and increased aggression. Attempts to curtail these behaviors have led to practices such as debeaking, which has its own negative consequences on animal welfare and on public perception.

Alternative housing systems may be developed that are economically viable, and at the same time, provide for improved well-being for the birds. Alternative systems being studied range from extensive outdoor systems to intensive systems in which hens have the opportunity to space themselves in relatively unconstrained ways, usually through incorporation of such features as perches and nest boxes. Appleby and Hughes⁸ examined environmental, physical, and behavioral aspects of welfare in laying hens in cages and in alternative systems, considering the systems in relation to the five freedoms of animals already discussed. All systems satisfied the first freedom, that is, freedom from hunger and thirst. But there were potential problems in all systems with freedom from pain, and from injury and disease. The potential for minimizing these problems was apparently greater in alternative systems under conditions of good management. However, with regard to the freedom from fear and distress and the freedom to exercise normal behaviors, the cages consistently fell short of the alternative systems. The authors concluded that welfare is compromised more in conventional cages than in well-run alternative systems.

Tanaka and Hurnik⁹ compared behavior and

performance in laying hens in battery cages and in an aviary. The aviary was essentially an intensive system with perches and nest boxes, allowing the birds to move about and to exercise normal behaviors. Stereotyped behaviors were observed significantly more often in the caged birds, whereas comfort behaviors were observed much more commonly in the aviary. Egg production was slightly lower in the aviary. The authors concluded that aviaries provide a more comfortable environment for the birds, with almost the same productivity per bird, compared with that for birds in battery cages.

Trends are apparent in this research, as shown in the poultry as well as the swine studies cited. Behavioral indices are being widely used as measures of comfort for animals in alternative management systems, and where these indices indicate improvement, a slight decrease in productivity seems to be acceptable. These trends will have to be translated into dollars and cents to see if they are also acceptable to producers and, ultimately, to consumers.

What has been the impact on productivity and prices in Europe as these various regulations have come into effect? Considerable information is available on the effects on the poultry industry. In many cases, economic performance and individual animal welfare are closely related, as, for example, in attempts to reduce disease mortality, bone breakage, and feather picking. However, in other areas, practices that increase overall flock productivity are at the expense of individual welfare, the obvious example being increased stocking density. European regulations vary from an outright ban on cage housing for laying hens, since 1988 for new poultry housing in Sweden and since 1992 in Switzerland, to increased spatial requirements where cages are used, as in Denmark, where farmers must provide 600 cm² of space/bird.¹⁰ Studies to consider alternative systems of production that will satisfy the regulations have been performed in Sweden¹¹ and Switzerland,¹² as well as in Great Britain.¹³ Costs of production vary between systems.¹⁰ Allowing birds 750 cm² in cages increases costs by about 15%, housing on deep litter, by about 18%, and on free range, by about 50%. Other systems are intermediate in cost. Changes, such as adding perches and nest boxes, although only minimally changing spatial provisions, increased costs marginally (1 to 2%).

What has happened to egg prices with these increases in production costs? In Great Britain, eggs produced under alternative systems have commanded a premium, especially free-range eggs, which are clearly the most expensive to produce.¹⁰ This premium is based on the assumption that free-range hens are kept under a better welfare system, which may or may not be true, depending on stocking density and animal care. European Community standards provide certain stipulations before eggs may be labeled free-range, whereas

elsewhere, there are no specific regulations. The premium is less reliable for eggs produced under other alternative systems, but in the United Kingdom, for example, free-range egg production has become and has remained a profitable business, accounting for about 12% of total egg production. About 85% of eggs in the United Kingdom are still produced from caged birds, but this is expected to decline further as the demand for free-range and barn eggs increases.

One thing to consider in this discussion is that when eggs are produced under a certain system in response to market demand, a logical assumption is that consumers will be willing to pay a premium, which will cover the increased costs of production. This assumption has been borne out by experience, with respect to free-range eggs in Great Britain.¹⁰ However, if production costs increase in response to legislation, consumers may be less willing to bear the increased costs. These costs somehow will still have to be accounted for, whether the producer absorbs the costs, prices increase, or eggs are imported from countries with less restrictions.

In evaluating the various alternative management systems for laying hens, there are efficiency problems with every one, such as increased labor intensity, increased potential for disease through difficulties of managing waste, increased chances for infection, more wastage of eggs, higher costs for many items including food (which is the main factor in total production costs), and housing. In fact, the cage system evidently is the most efficient system of egg production that we know of, yet its use is clearly declining in Europe in response to pressure from animal welfare advocates. At this point in North America, almost 100% of eggs are cage produced, although there is a small demand for free-range eggs. How will the industry respond to the growing concerns about poultry welfare? It will be interesting to see if the industry will lead the way, with gradual and planned changes that will protect poultry producers, or if change will only come about as the result of legislation.

Transportation and Sales of Feeder Animals

The marketing system for beef cattle in North America has received a great deal of attention. As opposed to providing freedom from injury and disease, the system, as it has developed, often results in suffering and health problems for cattle. Cattle are generally transported at least two to three times, from the original cow/calf operation to frequently more than one sales barn before they end up at the feedlot. Along the way, the calves are subjected to various stressors, such as weaning, the rigors of transport (often over long distances and under varying environmental conditions), being mixed with various animals of varying health status, surgical procedures and vaccinations, and changes in feed and water, often with uncertain access to both. The resultant problems are only too

familiar to veterinarians who attend feedlot cattle, and who must balance the animals' need for treatment with the economic factors involved, as well as with the necessity for minimizing drug use to meet residue standards.

Because treating cattle at the feedlot seems to be at best a salvage situation, the logical approach would be to prevent as many of these problems as possible, and from this approach arose the concept of preconditioning programs. Programs based on the studies of Dr. John Herrick were started in the mid-1960s in several states in the midwestern United States¹⁴ and in western Canada.¹⁵ Although the concept is theoretically sound, success and acceptance of the programs have been uneven. Results of various trials attempting to compare performance of preconditioned and unconditioned calves have been equivocal.^{16,17} Morbidity and mortality vary between regions of the country and between studies, so generalization of the benefits of preconditioning programs has been difficult. In western Canada, morbidity is not uncommon to be as high as 60 to 75%, with 3% mortality.¹⁷ From studies¹⁶ in the United States, average morbidities of 50% and mortalities of 1.5%, ranging up to 10%, have been reported.

The effects of preconditioning programs have not been well established, partly because of lack of standardization of the procedures involved on the farm and in the studies. Too often, preconditioning programs have simply meant an added burden of stresses for the calf immediately before or on arrival at the feedlot, in the form of vaccination, deworming, and other treatments. This sort of treatment obviously negates the whole concept.

Generally, however, the most important aspects of preconditioning programs have been earlier weaning of calves, with a subsequent acclimation period, and vaccinations to prevent bovine respiratory disease complex. In studies of preconditioned calves on farms,^{16,17} decreases in morbidity of approximately 6% and in mortality of approximately 0.7%, compared with that in control groups, have been shown when these procedures are performed under conditions of good management.

With these results, preconditioning programs should seem likely to gain more attention as a system for promoting animal welfare. However, health problems are only one factor in the feedlot assessment of preconditioning programs. Other major factors are the purchase price and the cost of feed. The result of all this has been to make it difficult for producers to evaluate any economic advantages of purchasing preconditioned calves. As well, a fundamental difference in perspective exists for the cow/calf operator, compared with that of the feedlot owner. Ironically, mismanaged calves often represent the best economic opportunity for the feedlot because they can be bought cheaply and thereafter will gain proportionately more.¹⁷

Despite these problems, an active interest re-

mains in preconditioning programs. In surveys of producers,¹⁴ much greater economic advantages of preconditioning programs are reported than in the controlled studies^{16,17} already cited.

In Canada, preconditioning programs have been monitored for several years in Alberta, Saskatchewan, and Ontario.¹⁵ The programs have been encouraged, supported, and subsidized to varying degrees by the provincial Departments of Agriculture, which also have endeavored to coordinate and maintain uniformity among the programs. A considerable amount of data has been collected, particularly from Alberta. From 1980 to 1987, the average premium for preconditioned animals was approximately \$5/51 kg of body weight and the average cost of preconditioning was \$47. Clearly, unless major weight gain is involved, preconditioning programs would not be to the cow/calf operator's advantage. Because of conditions in Alberta, where fall grazing conditions are poor, unweaned calves may actually be losing weight. Calves weaned in early October and started on well-balanced rations consistently gain about 1 kg daily, which is sufficient to result in a positive net return to the operator. In addition, cows with early-weaned calves, particularly on declining pastures, will be in better condition, an added advantage to the cow/calf operator.

Completed survey questionnaires of feedlot operators between 1980 and 1987 in Alberta reveal a consistent decrease in morbidity and mortality in preconditioned calves,¹⁵ but whether operators are willing to pay the required premium depends on many factors, as has already been discussed. For many producers, the bottom line seems to be that the increased premium sought by cow/calf operators for preconditioned calves cannot be justified by economic gains to the feedlot operator, despite the demonstrable decrease in health problems. Smaller, one-time per year feeders appear to be more willing to pay the premium to reduce treatment costs, whereas larger feedlot operators are more inclined to accept the increased risks associated with nonpreconditioned calves.

All this information relates purely to economics. But clearly a great deal of animal suffering is reflected in these statistics on morbidity and mortality. These numbers would certainly be unacceptable in any animal-use protocol.

The preconditioning concept remains theoretically sound, as veterinarians, animal scientists, producers, and managers agree. Some form of accountability from conception to processing has been proposed to provide data that would benefit the entire beef industry.¹⁸ Identification of cattle would be a priority, and monitoring of herds would facilitate documentation of any regional difficulties, such as micronutrient deficiencies or increased susceptibility to disease. As well, this attention to identification and monitoring could address public concerns about the safety of food of

animal origin. If these benefits could be demonstrated, the costs of preconditioning programs could be spread out within the beef industry, rather than being borne by individual producers. At the same time, the industry would be acting on a commitment to improve health and ameliorate suffering in these animals (ie, promoting the freedom from injury and disease).

Veterinary Practices

What is the role of the veterinarian in this dialogue, which involves consumers, producers, regulatory bodies of government, animal rights activists, and animal scientists? We would seem to be in an ideal position to serve a central role. Our primary concern is the well-being of animals, our patients, as we are reminded by the Veterinarian's Oath¹⁹:

Being admitted to the profession of veterinary medicine, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge. I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics. I accept as a lifelong obligation the continual improvement of my professional knowledge and competence.

This is a comprehensive mandate and some aspects have been argued to be mutually exclusive. This dilemma exists because, in recent decades, animal agriculture has focused almost exclusively on maximizing productivity. The result has been that the role of the veterinarian in large food animal production systems has had an important economic component, and developing skills as a managerial consultant has become essential for the large animal practitioner. One has only to examine some of the articles in the literature to recognize this trend.^{20,21} The whole concept of production medicine has become firmly entrenched in the food animal community. High productivity in an animal or a group of animals has been accepted to be synonymous with the animal's well-being.

To some extent, of course, this is true, because an animal cannot be productive when its most basic needs are not being met. These needs for food, water, and shelter have been met in intensive rearing systems that technology has enabled the food animal industry to develop. The result has been efficient and economical production of cheap and plentiful food. However, an increasing number of people no longer see this as a goal sufficient unto itself. They question some of the by-products of intensive management systems, such as the impact of herbicides, pesticides, hormones, and drug residues on human health and on the environment.

Similarly, people question the tenet that economic pressure justifies the cost to the animals' quality of life. The concept of farm animal well-being was not part of the public consciousness in the past, except in cases of gross negligence or cruelty, but this is no longer true.

We must look critically at our position with regard to these practices that are coming under scrutiny. Veterinarians have a certain credibility with society that other parties in this debate may lack. Animal agriculturalists are seen to be pursuing technologic efficiency at all costs, and researchers are seen as holding the interests of their animal research subjects as distinctly secondary to their primary research goals. Members of the veterinary profession, on the other hand, have as a basic *raison d'être* the securing of the health of animals.

Maintaining our credibility is important. Let us look at our public response to increasing concerns about animal welfare.

In June 1993, the AVMA released a position report entitled "Animal Welfare: Position Statements and Background Information."²² Section III is concerned with animal agriculture. In the preamble, it is acknowledged that "in some cases, husbandry practices have evolved that do not fully consider animal welfare."

The report also includes the statement, "The problem of feeding the increasing population, particularly in developing countries, must include access to confinement rearing of livestock and poultry." The economic benefits of intensive production practices are described. Included also is a statement that because the producers' success depends heavily on the well-being of the animals they raise and because most producers are professionals who are well trained in their fields, as well as being ethical and moral individuals, they therefore can be relied on to have a sensitivity to animal welfare. The AVMA also "encourages and actively promotes both applied and fundamental research on the welfare of livestock and poultry raised in confinement production systems."

In the document, specific positions on the practices associated with confinement rearing that have come under the most public scrutiny are supported. The AVMA endorses the use of individual tethers and stalls for sows, without bedding, and describes the advantages of these systems for producers, including improvements that have made this marginally less restrictive for the sows. With respect to swine, the AVMA endorses castration and tail docking and ear notching for identification, if performed competently, in the first week of the pig's life. The same guidelines for ear notching and tail docking have been published elsewhere, but castration was recommended before three weeks of age.⁴

With respect to chickens, that housing layer chickens in cages has resulted in healthier chickens and lower egg prices is accepted in the position

report. The concern that recommended space allowances do not provide for the "natural behavior needs" of the birds is recognized, but "present knowledge is not sufficient to support a radical change or ban of this system." Reference to any alternative systems that are being tried, such as aviaries, is not included. Beak trimming and induced molting also are discussed and are approved, as long as they are done appropriately.

The only comment pertaining to cattle is that dehorning and castration should be done as early as possible, and done by procedures that reduce or eliminate the associated pain, with the recommendation that "viable alternatives to castration and dehorning of cattle be developed and applied." Presumably, this means a greater use of polled breeds or simply eliminating the procedures.

In the section on veal calves, this area of production is recognized as having been characterized as the least defensible food animal production practice, and the reasons for this are listed. Specific recommendations are made to address these concerns for housing, equipment, pens, feeding, blood iron concentration monitoring, and disease surveillance. Ultimately though, the production-driven rationale for confinement rearing of these animals is accepted.

This is essentially a conservative document in which intensive rearing practices and economic considerations are accepted in every case. Veterinarians should ask if this is enough.

Veterinarians know the situations that result from intensive management, in which the financial bottom line is the only consideration and the profit margin is so slim that producers make decisions that may not be the best from a veterinary standpoint, but may be the cheapest. For example, although all the animal care handbooks state that prompt veterinary care or humane euthanasia should be provided for sick or injured animals, too often we know this is not the case. A monthly column on veterinary medical ethics in the *Canadian Veterinary Journal* deals regularly with these questions, in which the economic best interests of the producer appear to be at odds with the best interests of the individual animal and the veterinarian is squarely in the middle.²³ We also know that we could alleviate pain and suffering involved in many so-called minor surgical procedures if time and finances permitted us to use our best medical techniques, such as administering a cornual nerve block in cattle to be dehorned.

The AVMA has recently gone on record about the inhumanity of leghold traps.²² Perhaps this indicates that veterinarians are beginning to challenge long-held or deeply entrenched beliefs concerning animal welfare. This also could be a small measure of changing attitudes in a changing profession in a changing society. Long-held positions will likely change, particularly as the members of our profession become more diverse.

Conclusions

From an economic standpoint, all those involved in the food animal industry must understand that we are not just raising livestock, but that we are marketing food. We cannot afford to ignore consumer concerns about animal welfare, just as we have not ignored concerns about additives, residues, and food safety. The efforts of veterinarians and producers have resulted in the Milk and Dairy Beef Quality Assurance Protocol. This is a comprehensive chemical residue avoidance program designed to educate farmers and veterinarians regarding responsible use of pharmaceuticals.²⁴ It addresses two areas in particular: the choice to administer drugs, because obviously no residues will result if no pharmaceuticals have been used; and the question of marketing milk or meat from an animal that has been treated, a decision made most often by the producer. Lack of proper observance of meat and milk withholding times is the most common cause of residues.²⁵ A poor veterinarian/client/patient relationship, improper records of treatment, and inadequate identification of treated animals are the most frequently cited reasons. These problems are dealt with by this program, and implementation of the program has become mandatory for producers when problems have been identified. Similar programs have been developed for other food animals (eg, the Pork Quality Assurance Program).⁴

What about the issue of animal welfare? Regulations have been enacted in the area of food safety, and veterinarians played an important role in drafting them. In Europe, far-reaching legislation concerning food animal production has been passed, much of it clearly giving value to the animal's perceived quality of life, even if that means subordinating requirements for efficiency of production. We also have the example of federal legislation in Canada and all other developed countries, concerning laboratory animal welfare. This legislation came about in direct response to the animal rights movement, with a good deal of societal support as well.

Increasing public pressure, and probably legislation, seems inevitable resulting in at least some retreat from practices of confinement rearing. Veterinarians should be involved in effecting these changes because we are those traditionally responsible for the health of animals. For this to happen, we must maintain our credibility as those who have the animals' best interests at heart. To do this, we must continue to take an active role in initiatives to study and promote animal well-being.

Much fascinating research has been done in the area of clinical ethology.^{26,27} Investigators are endeavoring to identify behavioral or other scientific assessments of welfare, using measurements such as performance criteria, aversion tests, and preference tests. The influence of stockmanship and the importance of abnormal behaviors that do

not appear to be detrimental to an animal's welfare are being considered. Attempts are being made to quantify the effects of changes in practices on the animals' well-being. Food animal practitioners must keep abreast of the work done in this area. We must be involved in the discussions, and we must use the knowledge gained in our positions and policies.

A promising initiative is the Food Animal Integrated Research for 1995 Symposium. This symposium aims to establish research priorities for competitive and sustainable food production from animals, with the ultimate aim of linking science and technology to societal benefits.²⁸ The goals are to enhance industry-wide responsiveness to consumer and societal concerns; to meet market demands through increased efficiency and competitiveness; to develop integrated food animal management systems; to maintain and enhance environmental quality; to improve food quality control in terms of safety, desirability, and nutritional composition; and to enhance animal well-being throughout the life cycle of food-producing animals. The last goal, of primary concern to us, is to be accomplished through two objectives: to determine scientific measures of well-being in food-producing animals; and to develop long-term management options and short-term production practices on the basis of scientific research findings about animal well-being.

This is certainly a comprehensive approach to the whole question. Producers, veterinarians, animal scientists, processors, and advocates from environmental, consumer, and animal welfare groups are involved in the process. Only by an integrated approach such as this can we hope to satisfy the broad base of societal concerns. Being in the forefront creating change is certainly preferable to reacting to legislated changes imposed on us.

In the past, the veterinary profession has been mostly concerned with animal health as the absence of specific diseases. We are the logical ones to concern ourselves with animal health in the expanded sense; that is, to include welfare as an aspect to be considered. If we close ranks and insist that because current intensive rearing practices are efficient, they are therefore satisfactory, we are certain to fail.

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