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AVMA
Animal Welfare Forum
Enhancing wellness in animals and people

November 9, 1990, Chicago, Illinois

"Animal welfare, how we choose to interact with and care for those living creatures we share our planet with, has become one of the great social issues of the 20th century. The AVMA Animal Welfare Week, November 5 to 9, 1990 was conceived by the Steering Committee as a way of highlighting the many ways in which veterinarians are involved in animal welfare activities on a daily basis. We all know that the veterinary medical profession is dedicated to promoting the best care and treatment of animals, wherever they are found, but this is a never ending challenge as we see our environment and priorities changing rapidly."—Dr. Sherbyn Ostrich

Animal Welfare Week Steering Committee

Dr. Sherbyn Ostrich, Chairman

Dr. Joan Arnoldi
Dr. David Johnson
Dr. Lew Runnels
Dr. Al Strafuss
Dr. John Boyce
Mrs. Peggy Wilhelm
Mr. Michael Walters

The following papers were presented at the first AVMA Animal Welfare Forum. Over 130 individuals participated in the Forum, which was the concluding event of AVMA Animal Welfare Week. At the end of the Forum, the first AVMA Animal Welfare Award was presented to Dr. Lawrence W. Bartholf of Greenfield Park, New York.

The success of the Animal Welfare Forum was ensured by a generous grant from the Procter & Gamble Company of Cincinnati, Ohio. Additional financial contributions to support Animal Welfare Week activities were made by Pfizer, Incorporated; Hoescht-Roussel Agri-Vet Company; Hartz Mountain Corporation; Hoffman-La Roche, Incorporated; and The Upjohn Company.

The second AVMA Animal Welfare Forum is scheduled for Thursday, November 7, 1991 with the theme, "The Veterinarian's Role in the Welfare of Wildlife." For additional information on Animal Welfare Week or the Animal Welfare Award, please contact me.—Dr. John Boyce, AVMA Division of Scientific Activities.

Veterinarians as members of the humane community

Gus W. Thornton, DVM

I consider it a real privilege and a great honor to address the first AVMA Animal Welfare Forum. The following ideas and conclusions grow out of my experience and observation of 30 years as a practicing veterinarian and now as President of one of the world's largest animal protection organizations, the Massachusetts Society for the Prevention of Cruelty to Animals. I have one foot squarely in both the humane and veterinary communities. This provides me with the unique opportunity to deal firsthand with members of both communities and to understand many of their hopes and concerns as they relate to animal welfare. My remarks will not be directed at whether or not veterinary medicine, by its very nature, speaks for animal welfare. That association is obvious. I will direct my remarks at how the profession as a whole has been involved in issues that impact the well-being of animals. I will look at how the profession has been and is involved in these issues, some of the reasons why, the importance of change, and how these changes might be accomplished.

Apparent apathy

Regrettably, if I am honest with myself, I can only state that, in large measure, veterinarians have not been a part of the humane community or involved in animal welfare issues, and the relationship of these two groups can best be characterized as adversarial and polarized. This fact was vividly displayed in major articles appearing in 1989, as the two groups hammered away at one another in print.[1,2] As a profession, we seldom register a position on animal welfare issues. We don't speak out or provide leadership. We tend to say nothing, take a neutral stance, or a "same as" position that the research or medical community has articulated. We don't decide—but I submit that, as the saying goes, "not to decide is to decide."

We wonder why this is so—especially when we realize that, historically, in European countries, veterinarians have played a leadership role in promoting animal welfare concerns and also when we realize that we share many concerns about the welfare of animals.

From the Massachusetts Society for the Prevention of Cruelty to Animals, 350 S Huntington Av, Boston, MA 02130.

Causes of estrangement

Except for the young members of the profession, most veterinarians were trained in colleges associated with land grant universities that had heavy agricultural and rural emphases. Large animal practice received top priority. The utilitarian role of animals and groups of animals, rather than the individual animal, was emphasized. Survival surgery labs were the norm—it was inappropriate to care about pain and suffering. Anesthesia in relation to castration or dehorning was not a concern and even to consider it was likely to threaten one's very livelihood in practice. Caring about pain, suffering, and the feelings of animals was largely drummed out of us and to think or talk about it was looked at by our mentors in the same way that we view those who collect housefuls of cats today. Fortunately, this is rapidly changing.

Another reason for the estrangement is the activity of some of the radical "animal rights" groups. Violence, breaking and entering, boycotts, marches, and insisting on positions such as vegetarianism and abolition of the use of animals in research and teaching were incompatible with the philosophy of most veterinarians and were thought to be inappropriate and ill-considered. These same groups and individuals criticized veterinarians for lack of concern and characterized them as uncaring and profit driven. The result was that veterinarians tended to paint all people and groups concerned with animal welfare with one brush, and thereby totally discredited them.

The only formal group concerned with such issues for veterinarians to relate to was the Association of Veterinarians for Animal Rights. Nevertheless, this association offered little help for most of us because of its philosophies. The American Veterinary Medical Association, considered by many as the voice of veterinary medicine, found speaking out with clarity on issues involving animal welfare to be largely impossible because of the diverse nature of its constituency, which includes researchers, teachers, food and small animal practi-

tioners, zoo veterinarians, and those involved with wildlife, to name only a few. The organization was paralyzed.

We have found it comfortable to hide behind the thought that by the very act of providing medical care to animals we are involved and speaking out on animal welfare issues. This has allowed us to ignore with a clear conscience many of the major issues that affect animals and that have nothing to do with medical care.

Finally, individually and collectively, as veterinarians we have fallen victim to what I call the 80/20 problem. Although we can agree on at least 80% of the positions taken on animal issues by those working with and on such issues, we become completely unable to deal in any constructive way with these because of the 20% we do not agree on. All of the energies of both groups are spent arguing about this 20%—at no benefit to the animals with which we are all concerned. Compounding this is the deep and intense mistrust that exists. We are afraid to agree on anything in that 80% for fear it will in some way draw us into agreement on the dreaded 20% issues; a classic we/they with the clear losers being animals. I am sure at this point many of you are saying—"It isn't so, you're exaggerating." Let's take a quick look at a few of these issues.

Pet overpopulation

The grim reality that the pet overpopulation crisis necessitates the destruction of 16 million unwanted dogs and cats annually (an astonishing 2,000 per hour) remains unchecked and largely ignored by the veterinary profession. The tragedy of this reality is almost beyond belief. Unwanted animals suffer, spread disease, inflict injuries, pollute the streets, disturb sleep, damage property, kill other animals and occasionally, a person. They cause traffic accidents, are hit by cars, and are injured or killed. They consume significant amounts of the operating cost of animal shelters that try to provide them with at least a humane death. As the liberties accorded to improperly cared for animals impinge more and more on human rights, there will be more and more voices demanding that something be done. Because many veterinarians do not consider spay and neuter the answer to the problem, we have tried to make the case that the problem does not exist—a ridiculous, foolish, and indefensible position.

The problem is complex and is not going away. Present attempts to control pet overpopulation have not been impressive. Solutions are certainly not obvious nor will they be easy. They most certainly will include improved and enforced control and licensing measures, continued and expanded programs for accepting and collecting unwanted animals for humane euthanasia, education of the public as to their responsibility for reducing animal overpopulation, and the neutering of greater numbers of pets. As veterinarians, we should be involved in all of these, not only through cooperation and availability because of our technical skills, but by promoting and offering leadership for such programs. In our practices, we should educate people daily about the overpopulation crisis. In addition, I feel that, as veterinarians, we should be offering our services for neutering pets at a price which prohibits no one and encourages all to have their pets neutered. "Cheap spays?" No! A public service, partial solution that only we can offer? Yes!

Involvement issues

Individually, we did not create the problem, but the society that we are a product of did. The decision as to whether or not we become involved in the solution is ours, and so is the responsibility. Between 10 and 15% of the dog and cat population of the United States is euthanatized annually because of a lack of homes for these animals. How would the veterinary community respond to a disease that annually resulted in the death of 10 to 25% of the dog and cat populations?

There are many other issues that our profession is uniquely qualified to influence. For example, cruel steel-jaw leghold traps are still in widespread use. Veterinarians continue to see the painful, debilitating, and sometimes deadly injuries they cause, but we have failed to speak out in any numbers. The AVMA continues to struggle, putting out statements that refuse to say these traps are cruel. The heartless puppy mill/pet shop business continues unchecked, and efforts to change it receive only tacit support from veterinarians who daily see the sad reality of this industry on their examination tables and in the faces of their clients. Rats and mice still are not included in the rules and regulations under which APHIS inspects laboratories. The AVMA continues to lobby for legislation on unrelated business income tax that, if passed, may threaten the continued operation of institutions like Angell Memorial Hospital, possibly eliminating internship and residency programs as well as facilities extending excellent animal care. Several countries continue to ignore ivory and whaling bans. Environmental issues such as the greenhouse effect, agribusiness, pollution of our rivers, streams, and atmosphere, and the decimation of our rain forests demand attention. A species becomes extinct every 60 minutes. The list goes on and on. These are animal issues. We should be involved.

Call for involvement

Many things are changing in our profession, in our society, and in our world that make it imperative for us to take an active leadership role in animal welfare issues. By avoiding this role, we will lose a major opportunity to be involved members of our society. The public has given us a leadership role and we have largely ignored it. It will be taken

away if we do not become aware of the changing concerns regarding animals. A good example of this "taking away" was the segment on animal welfare and animals in research which aired on "48 Hours"[3] in the past year. During the entire segment, not one veterinarian was interviewed. Physicians, researchers, technicians, and animal welfare advocates were. This sends a clear message—we don't have an opinion.

Dean Frank Loew points out that "Our population is changing. Ninety percent of the people in this country live in urban areas, 98% are not farmers. The root of the animal rights conflict is shaped by a new urban view of animals, which is that of the pet owner who sees animal issues through the prism of an individual animal. This perception is in opposition to the view of scientists, researchers, and farmers who see animals in terms of species that have a utilitarian role. The utilitarian viewpoint is essentially dead in the national political debate."[4] The majority of graduates from our colleges of veterinary medicine are female and from urban backgrounds. Their views reflect this background. The emphasis of our profession is shifting from food to companion animals.

Today's graduates will be the young practitioners and junior faculty of tomorrow. Many of them are interested in and understand animal welfare issues. Survival practice surgery labs are a thing of the past. Consideration of pain and suffering is expected. The human-animal bond and pet loss grief counseling are real. The public and our clients expect individual veterinarians and organized veterinary medicine to provide advice and guidelines concerning animal welfare issues.

I am very optimistic—changes are occurring. Individual veterinarians and organizations are becoming involved. The activities of the AVMA Animal Welfare Committee, this forum, and the first AVMA Animal Welfare Award are examples. The AVMA is dealing with animal welfare issues it previously ignored. The AAHA is also interested. Courses in ethics and moral values as they relate to animals are commonplace in our veterinary colleges today.

What more should we be doing? We should develop positions on issues affecting animals, issues that the public, our clients, and the humane community expect us to take a stand on. Overpopulation, early spay/neuter, leghold traps, pet loss, no-pet regulations, pet-assisted therapy, animal control, euthanasia methods, responsible pet ownership, animal behavior, pound seizure, pet theft, and humane slaughter, are a few of these. We will not and should not always agree with others on animal welfare issues but we must take a stand and provide expertise. We should provide opportunities for free discussion of these types of issues at local, state, and national meetings between ourselves and other concerned organizations. We must stop dealing only with the issues we are against, and start supporting those we are for. We must become involved, both individually and in organizations, with other groups dealing with animal protection.

It is important that we clearly understand the difference between moderate, mainline animal protection organizations, and the more radical, aggressive, confrontational groups. Then we must work with those we are most comfortable with.

We have so much to offer and so much expertise. The time for our involvement is now. It is critical that we respond. I am optimistic that we will.

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Animal behavior and animal welfare

Katherine A. Houpt, VMD, PhD

Summary: The value of behavioral techniques in assessing animal welfare, and in particular assessing the psychological well being of animals, is reviewed. Using cats and horses as examples, 3 behavioral methods are presented: (1) comparison of behavior patterns and time budgets; (2) choice tests; and (3) operant conditioning. The behaviors of intact and declawed cats were compared in order to determine if declawing led to behavioral problems or to a change in personality. Apparently it did not. The behavior of free ranging horses was compared with that of stabled horses. Using two-choice preference tests, the preference of horses for visual contact with other horses and the preference for bedding were determined. Horses show no significant preference for locations from which they can make visual contact with other horses, but they do prefer bedding, especially when lying down. Horses will perform an operant response in order to obtain light in a darkened barn or heat in an outside shed. These same techniques can be used to answer a variety of questions about an animal's motivation for a particular attribute of its environment.

The veterinarian's role has always been to improve animal welfare. Heretofore, this has meant treating and preventing disease, repairing injuries, and optimizing reproduction. The members of our profession have the opportunity and the expertise to be the leaders in animal welfare. In the past decade, however, animal welfare has come to include the psychological as well as the physical well-being of animals. Traditionally, our training has emphasized diagnosis of disease, and the first sign of most diseases is abnormal behavior such as listlessness, loss of appetite, and decreased self grooming, to name a few. Long before ethology was a discipline, veterinarians had been observing animals closely in order to distinguish normal from abnormal behavior. Therefore, in addition to examining for physical well-being, we should be able to examine an animal for psychological well-being.

Methods of assessing welfare

Physiological—Before returning to behavioral techniques for assessing psychological well-being, let us examine other techniques. Well-being is believed to be the absence of stress, or perhaps the absence of too much stress. Catecholamine release, or the resulting tachycardia, may be used as a measure of acute stress. Because stress activates the pituitary adrenal axis, measurements of corticosteroids are also frequently used as an index of stress. Corticosteroids increase in various animals in a number of stressful situations such as isolation of horses[1] and sheep,[2] transport of calves,[3] and crowding of pigs.[4] The effects of corticosteroids on other physiological systems can also be measured as indicators of stress. One example is the ratio of neutrophils to lymphocytes, which decreases in response to corticosteroids. A related method is the measure of the adrenal response to exogenous ACTH. A poor response is interpreted as adrenal exhaustion—an indication that the animal has been chronically stressed. In some cases, a rise in corticosteroids does not always indicate stress. For example, corticosteroids also rise in pigs during copulation, a situation in which the animal's psychological well-being is assumed to be good.[5] Unfortunately, hormonal measurements are not the infallible and objective measurement of well-being that is needed. Moberg[6] discusses the problems in detail.

Another technique, that of immunology, has recently received considerable attention as an indicator of well-being or lack of well-being. Kelley[7] has reviewed this subject and that of brain-immune system interactions.

Behavioral—The behavioral methods of assessing welfare can be divided into 3 categories: (1) comparison of animals in their natural environment with that of animals whose welfare may be at risk; (2) choice experiments in which the animal can choose the environment or treatment that it prefers; and (3) operant conditioning in which the animal must work for a reward; the amount of work it is willing to do can be used to assess the importance of that reward to the animal.

In an example of the first method, one can compare the behavior of pigs ranging freely in pig parks with that of pigs in a modern swine produc-

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tion unit. The free-ranging sow leaves the herd, builds a nest, delivers her piglets and leads them from the nest 10 days later. She will wean them between 14 and 17 weeks.[8] The sow in a commercial operation will spend a variable time in a crate before farrowing, from a few days to the entire gestation period. She will not be able to build a nest because no nest material, and possibly no bedding material, is present, but she will still attempt to do so. She will remain in the farrowing crate after her piglets are born. The piglets will be weaned at 4 weeks. The sow in the farrowing crate may exhibit bar biting, a stereotypy, but she is warm, dry, reasonably healthy, and she will lose very few of her piglets whereas the free-ranging sow may lose her entire litter to exposure or predators.

There is no question but that the behavior of intensively raised animals is different from that of conspecifics in a natural environment. The problem is how to determine whether the difference implies a lack of well-being. Do animals suffer when they cannot act as free ranging animals do?

Choice experiments can help to answer some of the questions raised by comparative studies of natural and artificial environments, but first the weaknesses of choice experiments should be discussed. One weakness is that the animal may be making its choice on the basis of something other than that which the experimenter planned. When given 2 foods, the animal may choose 1 food not because it likes that food, but because it is in the righthand bucket.[9] Careful controls such as alternating right and left, and keeping everything in the environment constant except the factors of interest can keep these kinds of errors to a minimum.

Another weakness is that the animal can make a choice, but may be choosing between alternatives, both of which it would avoid or both of which it would choose. Even if a horse chooses apple flavor over molasses, it is not inhumane to feed it molasses. Experience also plays a part in choice because animals may be reluctant to choose an environment or a food with which they have no experience. This behavior is termed neophobia.

Good examples of choice experiments are those of Dawkins[10] in which chickens chose between small cages, the size of battery cages, and large cages. The chickens chose large cages, but only after they had had experience in them. Not all choice experiments have to be simple, two-choice ones. The animal can choose between many alternatives. One can then remove the first choice and determine what the animal's second choice is. One can also complicate the choice by making an animal choose between a normally preferred environment without food and a nonpreferred environment with food.[11] The number of hours of fasting necessary before the animal chooses the non-preferred, but food-containing environment is a measure of the strength of the animal's motivation to avoid the environment.

One of the best uses of the two-choice experiment demonstrated that electroimmobilizers were inhumane. Sheep given a choice between being electroimmobilized or restrained on a tilt table chose the tilt table.[12] The sheep almost always chose the tilt table once they had experience with both. Rushen[13] did not give the sheep a choice, but, instead, measured their reluctance to approach the electroimmobilizer. He found that the sheep had to be pushed much harder to approach the electroimmobilizer than to approach a mechanical restrainer. Both the strength of the choice and the effort the sheep would expend to avoid the machine indicated that the sheep found the electroimmobilizer aversive.

Operant conditioning is the technique developed by the late B. F. Skinner, in which an animal operates on the environment to receive a reward. The most well-known example is the rat pressing a bar for a food reward. The advantage of operant conditioning is that the amount of effort the animal has to expend for each reward can be varied. The animal may be on a ratio of 1 reward for every response (bar press), or a very high ratio—many responses for each reward. Horses can be taught to push a panel with their nose for a food reward. They will push as many as 19 times for each reward of a one-quarter cup of grain.[14] A way to measure relative preferences is to use a progressive ratio technique in which the animal first presses once for a reward, then twice, then 3 times, and so on. The ratio at which the animal stops responding, that is the break point, can be determined for 1 reward and then compared with another. For example, Kennedy and Baldwin[15] showed that pigs would work until the ratio was 40 for 1*M* sucrose, but only until the ratio was 10 for 0.03*M* sucrose.

Feline welfare

Many behavior problems are referred to The New York State College of Veterinary Medicine.[16,17] Some of these behavior problems are severe enough that the owner will have the animal euthanatized or abandon it to an animal shelter, which, in the case of adult cats, is usually tantamount to euthanasia. One such behavior is furniture scratching. There are behavioral means for reducing furniture scratching and encouraging cats to use scratching posts, but these are usually not 100% effective in cats that have already developed a scratching problem. Onychectomy is a cure, but there are those who feel that declawing is cruel. It is true that onychectomy, like any elective surgical procedure, subjects the animal to pain but does not save its life. This pain can be minimized by good surgical technique, anesthesia, and postoperative analgesia, but there have been other objections to declawing. Humane organizations and the Canadian Veterinary Medical Association have advised against declawing on the basis that it leads to behavior problems.

Two surveys were conducted to compare the behavior and misbehavior of declawed and intact cats. In the first survey,[18] 25 owners of declawed cats and 25 owners of cats with claws were asked a series of questions about their cat's behavior before and after surgery and to rate the cat's qualities as a pet. There was no higher incidence of behavior problems in declawed cats and the owners rated them as more desirable. In this case, the behavior of the population whose welfare might have been at risk was no different than that of the control population.[18] In the second study,[19] a computer interest group "Rec.pets" was queried as to their cats' behavior problems. In this case, the study was done blind in that the respondents did not know the true purpose of the questionnaire. One hundred owners (125 cats, total) responded. There was 1 behavior that was more common in declawed cats: they jumped on counters or tables more often.[19] This may reflect the fact that owners who object to having their furniture scratched also object to cats walking across counters. It certainly indicates that declawed cats are willing to jump. In neither study was biting or house-soiling more common in declawed cats than in cats with claws.

Another question about feline welfare that was answered using behavioral techniques involved nutrition. Young cats were fed either a commercial tuna fish cat food diet or a beef diet. Although neither the ability of the cats to learn a simple maze nor their behavior in a novel environment or with a strange person was affected, there were large differences in the cats' behavior when undisturbed in the home cage. The tuna fed cats were less active and took longer to consume their food.[20] It is interesting that it was only when the animals were not aroused that the differences were apparent. The tuna fish cat food contains mercury and the brains of the cats fed tuna fish contained higher concentrations of the heavy metal than did those of the cats fed beef.

Equine welfare

In the past 10 or 15 years, more attention has been paid to the welfare of domestic animals. In particular, the welfare of intensively raised animals has been questioned. One species whose welfare has not been addressed is the horse. This is probably because horses were the first species to be intensively raised, that is, removed from a free ranging condition and kept in a small enclosure. People are so accustomed to seeing horses in stalls that they do not consider it to be the same degree of infringement as a farrowing crate or a veal calf stall. Horses usually leave the stall for a few hours a week so they are not really totally confined. Nevertheless, this species also deserves an optimal environment.

Some of the features of the typical stable are obviously different from those of the horse's natural environment. Naturally, horses almost always live in groups. As foals they follow their mothers and are part of her band for 2 or 3 years. Weaning occurs shortly before their mother foals again. As they mature, juvenile horses, all colts, and most fillies leave their natal band, but are soon part of other groups. Colts join bachelor herds and fillies either join another band or form the nucleus of a new harem group with a young stallion. The young stallion usually had been the dominant member of his bachelor group and is at least 5 years old.[21,22]

Horses in stables are kept in individual stalls, either tie stalls or box stalls. Horses on pasture or in corrals are also usually in groups, but the groups are often larger than the typical horse herd and are not family groups. Instead, they consist of horses introduced as adults. Fighting may occur, especially when the groups are newly formed or when the animals are crowded together. A horse that is bitten or kicked by the others cannot escape and can be seriously injured. Subordinate horses may also be food-deprived by more dominant ones.

Social situations—How important is it to a horse to be able to see another horse? It has already been shown that horses eat more when they can see other horses,[23] so the sight of other horses can influence equine behavior. A two-choice experiment was designed to test how important it was to a horse to see other horses (Fig 1). The separated horse could stand to one side of the partition and see the other horses or even make direct contact over the fence separating them, but if she stood to the other side she could not see the other horses. The partition was rotated weekly so that the barricade was on the right side half of the time, and on the left side the other half of the time. Time lapse video recording was used to determine how long the horse spent on each side of the paddock as well as to determine the time spent in each type of behavior by all 3 horses. The separated horse spent approximately half her time on each side of the paddock. The separated horse showed no definite preference for making visual contact with the other horses, but still spent 6 out of 12 hours in visual contact.[24] In the presence of other horses it is not necessary for visual contact to be provided. Apparently, the horse is aware that there are horses on the other side of the partition even when they are not visible. Odor, sound, and memory are probably involved in determining that there is another horse nearby.

There was no difference in the behavior patterns of horses in the separated and together situations, but horses in the paddock when no other horses were in the adjacent paddock (alone situation), that is, no other horses could be seen, were very different in their behavior. They ate less often (35 vs 43% of the time) and walked more often (25 vs 7% of the time). The conclusion is that horses are affected by the absence of horses. The increased walking observed in horses in the alone situation could be interpreted as herd-rejoining behavior. The same circumstances can lead to stereotypic

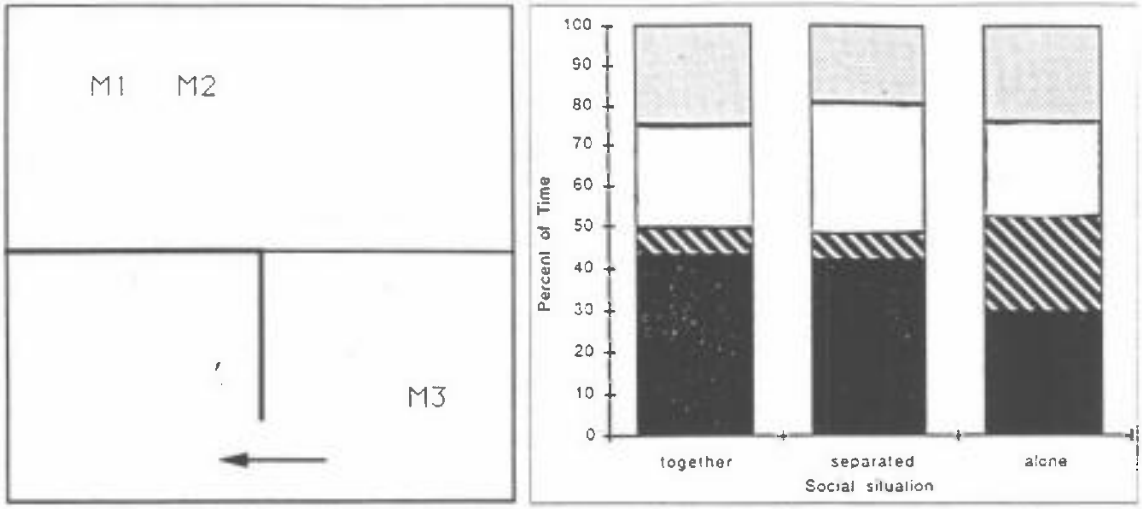

Figure 1—Plan of the social situations (left) and behaviors of mares in the three different social situations (right). In the together condition, the mare was living in a paddock with another mare (M1 and M2). In the separated condition, the mare was in a paddock by herself (M3), but two other horses were in the adjacent paddock. In the alone condition, no other horse was in the adjacent paddock or within visual range. The heavy L-shaped line represents the solid 3-m high partition that blocks visual contact with the mares in the adjacent paddock (M1 and M2) when M3 stands on that side. The arrow indicates the path M3 would take to move to the blocked side of the paddock. Each mare was tested separated, together, and alone. Time spent: ■ = eating; ▨ = walking; □ = standing; ⊞ = other.

stall circling or fence walking in horses. Removing companions can also cause release of ACTH in horses, indicating that this stress does cause activation of the pituitary adrenal axis.[1]

A final interesting outcome of the experiment was that the horses spent < 12% of their time in the 3-sided shed provided, indicating that even during winter in the Northeast, when the experiment was performed, housing was not chosen often.

Light preferences—Many stables have no windows, or only small ones well above the horses' heads. These stables are very dark, especially at night. Anyone caught in a building when the electricity went off can attest that it is darker inside than it would be outside even on cloudy nights. For this reason, and because we have seen cases of fear of the dark in horses, we wished to determine whether horses preferred a light to a dark environment. The technique of operant conditioning was used to determine if horses preferred a light or a dark barn. Each horse was placed in a stall in a completely dark barn. In the stall was a manger equipped with a light beam and a photoelectric cell. When the horse broke the beam to the photoelectric cells, lights would go on for 1 minute (Fig 2). The beam would have to be broken again to "earn" another minute of light. The second manger, a control, was also equipped with a photoelectric cell, but breaking that beam did not turn the lights on.

The horses did learn to turn the lights on, and, when the control and test manger were reversed, the horse quickly learned to break the beam on that manger and ignore the other. They earned 61 minutes of light per day. It is interesting that the lights

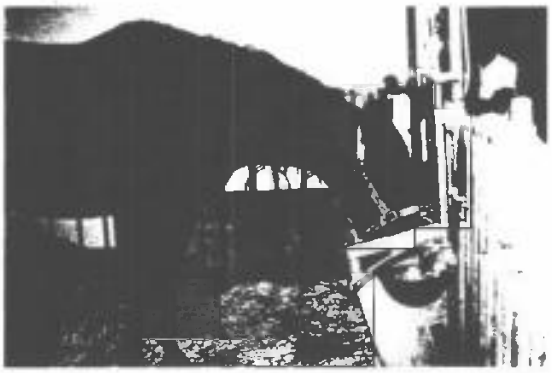

Figure 2—A mare places her head in a manger, turning the lights on for one minute in an otherwise dark barn.

were turned on more often during the day than at night (Fig 3). Horses would prefer a light to a dark environment.[2-4]

In order to investigate the effects of a social companion on light preferences, we tested ponies in the same dark barn with and without another pony. The ponies were less interested in turning on the light than the horses were. They turned the lights on 11 ± 3 times/day the first week they were in the dark, but increased to 32.8 ± 32.7 times/d when another pony was present. When the companion pony was removed, their response increased to 65.6 ± 23.6 times/d. One pony responded at a high rate of 217.3 times/d when with another pony, but when that pony was removed he turned the lights on 745.3 out of a possible 1,440 times/d.

Bedding—Horses are often kept indoors on hard surfaces such as wood or concrete. Although bedding is generally provided, it may be removed

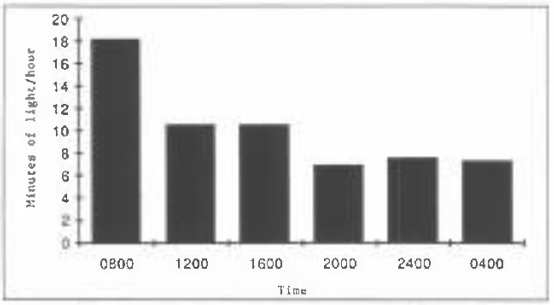

Figure 3—Operant responses of mares for light, in mean number of times that mares turned the lights on for 1 minute during each 4-hour period.

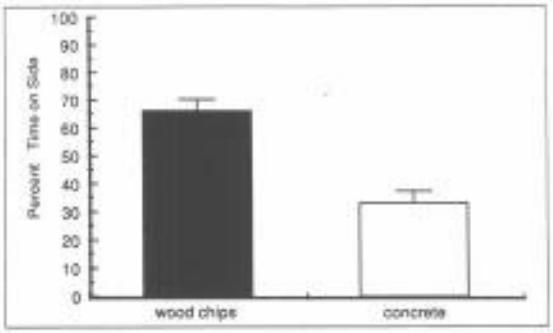

Figure 4—The percentage of time spent by ponies on bedded (wood chips) and unbedded (concrete) areas of a stall. The vertical line is the SEM.

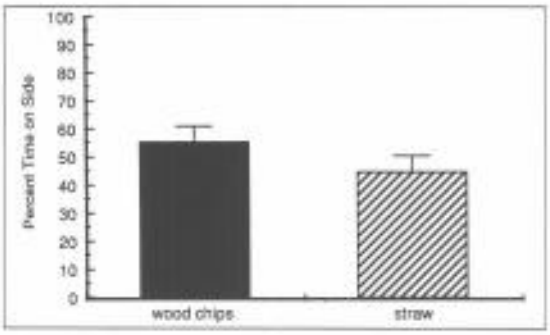

Figure 5—The percentage of time spent by ponies on wood chips and straw covered areas of a stall. The vertical line is the SEM.

in experimental conditions to prevent its ingestion.[25] To determine whether horses preferred bedding and whether a particular kind of bedding was preferred, a two-choice preference test was given. A box stall (3.4 × 5.4 m) was divided in half. One half was bedded with wood chips; the other was bare concrete. Time-lapse video recordings of the pony's night behavior were made. The time spent on each side of the stall and the behavior on each side were calculated. The ponies had a significant preference for the bedded side: 67% of their time was spent on the bedding (Fig 4). Preference for the bedded side was strongest when the pony was lying. Although 13% of their time was spent lying, none of the ponies lay on the concrete. All chose the bedded side for that behavior. The ponies did not show a similar discrimination between beddings. They spent 52% of their time on wood shavings and 48% on straw (Fig 5).[26] Our conclusions were, on the one hand, that ponies show a strong preference for bedding, but, on the other hand, they do not prefer one of the common beddings to the other.

Recently, we have done a follow up study in which ponies were tested in an outside shed. In this case, the choice was between the dirt surface and wood shavings on the dirt. There was no overall preference, but when the separate behaviors were examined, a preference for lying on the bedding was again observed. Horses can lie either on their sternums or on their sides. When the posture of the pony was considered, 80% of the time lying sternally and 100% of the time lying laterally was spent on the bedding.

A final question we asked about equine environmental preferences concerned warmth. Again, operant conditioning was used to ask the question. The horse could obtain 1 minute of heat from 4 heat lamps if he interrupted the beam of a photoelectric cell. The horses were tested from January to April. They turned on the heat lamps 115 ± 31 min/day. Horses apparently would like to be warmer even when they have shelter available. This appeared to be especially true in wet as opposed to cold weather.

A final area worth investigating is that of the effect of drugs on equine behavior. Of course, one expects stimulants and sedatives to affect behavior, but other drugs do as well. For example, the commonly used diuretic furosemide stimulates water intake and probably salt intake in horses.[27] Drugs may also be unpleasant for horses. Apomorphine, which causes excitement in horses, must also be aversive because horses will avoid consuming food associated with its administration.[28] This phenomenon proved taste aversion could be used to determine which drugs make animals feel ill. This can be very useful in choosing an analgesic. For example, if 2 drugs are equally effective as analgesics but 1 makes the horse nauseated, the other should be used.

In conclusion, behavioral methods are as sensitive as, and in some cases more sensitive than, physiologic measurements in evaluating the well-being of animals. Quantification of behavior patterns, choice tests, and operant conditioning can all be used to construct the optimal physical and social environment for domestic animals.

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Ethics and animal welfare: The inextricable connection

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In this paper, I shall argue that the study and promotion of animal welfare are inextricably connected with ethical concerns. This proposition might appear entirely unremarkable and not deserving of much discussion. It seems obvious that animal welfare cannot be divorced from ethics. When asked why animal welfare is something worth understanding, almost everyone will say that among the most fundamental moral obligations we human beings have to animals is to pay due regard to their welfare. To understand and improve animal welfare, most people would agree, is precisely to attend to ethics.

The pure science model of animal welfare investigation

Although a desire to treat animals fairly and decently lies at the heart of most peoples' concern about animal welfare, there is currently in the animal welfare literature a model of animal welfare investigation that attempts to separate the study of animal welfare from ethics. This model, which I will call the "pure science" conception of animal welfare investigation, is accepted by many animal welfare researchers. (See, for example, Duncan IJH. Animal rights–animal welfare: a scientist's assessment. *Poult Sci* 1980;60:490; Dawkins MS. *Animal suffering: the science of animal welfare*. London: Chapman and Hall, 1980; 3-9; Fraser AF, Broom DM. *Farm animal behaviour and welfare*. London: Bailliere Tindall, 1990;4) Indeed, the model may already be the prevailing view of animal welfare study among veterinarians, animal welfare scientists, and biomedical researchers.

I shall argue that the pure science model fundamentally misconstrues the nature of animal welfare. I will demonstrate that even the proponents of this model do not—because they *cannot*—adhere to the model's demands for value-free "objectivity." I shall also argue for a proposition that some veterinarians and scientists might find

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discomforting: animal welfare science is as much ethics as it is science, and serious investigations of animal welfare must include substantial input from ethicists as well as members of the general public.

The model defined—The pure science model does not deny that the underlying motivation for investigating animal welfare can be the ethical principle that people should pay due regard to animal welfare. Rather, the model asserts that once one begins to study animal welfare scientifically, one must do so without considering or taking any positions with respect to ethical issues. According to the model, one need not make any value judgments in studying animal welfare because animal welfare is a state or condition that is experienced or undergone by an animal itself. Determining whether an animal is living in conditions that are conducive to its welfare is thus like discovering whether it can see. In determining whether an animal can see, one engages in empirical observation of the animal. One would not wonder if the world would be a better place if this animal could see, or whether human beings have a moral obligation to assure that animals like this retain their ability to see. These might be important questions, but they are different from the question of whether an animal can see. Likewise, according to proponents of the pure science model of animal welfare investigation, asking when people ought to afford conditions conducive to animal welfare may be an important question. But this is different from asking whether animals are living in conditions conducive to their welfare. The latter issue is a purely factual one, and addressing it does not involve making value judgments.

The pure science model does not imply that determining what conditions are conducive to animal welfare is always easy. Most investigators, for example, agree that the presence of stress is relevant to animal welfare, but there are disagreements about how to determine whether "stress" is present in animals, and even about the meaning of the term stress itself. There are also vigorous debates among proponents of the pure science model about what factors (eg, absence of pain or suffering, absence of stress-related chemicals, reproductive success, absence of disease, choice of various stimuli) are legitimately included among criteria of animal welfare. However, adherents of the pure science model all insist that deciding what conditions are relevant to animal welfare and determining whether such states are present, are empirical tasks that do not involve making value judgments.

Nor does the pure science model imply that animal welfare is a simple, indivisible quality that is or is not present in its entirety at any given time. Animal welfare scientists commonly speak of varying degrees or levels of animal welfare, ranging from conditions so minimally beneficial that they barely qualify as being conducive to animal welfare, to conditions that approach or constitute optimal welfare.[1,2] Proponents of the pure science model concede that it is a matter for ethical discussion to determine what level of welfare is morally appropriate. Nevertheless, they maintain that determining the level of animal welfare is an entirely empirical undertaking devoid of value judgments, just as determining the level of acuity of an animal's eyesight does not include making value judgments.

A well-known statement of the pure science model occurred in a 1983 policy decision of the AVMA Animal Welfare Committee, on the subject of animal welfare and animal rights. The Committee asserted that "the AVMA believes that use of the term 'animal rights' has to do with personal philosophical values and therefore recommends that the term 'animal rights' not be used and encourages the profession to focus its attention on the welfare and humane treatment of animals."[3] In other words, the investigation and promotion of animal welfare by the veterinary profession is a scientific matter that does not involve the assertion of personal values about how animals ought to be treated. The official compilations of the AVMA on the subjects of companion animal welfare and food animal welfare reiterate this view:

> AVMA positions are concerned primarily with the scientific aspects of the medical well-being of animals. It is also recognized that certain ethical, philosophical, and moral values must be considered.[4,5]

Another important statement of the pure science model is made by Fraser and Broom[6] in their recent treatise on farm animal welfare. According to the authors:

> The assessment of welfare can be carried out in an objective way which is quite independent of any moral considerations. Mortality rate, reproductive success, extent of adrenal activity, amount of abnormal behavior, severity of injury, degree of immunosuppression, or level of disease can all be measured . . . . In addition to measurements of poor welfare, it is possible to investigate the preferences of animals and the value which they place on various resources or other aspects of their environment. Such studies and a wide range of work on the basic biology of animals give information about the biological needs of animals . . . .
>
> When scientific evaluation of welfare has been carried out, there remains the moral question of how poor welfare should be before it is regarded as unacceptable. This is an issue where the farmer, the veterinary surgeon, the welfare research worker, or the member of the public are equally entitled to have an opinion.

Regarding ethical issues, the authors believe everyone is entitled to an opinion because these are essentially matters of attitudes and values and no one possesses special expertise in matters of values. In contrast, animal welfare is the special province of scientists (among which the authors

include veterinarians) because this is an area that restricts itself to the scientific observation and measurement of facts. The pure science model postulates an inseparable theoretical gap between animal welfare science (a realm of facts) and animal welfare ethics (a realm of values). According to the model, those who are engaged in welfare science cannot be engaged simultaneously in welfare ethics; the latter involves a qualitatively different activity, the expression of moral judgments.

Attractiveness of the pure science model—It is not difficult to understand why the pure science model is attractive to veterinarians and animal welfare scientists. As Fraser and Broom[6] observe, although most people would agree that they have a moral obligation not to subject animals to miserable conditions, there is nothing approaching unanimity regarding what conditions of welfare are morally acceptable. Sometimes, controversies about what is morally owed to animals become bitter, even violent. Partisans of varied views take to the media, and the disputes can find their way into the halls of government, which is sometimes asked to impose one or another view of animal welfare by law.

If the pure science model of animal welfare is correct, animal welfare investigators can go about their business unaffected by such ethical and political debates. They need not attempt to resolve difficult moral issues when society in general may not be prepared to resolve them. Their investigations will be driven not by public demand or by the passing moral preferences of the day, but by scientific considerations of what is known and what needs to be learned. Animal welfare researchers will provide a storehouse of objective factual information, which will be available when the public and government are ready to decide how much or what sort of animal welfare should be provided. Animal welfare research can, in short, be kept where any branch of science is *supposed* to belong—safely in the field or laboratory and away from messy and perhaps unresolvable ethical controversies.

The pure science model also appeals to the (surely admirable) tendency of veterinarians and scientists to avoid making proclamations on matters about which they have no special expertise. Veterinarians and animal scientists do have special knowledge about the biological characteristics of animals. They do not speak with special knowlege or wisdom about ethical matters. At the same time, the pure science model gives veterinarians and animal welfare scientists a special status. As scientists, they clearly are entitled to speak on matters relating to welfare. Laymen, however, are not scientists and thus according to the model are not "equally entitled to have an opinion."

Cracks in the model

Problems in the pure science model appear when one examines how investigators really decide what questions to ask about animal welfare.

How do investigators determine whether the welfare of an animal is worth studying?—In Boston, the largest public works construction project in the history of the United States, perhaps the world, is to begin soon. A massive new interstate highway will be placed into a tunnel that will be dug under the length of the city. The "big dig," as Bostonians call it, will not only unearth literally mountains of soil, but will displace millions of rats presently residing under the city. (How many millions is anybody's guess.) Government officials are trying to discover how to kill the rats before they overrun the entire city.

In the substantial controversy about the rats, there has been some talk about not subjecting the animals to more suffering than is necessary. However, few but the hardiest animal rights activists have suggested that there should be concern for the general welfare of these animals. There has been no call for scientific studies to determine what conditions would be conducive to the welfare of the rats, so that they can either be exterminated in accordance with minimal violation of this welfare, or so that some of them can be relocated to environs that meet this welfare.

There is little interest, if any, in the welfare of these animals because it is generally believed that they are owed very little. As I have already noted, people are concerned about understanding and providing for the welfare of an animal when they believe that it is morally right to have such a concern, when they believe that the animal's welfare is something that should be protected at least to some extent. In other words, an ethical decision has been made that the animal is entitled to conditions conducive to or constitutive of its welfare.

Thinking that an animal (or a group, species, or kind of animal) is worthy of having its welfare protected to some extent is not the same thing as saying that we favor, like, or admire that animal. One can imagine a very dangerous species of predator, for example, that people might believe should be protected from certain conditions inimical to its welfare because the species is endangered. Such animals could be as nasty and generally disliked as urban rats. Nor is saying that people should protect the welfare of an animal the same thing as saying that they have some moral obligations to it. I maintain that Bostonians have a minimal obligation to avoid causing the rats more pain than is necessary to get the job done in a successful and cost-effective manner. However, this is quite different from saying that one should be concerned about the *welfare* of the rats. There is an important linguistic point here. When people talk about the welfare of an animal they are referring to conditions that go beyond the most minimal ones that are morally obligatory. As will be discussed further, whatever else we mean by the term, welfare refers to a state that includes some measure of a success-

ful life. Most of us do not speak about the welfare of Boston's soon-to-be-displaced rats because we do not believe that we owe them this much.

Scientists, like laymen, usually take an interest in the welfare of an animal only if they believe that its welfare ought to be respected to some extent. There are, to my knowledge, no scientists who are undertaking studies of the welfare of urban rats, vampire bats, tsetse flies, or man-eating sharks. Some scientists investigate the behavior of these animals and may be interested in what conditions are conducive to their thriving. However, a researcher who said that he is interested in the *welfare* of such animals would probably be considered odd, or worse.

Because there is widespread agreement about the moral appropriateness of protecting the welfare of most kinds of animals, some people may have forgotten that the decision to study the welfare of *any* animal is in part an ethical one. Indeed, there is such wide-ranging concern that all species we human beings use for our own purposes be treated properly that it might seem obvious that the study of animal welfare is a worthy undertaking. However, not so long ago, there was little regard for animal welfare. Prior to 1800, well before the advent of anti-cruelty statutes in England and the United States, farm animals were routinely tortured, neglected, and subjected to the most miserable conditions.[7] Before the passage of the first federal Animal Welfare Act in 1966, assertions that all laboratory animals were treated perfectly were not uncommon.[8] Those who worked for the study and promotion of farm and laboratory animal welfare during these times were viewed as moral crusaders, both by themselves and their opponents.[7,8]

Determining that the welfare of a particular animal is worth studying is an ethical activity. This is illustrated by those few animal rights activists who might say that the Boston rats are equal in value to the Bostonians whose habitations are about to be overrun, and who feel perfectly comfortable advocating the welfare of these rats. Most of us reject this view because we believe that people are more worthy of protection than rats. However, this belief, like the position it rejects, is an expression of values.

No universal consensus: the question of wildlife animal welfare—At this point a proponent of the pure science model might concede that, although there are valuational underpinnings to animal welfare science, these underpinnings are not operationally important within the scientific study of welfare. The proponent of the model might say that the overwhelming majority of people already agree about the importance of protecting the welfare of animals used in agriculture, industry, entertainment, and in the home. Therefore, animal welfare scientists can now go about their purely objective scientific business of exploring animal welfare.

However, determining whether or not the welfare of an animal is worth studying is not an easy task. There are some animals in which a universal consensus regarding the worth of their welfare does not exist.

Among philosophers, ecologists, and members of the general public, there is substantial disagreement about what may or may not be owed to wild animals and what sort of interest we should take in them.[9] Most people appear to agree that there is a moral obligation not to harm wild animals unduly (although there is disagreement about what constitutes "undue" harm and about how strongly human interests count against those of wild animals). There thus appears to be agreement that some aspects of wild animal welfare should be respected. Beyond this, however, disputes rage. Some believe in veterinary treatment for and the promotion of the welfare of at least some wild animals, such as those that have been injured or those that have been harmed by human misdeeds.[10] However, others maintain that it is wrong to interact in any way with wild animals aside from not doing harm to them.[11] It is also argued that, given scarce resources, it is wrong to treat wild animals that become injured (even by human activities such as oil spills) when resources can be used to help the many farm and companion animals whose owners cannot afford veterinary care.[12] Some contend that helping members of non-endangered or non-threatened species can upset natural processes of evolution and create animals and perhaps species that ultimately will have a harder time in the wild and may come to require continuing human assistance. Among those who argue that people ought to protect certain wild animals, there is disagreement about whether this should be done because we owe something to individual wild animals[13] or species[14,15] for their own sake, or because a variety of wild fauna and flora is beneficial for human beings.[16]

These ethical controversies have important implications for animal welfare investigation. For example, if the only proper moral stance toward wild animals is to leave them alone, we might want to wish the best for many wild animals and species, and we may even study (under limited circumstances) how they fare in the wild, but it could be wrong to take a serious scientific interest in their welfare if this would affect any of these animals' lives. If it is morally appropriate to protect certain wild animals or species not for their own sake but as means to provide a healthy or happy existence for people, it might be inappropriate to speak of protecting their welfare. When most people advocate the protection or promotion of animal welfare, part of what they mean is that something is owed to the animals for their own sake. If wild animals should be viewed only as components of a world that is good for people, we might want to study what conditions permit them to succeed so that

they can fulfill this function. However, we probably would want to say that we are interested, not in promoting their welfare, but in promoting our own.

Scientists who seek to study or promote the welfare of wild animals cannot avoid these value questions, just as those who have wanted to understand the welfare of farm or laboratory animals could not avoid valuational issues relating to what, if anything, these animals are owed.

Individual animal or group welfare?—Proponents of the pure science model cannot even maintain that, with respect to kinds of animals now universally recognized as legitimate subjects of animal welfare study, investigators can pursue their research without reference to ethical issues. It is possible to speak of the welfare either of an individual or a group (of people or animals). Moreover, there can be circumstances in which the welfare of an individual is compromised for the general welfare of the group, or in which the welfare of the group is held to be less important than the welfare of an individual or of each individual. For example, citizens who are drafted to fight in a war suffer some diminution in their individual welfare in service of the common welfare. Also, we sometimes insist that an individual's right to promote his own welfare (for example, by keeping a certain proportion of his earnings free from taxation) should take precedence over the benefits that compromising this right might bring to the general welfare.

Deciding whether to respect or promote the welfare of an individual or of a group is an ethical decision. It is a decision about whose interests *ought* to have priority. Such a decision is not purely a matter of objective observation or measurement.

Currently, there is much controversy among agricultural producers, welfare scientists, veterinarians, and animal welfare advocates about whether the proper focus of farm animal welfare science and practice ought to be on individual animals or on herds.[17] Sometimes, promoting the optimal health of an entire herd will cause some diminution in the welfare of certain individual animals. This can happen, for example, when treating a selected number of individuals is so expensive that a farmer's ability to care for his herd is compromised. By allowing some disease in some animals he can preserve the general welfare of the group, thereby allowing him to fulfill his economic goal of making a profit.

I have argued that it is ethically unacceptable to consider the needs of individual animals irrelevant, or relevant only in so far as the fulfillment of individual needs furthers the productivity or general welfare of the herd.[18] There are, however, some who disagree.[18] As I have suggested, it is not always easy to decide where the interests of individual animals should prevail over either those of a herd or of a farmer.[18] However, the decision whether and to what extent to concentrate—either in one's scientific studies or practical activites—on the welfare of individuals or of herds is an irreducibly ethical one. It is an ethical decision about how various interests *ought* to be weighed. Thus, at the core of contemporary farm animal welfare studies, for example, ther is a difficult valuational issue that is not solely a matter of factual observation or measurement.

How much welfare?—Even after animal welfare scientists have decided that the welfare of a particular animal is worth studying, and whether or to what extent the welfare of individuals or groups of animals will be studied, they must face another difficult ethical task: they must decide how much welfare is worth studying.

As previously noted, it is generally agreed that animal welfare is often a matter of degree. For example, a pig farmer can use various kinds of outdoor husbandry techniques. Or, if he uses an indoor confinement system, he can (among other things) use floors constructed of and covered by various materials, provide various amounts of space to his animals, keep the facilities at various temperatures and levels of lighting, and provide a range of different possibilities for activities by the animals. Some of these conditions may provide what scientists would call minimal welfare, some might yield a higher level of welfare, and some might provide conditions that approach or constitute what might be called optimal welfare.

Let us suppose for the moment that the concept of "minimal animal welfare" is a purely scientific one, ie, that one can determine whether a minimal level of animal welfare is present without making an ethical judgment. It nevertheless is an undeniably ethical decision what level of welfare ought to be provided to various kinds of animals. For example, if providing a high level of welfare would be so costly that it would bankrupt farmers, many people would agree that providing this level of welfare is not morally obligatory if at least a satisfactory "minimal" level of welfare is maintained. Sometimes it can be argued that an animal's interests are not sufficiently weighty to require even a minimal cost. For example, sows and their piglets appear to enjoy looking at and attempting to manipulate objects suspended above them, and Curtis[1] suggests that providing such objects can raise these animals' level of welfare. However, some producers will argue that pigs do not have a very strong need for such visual stimulation because they can get along nicely without it. From this some might conclude that it is not morally obligatory for a producer to spend even a modest amount of time and effort providing such visual stimulation.

Although Fraser and Broom[6] concede that deciding what level of welfare ought to be provided is an ethical issue, they insist that animal welfare

science can study such levels without resorting to values. However, no successful animal welfare investigator could long do this. Imagine a researcher who proposed to study the levels of welfare experienced by swine in various conditions of housing. In order to explore the optimal levels of welfare, he wants to investigate situations in which sows and their piglets are given what farmers would consider luxurious care. He proposes that several buildings be constructed to house the animals. One building will house 1 sow and her piglets, a second 2 sows and her piglets, and a third 3 sows and her piglets, and so on. Each set of animals will be attended around the clock by researchers who will simulate farm workers; the number of workers in attendance at all times will vary from 1 to 6. These workers will make sure that temperature and lighting are continuously adjusted in various ways and will attempt to provide frequent stimulating human-animal contact. The workers will attempt a number of farrowing techniques. For example, while sows typically are not exercised during their no more than 14-day stay in farrowing crates,[19] the workers will periodically try to remove the piglets from around the crate, help the sow to exercise, place her back in the crate, and return the piglets.

I could go on, but my aim is to imagine our scientist proposing to investigate conditions that are incompatible with successful economic production and would not be adopted. I suggest that no animal welfare investigator would propose such studies. This is because welfare investigators are not interested only in scientifically determining various levels of welfare. If this were really their only interest they might, in fact, study conditions that had no possibility of being adopted. Investigators would not propose such studies because doing so would be practically pointless, and animal welfare scientists make the *value judgment* that it is not appropriate to conduct pointless investigations. Also, such studies would not be undertaken because few people believe that producers have a *moral obligation* to provide such optimal levels of welfare if (let us suppose) doing so would make the entire production process economically unfeasible.

Many of Fraser and Broom's own discussions illustrate that when investigators are not engaged in theoretical discussions about the value-free "objectivity" of animal welfare science, they frequently engage in moral judgments about what levels of welfare might be obligatory—in their choice of research questions and in their recommendations regarding the treatment of animals. For example, the authors[6] state that in a farrowing crate the sow:

> is very restricted in her movements . . . and she cannot move much toward the piglets. Hence it would seem to be a rather frustrating situation for the sow. Before farrowing, sows will build large nests if they are given the opportunity and there are indications that the inability to build a nest is frustrating for the sow (citation omitted). Overall the widely used farrowing crate is easy to manage but is far from ideal for the sow. Although it is better for the piglet than a farrowing pen of similar size with no crate in it, a large amount of space and deep straw would seem to be better still. Research on alternative farrowing accommodation is being carried out but much more work is needed in this area.

Let us assume, for the sake of discussion, that when the authors say the farrowing crate is far from "ideal" for the sow and that it would be "better" for piglets to have more space and deep straw, they are making purely factual judgments about relative levels of welfare. It is nevertheless clear that they also believe that, if possible, alternative farrowing accommodations that would provide better welfare for sows and piglets *ought* to be used. There is a value judgment here, namely that a higher level of welfare ought to be studied and implemented if possible.

Perhaps the authors would want to say that this is not a moral value judgment, but that the recommendation reflects some "scientific" principle that higher levels of welfare ought always to be found and implemented if possible. But such a judgment is precisely a moral value judgment. It is a judgment that the animals are *entitled* to a higher level of welfare if it can be provided. That this is a moral value judgment is made clear if we consider the reaction of a hypothetical farmer who might say that, even if certain farrowing accommodations frustrate sows and piglets, these animals are *not* entitled to better treatment. The only response Fraser and Broom could offer is that the animals are entitled to better treatment, because farmers ought to minimize frustration and improve the welfare of these animals. This is surely a moral value judgment that purports to decide how much relative weight ought to be given to the interests of animals, producers, and others (including consumers who pay for the animal products).

Throughout the discussions of animal welfare investigators, one finds the identification of issues or "problems" and the suggestion of solutions that are based on researchers' perceptions about whether animals are being treated as they ought to be treated.[1,20,21] Moreover, researchers commonly evaluate practices on the grounds that welfare conditions are morally intolerable or unacceptable. And when they do so, they rarely claim that they are speaking only as ordinary citizens, not as scientists.[6,20]

Ethical components of welfare

A proponent of the pure science model of animal welfare may assert at this point that there is still a large area for scientific study devoid of value judgments, namely *welfare itself* and its varying levels or degrees. It might be maintained that even if many of the questions addressed by animal welfare science are motivated by ethical concerns,

once these concerns have indicated that the welfare of certain animals at certain levels should be studied, investigation will be solely into matters of fact, observation, and measurement. For example, once it is decided on ethical grounds that the welfare of pigs should be studied, and that pigs should be provided conditions that do not cause them to suffer, but at the same time do not bankrupt producers, scientists can study the welfare of pigs in this range without reference to values. Society can then determine how much or what level of welfare it wants to provide.

Welfare as conducive to a preferable life—This position is also untenable, because the very concept of animal welfare—what ordinary people and scientists mean by the term welfare—includes an ethical component.

One can see this by examining how the term welfare is applied to people. Welfare refers in part to a state that is good for the person about whose welfare one is speaking. This is why we can talk of sacrificing the welfare of an individual for the good of others. When we speak in this way, we recognize that welfare refers in part to what is good for the individual, to what is conducive to his success in some sense taken in his own right. To sacrifice one's own welfare for the good of another's is to make some compromise in what is good for one.

An individual's (or a group's) welfare has something to do with its "success" in some sense. This has probably led some animal welfare scientists to suppose that one can find and measure animal welfare without making value judgments. This is a sense of success in which whether an animal is successful does not seem to have anything to do with values. For example, if a Boston rat is fat, energetic, and free of disease, it is in a sense functioning successfully as a rat. We can say that the rat is being successful and still say at the same time that it would not be morally wrong for Bostonians to try to prevent it from being successful. Therefore, it might appear that one can judge whether it is living in conditions conducive to its welfare without making any value judgments about what is good or bad or about how people ought to act. Moreover, because such rats can appear to have more or less success in prospering, proponents of the pure science model may suppose that characterizing the degree of this success (the level of welfare) involves no moral judgments.

However, the concept of welfare employed in our language is not synonymous with being successful in a way that makes no reference to values. This can be appreciated by considering the 19th century English philosopher John Stuart Mill's famous statement about human happiness and welfare. "It is better," Mill wrote, "to be a human being dissatisfied, than a pig satisfied; better to be Socrates dissatisfied than a fool satisfied."[23] Leaving aside Mill's somewhat unflattering view of pigs, he reminds us of the fundamental truth that there is a difference between true welfare and contentment. An individual's (or group's) welfare sometimes involves loss of contentment, satisfaction, or feelings of well-being. Thus, it is better to become educated and to learn about the world—even though doing so may be difficult and even if some of the knowledge one obtains makes one dissatisfied, impatient, angry, or sad.

As Mill recognized, most people believe that the uneducated (but contented) person experiences a lower level of welfare because we regard such a person as occupying "a lower grade of existence."[23] Not lower in a biological sense, for a fool need be biologically no less successful than an educated person; both may be physically vigorous and healthy. Indeed, it is possible that a person who devotes himself to higher aims and who thus attains a higher degree of welfare will sometimes be less robust than a physically fit fool. People think that the educated person attains a higher level of welfare because it is better—it is morally preferable— for a human being to be an educated person than a contented fool. There is a sense in which we can regard such a person as living a more successful life than the fool, but in this sense, being more successful is living closer to how one ought to live, not simply living with one's biological needs or drives satisfied.

Ordinary Features of the uses of the term welfare—Even when welfare is properly conceived as including an ethical component, it still makes sense to say that sometimes the welfare of an individual (or a group of individuals) ought to be sacrificed or diminished for the sake of the interests of others. To say this is to say that it is sometimes morally preferable, all things considered, for that individual or individuals not to live in a way that, other things being equal, would be better for them taken by themselves. Because it is sometimes morally permissible, or morally obligatory, to sacrifice the welfare of a person (or animal) to some extent, welfare and morality are not coextensive or synonymous concepts. This is why it also makes sense sometimes to say that one may or should provide less than optimal welfare to a person (or animal). Nevertheless, that one can sensibly say morality allows or requires some diminution or increase in the level of a person's or animal's welfare is consistent with there being an ethical component of the welfare regarding which one is making a further moral judgment.

The satisfaction of certain biological drives is a part of welfare, for without the satisfaction of some drives, a person may become ill or debilitated, may experience great pain or discomfort, or may even die—and we do not regard such states as good. Assessment of the frustration or degree of frustration of biological drives is often subject to scientific investigation, and much of this investiga-

tion can proceed without consideration of values. For example, scientists can determine what effects lack of sleep have on people and can estimate how various amounts of sleep deprivation are correlated with various physical and psychological problems. Although such things may be observed and measured scientifically, it is not this fact that renders the empirical study of sleep deprivation a study of welfare. These become welfare studies because people consider the effects of sleep deprivation inimical to welfare, that is, as threatening one's ability to live a worthwhile, valuable, and decent kind of life. The frequent congruence between welfare and the fulfillment of biological or psychological needs should not lead one to think that study of these needs can be separated from the valuational presuppositions that render these needs relevant to welfare. Likewise, pain, suffering, and unhappiness are often inconsistent with welfare because we regard such states, other things being equal, as evil and bad.

Many of the factors we consider conducive to welfare are capable to some degree of comparison or measurement, and it is therefore sometimes possible to speak of degrees or levels of welfare. For example, because pain is inimical to welfare, we will say that someone (or some animal) suffering a great deal of pain for a long period of time is experiencing a lower level of welfare than someone (or some animal) not in pain. Thus, while the measurement of greater or lesser degrees of welfare will sometimes depend on the possibility of comparing or measuring certain factors (such as pleasure or pain), and the measuring and comparing of such factors may well be a matter of empirical observation, it is the fact that certain states are regarded as good or bad and thus conducive or inimical to welfare that makes this an empirical comparison of levels of welfare.

There is no value-free boundary of minimal animal welfare.—The insistence of proponents of the pure science model to the contrary notwithstanding, it is not possible to mark out minimal levels of welfare without making ethical judgments. This can be shown most clearly in the animal area by considering the relevance of death to animal welfare.

Most, if not all, people believe that death is inimical to human welfare. We think this not just because living is necessary for experiencing welfare, but also because we value human life as a good. Death frustrates human welfare because it takes away the most precious gift one can have, life, and all that living can bring.

With respect to animals, however, many people deny that death is inimical to, frustrates, or indeed has any relevance whatever to welfare. Fraser and Broom,[6] for example, state that:

> If an animal is suddenly shot, with no previous warning that this might happen, and it dies instantaneously, then there is a moral question about whether such killing should occur but there is no welfare problem. If an animal dies slowly with much pain, or is wounded by a shot which results in pain and difficulties in normal living, then its welfare is poor. . . . .If animals are kept in order that they will eventually be eaten, their welfare could be good throughout their lives even up to the point of slaughter.

Although this statement is supposed to show that "welfare" does not presuppose value judgments, it demonstrates the opposite. Because we believe that the taking of innocent human life is evil, and because we value the lives that would be taken, we say that a genocidal maniac will negatively affect human welfare even if he kills his human victims immediately, without pain or warning. What is the difference between such human beings who would be killed and animals that are killed instantaneously and painlessly? The difference, clearly, is that many people (including Fraser and Broom) do not regard the taking of animal life as itself an evil and do not regard life as something that is morally owed to all animals.

However, people who object to the killing of animals, even when this might be done painlessly, do believe that such killing is inimical to animal welfare precisely because they regard the taking of an animal life under these circumstances as morally wrong. Philosopher Tom Regan maintains that even the painless killing of animals for food or in experimentation is inimical to their welfare because, in his view, such animals have an interest in living that ought to be respected. For Regan,[13] the farmer or experimenter who kills an animal, however painlessly, oversteps the minimal boundary of animal welfare.

> Death is the ultimate, the irreversible harm because death is the ultimate, the irreversible loss, foreclosing every opportunity to find satisfaction. This is true whether death is slow and agonizing or quick and painless. Though there are some fates worse than death, an untimely death is not in the interests of its victims, whether human or animal, independently of whether they understand their own mortality, and thus independently of whether they themselves have a desire to continue to live.

My point is not that Fraser and Broom are incorrect in thinking that it is sometimes morally permissible to kill animals. Rather, their characterization of the relevance of death to animal welfare rests on a value judgment that might appear so obvious and self evident to some that the authors do not recognize it as a value judgment. Fraser and Broom appear to endorse what I have called the anti-cruelty position, the view that one's major moral obligation to animals is not to cause them unnecessary pain or suffering.[18] However popular this view may be among animal welfare scientists and the general public, it is an ethical view nonetheless. It does not provide a value-free "objective"

boundary of minimal animal welfare.

Even among those who believe that one's minimal moral obligation is to avoid causing animals unnecessary pain or suffering, there can be disagreements about what would constitute minimal welfare—based on differences in value judgments regarding how much pain or distress animals ought to be allowed to experience. For example, some welfare investigators regard as intolerable and entirely inconsistent with welfare the pain experienced by cattle that are dehorned or castrated without the use of anesthesia.[24] Some farmers tell me that they see no welfare problem in such practices because pain is experienced briefly and alternative methods would be too expensive and time-consuming. The AVMA has taken the intermediate position that such pain constitutes a diminution, though not a complete departure from welfare, and reommends that "viable alternatives to castration and dehorning of cattle [without anesthesia or analgesia] be developed and applied."[5] Proponents of these three positions might well agree about the level and duration of pain experienced by the animals, and still disagree about whether or to what extent welfare is compromised. In this case, they would not disagree about the facts but about whether the pain constitutes such a weighty moral problem as to negate, diminish, or have any affect on what people should regard as these animals' welfare.

Value-laden definitions of animal welfare—In the animal welfare literature, value judgments are reflected in positions investigators take regarding whether certain factors (eg, reproductive success, animals' preference) should be included among criteria relevant to the assessment of welfare; whether certain levels of welfare are present; and the relative weight to be given certain factors (eg, pain, disease, stress, animals' preference) in the assessment of welfare. Although I cannot document here the operation of value judgments in discussions of all these issues, the presence of value judgments in animal welfare science is quickly seen by examining some of the definitions of animal welfare that have been proposed by leading investigators. The following are some of these definitions:

- "A state of complete mental and physical health where the animal is in complete harmony with its environment.[25]
- "The degree to which [animals] can adapt without suffering to environments designated by man."[26]
- Absence of "methods for handling and management [that] are so extreme as to induce stress or its overt symptoms, distress, on animals. Stress is understood to mean extensive physiological and behavioral disturbance in the animal resulting from noxious environmental factors."[27]
- Absence of "suffering."[21]
- "Mental well-being," which is identified with the absence of "suffering."[28] Suffering is defined as "a wide range of unpleasant emotional states" including "fear, pain, frustration and exhaustion" and other mental states "such as those caused by loss of social companions."[28]
- Freedom from pain and suffering. "Pain" is defined as "aversive stimulation of the central nervous system (CNS) originating from the damage of tissues, and, or organs either by disease, injury or functional disorder." "Suffering" is defined as "aversive stimulation of the CNS originating from behavioural and physiological conflicts with the environment."[29]
- "Well-being," characterized as the fulfillment of "needs."[1]
- An animal's "state as regards its attempts to cope with its environment."[6] The level or degree of welfare is seen as the degree of success achieved by the animal in coping "with difficult conditions."[6]

These definitions differ significantly. For example, while the "absence of suffering" connotes only the absence of certain very unpleasant experiences, the term well-being as it is ordinarily used refers to the presence of positive sensations, feelings, or experiences. Likewise, animals that might experience some degree of welfare because they are not subjected to treatment that is so extreme as to induce stress might nevertheless not be experiencing welfare (or might be experiencing a much lower level of welfare) under a definition that identifies welfare with a state in which an animal is both physically and mentally "in harmony with its environment" (whatever that means). Similarly, an investigator who defines welfare in terms of the degree of successful coping with adverse conditions might differ sharply with one who defines welfare as well-being and is therefore prepared to compare levels of welfare in various situations, some of which could not be called adverse.

It need not, surely, be different views of the facts that lead animal welfare investigators to differ in their definitions of welfare. Proponents of all of these definitions could look at an animal and agree that it is or is not undergoing certain kinds of experiences or conditions. For example, two investigators might agree that a particular veal calf confined in a crate and fed a low-iron liquid diet is not experiencing pain or distress. One, who defines welfare as the absence of suffering, will conclude that there is no compromise of the animal's welfare. The other, who defines welfare as a state of complete mental and physical health and who also views the ability to move, groom, and social-

ize as aspects of an animal's mental health, might view the situation as violative of welfare.

Someone who believes that welfare is fulfilled when there is absence of suffering takes the position that what constitutes an acceptable kind of life for an animal is one without suffering. Someone who believes that this is not sufficient for welfare believes that animals are owed more. Likewise, someone who defines welfare as the ability of animals to adapt without suffering to environments designated by man will assume the propriety of many kinds of animal care methods (provided they can be accomplished without suffering), while someone who defines welfare in terms of the satisfaction of needs may insist that one start with the animals' needs first and adapt environments to them—on the grounds that this is the morally correct approach.

The mischief of the pure science model

Those who maintain that their conceptions of "welfare" are value-free do not err in employing definitions of welfare that involve value judgments. For, I have argued, it is impossible to use the term welfare as it is ordinarily employed by people without committing oneself to certain ethical judgments. The denial that values are being endorsed does, however, lead to serious methodologic problems.

First, because those who endorse the pure science model do not recognize that they are making value judgments, they do not recognize certain important ethical issues as meriting consideration, much less serious discussion. For example, someone who defines welfare in terms of the fulfillment of needs will not recognize as independently relevant to welfare the fulfillment of what might better be termed wants—desires or preferences, the fulfillment of which might give satisfaction or pleasure, but the denial or frustration of which might not cause adverse or unpleasant physiological or behavioral effects. Because he assumes that what we owe animals is the fulfillment of certain needs, such an investigator will tend not to take seriously the ethical issue of whether people have a moral obligation sometimes to allow animals to do what they want.

Second, adoption of the pure science model leads to the foreclosing of potentially significant scientific investigations. For example, someone who defines welfare as the absence of suffering has already excluded as irrelevant research directed toward the promotion of positive mental states.

A good example of how ethical and scientific studies can be foreclosed by a definition of welfare is provided by Dawkins' view of studies of animal preference. Dawkins[30,31] found that hens prefer an outside run to a battery cage, although hens raised in a battery cage take some time to express this preference. Other studies have shown that laying hens prefer floors of fine-gauge hexagonal mesh to heavy rectangular mesh[32]; that pigs prefer light to darkness and will turn lights on even at night[33]; and that gilts prefer an earth floor over a pen adjacent to another pig but prefer being next to another gilt over straw or wood shavings.[6] Although such results suggest that animals can sometimes be made happier by being allowed to choose part of their environments, Dawkins[28] sees a serious limitation in viewing preference as evidence of welfare:

> Now the obvious rejoinder to the finding that hens prefer being outside in a run to being inside in a battery cage is that this does not tell us anything about whether they suffer in battery cages. A gourmet might prefer caviar to smoked salmon, but it would be difficult to argue that he would suffer if he had to make do with smoked salmon. This is another way of saying that preference by itself is not an indicator of suffering. To show that a preference does indicate suffering in the less preferred environment, we have to find out not merely what the preference is, but how strong it is. If it were shown that hens would do literally anything to get out of a battery cage and that their preference for the run was so strong that it overruled everything else, then it might be possible to conclude that they suffered in cages.

Dawkins is a proponent of the definition of welfare as the "absence of suffering"[28] (a definition based on a value judgment that people ought not to permit animals they use to suffer). This definition not only leads Dawkins to ignore the possibility of discussing whether farmers ought sometimes to allow animals to express their preferences even if doing so is not necessary to the alleviation or prevention of suffering. The definition also leads her to dismiss studies that would not show animals would "do literally anything" to express their preferences as irrelevant to welfare. For she appears to think (mistakenly, I would argue) that extremely strong preferences indicate only flight from suffering and not impetus toward pleasure. In any event, she rules out a whole line of inquiry relevant to the view that animals ought sometimes be allowed to express their preferences irrespective of whether this would affect their level or degree of suffering. For, someone might argue, even if certain conditions preferred by farm animals were analogous to unnecessary but nevertheless pleasurable epicurean delights, might it not sometimes still be incumbent upon farmers to provide them with such conditions, simply because these conditions make the animals happier? Might not this added happiness or pleasure heighten the level of their welfare?

There is no purely factual justification for the contention that preference is relevant only when it provides evidence of suffering. Rather, Dawkins appeals to unspoken value judgments that do not include the principle that animals are sometimes owed not just freedom from suffering but positive pleasures.

Another problem Dawkins[28] finds in preference testing is that:

> . . . animals do not always choose what is best for their own long-term physical well-being. . . . there is probably some connection between what animals choose on the one hand and what is best for their survival and reproduction on the other. The connection is not, however, a hard and fast one. Animals do not always choose what is best for them.
>
> . . . Domestic cattle . . . [s]ometimes eat poisonous plants or bloat themselves with clover. Animals such as pigs and rats have a strong liking for saccharine, and yet it has no food value. We can add other examples from everyday experience; people choose to smoke and do other things which may damage their health in the long run.

Here, welfare appears to be identified with physical health in the long run (apparently because Dawkins thinks that the absence of such health is associated with suffering). Dawkins seems to find behavior that either frustrates such health (eg, consuming poison) or does not further it (eg, consuming nonnutritive saccharine) as being inimical to welfare.

Dawkins is correct that free choice can be injurious to welfare, because people and animals can make poor choices. However, the relations between choice and welfare are not done justice by the statement that choice and welfare can sometimes conflict. Sometimes, we regard the ability to choose what one wants and the pleasure brought by such choices as a fundamental feature of welfare, even if what is chosen might not turn out to be optimal for physical health. For example, most of us would regard our welfare as diminished if we were forced to eat only healthful foods, or to exercise instead of enjoying certain sedentary pleasures, even if it could be demonstrated that our "health in the long run" might be damaged somewhat. Moreover, we do not regard as inimical to welfare a whole range of nonbeneficial activities, such as the consumption of pleasurable but nonnutritive foods. Indeed, most people would say that their welfare would be diminished if they were not often permitted to choose harmless pleasures.

We include within human welfare the freedom to enjoy some harmful and some harmless pleasures because we believe a life with such freedoms and pleasures to be better than a life without them. Is it self-evident that this cannot sometimes be true with regard to animals? Some people maintain that it is better—and therefore conducive to welfare—for wild animals not to be kept in captivity even if so keeping them provides a life that is longer and free from predation and disease.[13] They might believe that it is just better for such animals to live freely and choose what they want, on the grounds that either the pleasures the animals experience will be greater than those they will receive in captivity, or that living in the wild accords with their inborn natures.[34] Nor is it patently ridiculous to argue that pigs and other farm animals might live a better life if they could enjoy certain pleasures that did not result in their living an optimally healthy life, or even in their producing the amount and quality of foodstuffs farmers would prefer.

People who think that animal welfare might be served by sometimes allowing animals to do what they want might be making incorrect value judgments. However, it hardly seems fair to dismiss their value judgments by proclaiming a definition of welfare that incorporates a contrary value judgment. The only way to determine which of these value judgements is preferable is to approach them as value judgments and to assess them accordingly.

Also precluded by Dawkins' definition of welfare is potentially relevant scientific research. For example, it might be interesting to learn a great deal about how pleasurable nonnutritive (or nutritive) sweets may be to farm animals, whether such sweets interfere with the ingestion of healthy foods, whether they affect productivity, how much providing such sweets will cost farmers, and whether they might sometimes lead to disease or loss of fitness. Such studies might lead to the raising of ethical issues concerning whether such treats are owed to animals. This, in turn, might lead investigators at least to consider a characterization of welfare that includes some reference to pleasure. But all these interesting ethical and scientific issues will likely not even occur to investigators who have already adopted a definition of welfare that renders such issues irrelevant.

Should the concept of welfare be abandoned?

Dr. Michael Fox suggests that because the concept of animal "welfare" has become entwined in ethical arguments relating to the proper treatment of animals, the concept is now a burden to veterinarians and scientists. According to Fox, some veterinarians and ethologists are already "tending to avoid the term and advocacy of animal welfare in favor of advocating animal health and well-being (well-being implying provision of an environment and standards of care and husbandry that cause minimal stress and distress and satisfy the animal's basic behavioral and social requirements.)" Unlike welfare, "animal health and well-being can be objectively and scientifically determined, thus providing a basis for evaluating the humaneness of how animals are treated." By avoiding talk of welfare, veterinarians will not have to "stand in judgment of how society uses animals." The profession will be able to "focus objectively on areas of animal use wherein improvements in health and overall well-being are clearly needed."[35] Fox's proposed solution for the "problem" of value-laden discussions of animal welfare cannot work.

First, as Rollin[36] has demonstrated, what counts as "health" or "disease" in both human and

veterinary medicine often includes reference to the values of those who determine that a physical or mental state or condition is to be considered healthy or diseased. For example, societies that prize heaviness do not classify obesity as a disease, while in the United States, obesity is seen not just as contributing to illness, but as an illness in itself. Likewise, as Rollin notes, animals used in agriculture are frequently not considered ill if these animals are producing as expected even though they may be experiencing some distress. In contrast, the owners of companion animals with similar pain will take their animals to a veterinarian for treatment because these people find such pain unacceptable. Thus, replacing talk of welfare with the notion of health will not eliminate value judgments.

The same thing is true of the term "well-being," which, like the words health or welfare typically incorporate value judgments. Not every farmer, veterinarian, or scientist would agree with Fox's view that anything more than minimal stress or distress is inconsistent with overall well-being. Some would say animals that experience even some significant stress for some time are doing "well enough," and others would view well-being as not just the absence of stress but the presence of pleasure. The differences among these (and other) interpretations of well-being are based on differences in what is thought is owed to animals.

A more fundamental problem with Fox's rejection of the term welfare is that even if investigators tried to restrict themselves to the study of phenomena that do not refer to values, values will inevitably creep back into their work. There are phenomena that can be studied without reference to values. For example, insofar as human beings can determine that animals experience states such as discomfort, stress, pain, contentment, and pleasure, these determinations should be capable of being made without engaging in value judgments. Let us suppose that investigators discontinue speaking about welfare and instead turn to investigating such mental states, as well as other phenomena that can be described without reference to values, such as length of life-span, susceptibility to infection, and production of offspring. Two things will happen to such investigators.

First, they will find themselves relying on value judgments in making decisions about what animals to study, and about what kinds of states or conditions to study. Thus, most investigators would not undertake studies of stress in urban rats because they would not consider that such animals are owed freedom from stress. In contrast, most researchers would surely maintain (as they do now) that extensive studies should be done of the nature and causes of stress in farm and laboratory animals—because it is widely held that we owe it to such animals that they not experience significant stress. Just as at present there are disagreements among researchers about whether positive well-being should be included together with freedom from suffering in the definition of welfare, so will researchers who refrain from speaking of welfare disagree about whether animals are owed pleasure as well as freedom from suffering. Those who believe animals are owed more than freedom from suffering will find appropriate scientific studies of such states as pleasure, contentment, and happiness, while those who do not believe that animals are owed more than freedom from suffering will find such studies relevant only insofar as they might bear on the question of when animals suffer. In selecting and giving relative weight to animals' mental states and conditions of existence, investigators will be relying on their perception about how animals ought to be treated, even if they avoid using the word welfare.

The second thing that will happen if investigators attempt to restrict themselves to purely factual issues is that they will soon be using the current concept or idea of welfare even if they could somehow avoid the word welfare. That is, they will soon study conditions that are conducive to the kinds of existence human beings are ordinarily obligated to provide for animals—conditions that we now say are conducive to welfare. This will happen because the underlying motivation for most investigators will still be, as it is now, a desire to afford to certain animals the kind of life these animals ought to be provided.

Fox's own criticism of the term welfare itself illustrates why veterinarians, scientists, and the general public will never abandon the idea for which this term stands. Fox says that the advocacy of well-being will help the veterinary profession "best serve society and its animal constituency.[35] Thus, the promotion of well-being is a moral imperative, something that is owed to the animals. By including satisfaction of "the animals basic behavioral and social needs" in his definition of well-being, Fox is saying that the kind of life some animals are owed is one in which these needs are fulfilled.

Now suppose someone objects that animals are not owed such a life. Fox cannot respond that animals just are owed well-being as he defines it. For even if Fox's opponent accepted his definition of well-being, the opponent could still reject the claim that animals are entitled to well-being in this sense. Fox must respond with ethical arguments to demonstrate that what he deems to be basic behavioral and social needs ought to be fulfilled.

Fox's importation of his own ethical views into his definition of well-being is no different from the importation of ethical views into characterizations of animal welfare. His discussion and those of other welfare investigators demonstate that veterinarians, welfare scientists, and members of the public want a term that refers to what is good for an animal in the sense of what would provide it with the life we ordinarily ought to permit or encourage it to live.

In short, if the term animal welfare did not ex-

ist, there would soon emerge a word that means precisely what animal welfare has always meant. The current idea or concept of animal welfare has such potent moral force that if it somehow did not exist, it would soon be invented.

Central tasks of the field of animal welfare

Once we recognize that not just the promotion but even the study of animal welfare is inextricably intertwined with ethical issues, we can appreciate some of the tasks faced by students and advocates of animal welfare.

Because animal welfare studies involve making ethical judgments, it is inadvisable to speak of "animal welfare science" or "the science of animal welfare." These locutions may encourage the view that the study of welfare is a purely factual matter. Fraser[37,38] in discussions that recognize the connections between animal welfare and ethics, speaks helpfully of the field of animal welfare or welfare. Once one speaks of such a discipline, one can then appropriately distinguish scientific from ethical investigations (and investigators) within the discipline.

An urgent task faced by the field of animal welfare is the clarification of when and to what extent ethical rather than purely factual questions are being addressed. This is important, as we have seen, because unexpressed and unexamined ethical presuppositions sometimes lead investigators toward or away from certain kinds of empirical investigations. There must be relentless examination of how ethical views affect the choice of what animals' welfare to study and of how much or what levels of welfare are deemed worthy of study. Ethical presuppositions relating to what factors are considered indicative of welfare, or what weight should be given various factors, must be uncovered. Ethical positions must be subjected to as rigorous an analysis as the state of animal and veterinary ethics allows. This will require persons with advanced background in ethics to be included in the field of welfare.

To prevent the foreclosing of valuable ethical and scientific work, welfare investigators should avoid trying to give purportedly complete and exhaustive definitions of welfare. Definitions, as has been seen, can remove competing ethical and scientific viewpoints from one's universe of discourse; alternative ethical and factual inquiries become literally unthinkable because they do not fit a preconceived definition of welfare. Robust scientific and ethical enquiry about factors relevant to animal welfare is not facilitated by unexamined factual or moral propositions parading under the guise of purely "objective" definitions of central terminology.

Sometimes, different ethical approaches to welfare will support the same kinds of empirical research. For example, virtually every present definition of welfare includes pain and suffering among factors inimical to welfare. There is thus no reason why scientists who may favor different characterizations of welfare but who agree that the presence of pain is inimical to welfare cannot go about the purely factual tasks of attempting to characterize, find evidence of, and measure painful mental states or conditions. Where differing ethical views might lead to different kinds of scientific studies, and where these differing ethical views have at least some plausibility, the field of welfare should encourage the empirical research associated with these competing ethical views.

Factual discovery about what might benefit or harm animals will often lead to questions about ethical obligations. If ethicists participate in welfare investigations, relevant moral questions might be asked more quickly and more persuasively, and such questions might then suggest further appropriate empirical studies.

Another reason ethicists and philosophers should participate in animal welfare studies is that many terms already used by scientists to describe animal behavior and evaluate animal welfare are rarely subjected to careful philosophical analysis. As I have observed[18] veterinarians and animal scientists sometimes define terms such as pain, stress, distress, anxiety, suffering, and needs carelessly or with insufficient attention to what these terms mean in ordinary discourse. This can result in confusion among investigators employing different senses of terms. Philosophers whose expertise includes the careful analysis of terminology can assist scientists to clarify what they are trying to say.

The field of welfare must also include participation by sciences that have not traditionally investigated animal issues. Animal welfare can be greatly affected by physical objects such as cages, enclosures, fences and guards, flooring materials, and various kinds of machinery. Fields such as materials science, biomechanics, and industrial design may be able to contribute questions and answers relevant to animal welfare that would never occur to animal behaviorists, ethologists, veterinarians, or ethicists. Curtis[1] documents a number of improvements in environmental and equipment design, such as the development of a new laying-hen cage and a swine drinking-valve design for sow feeders, that were made possible by the contributions of physical and industrial sciences not historically associated with animal welfare.

Just as ethicists must play an important role in the field of welfare, so must those who use and benefit from animals whose welfare is under discussion. All specialists in welfare should avoid the view that because this is a separate field or discipline, only professional practitioners of this field are "entitled to an opinion" about what constitutes or promotes welfare. For example, in farm animal welfare studies, there must be participation by producers. Their economic interests must be

factored into husbandry decisions and who are intimately familiar with current procedures. Without such participation, the systematic review and improvement of farm animal welfare will be impossible.[1]

Finally, serious participation in welfare discussions by the public and its political representatives should also be encouraged. Practices in farm animal husbandry cannot be evaluated apart from the public's interest in safe and affordable foodstuffs. In assessing, say, a method of producing eggs that would improve welfare but increase consumer prices, an essential ethical issue will be whether benefiting the animals is worth the extra expense. This question cannot be answered without a complete understanding of what this expense would mean to real consumers. Similarly, public interests must be taken into account in evaluating, from a moral standpoint, welfare steps that could effect the cost and availability of biomedical research utilizing animals, or the cost or availability of entertainment animals such as racehorses. The most highly motivated animal welfare recommendations (or legal requirements) can be ineffective unless they are accepted by people who will be affected by them. To be sure, the preferences and interests of farmers, industries, and the public must also be subjected to ethical scrutiny. People do not always want what is owed to animals, and it is not always morally correct to require that animals adapt to human preferences.

The 1985 amendment to the federal Animal Welfare Act requiring researchers to provide facilities to promote the "psychological well-being"[39] of primates illustrates what can happen when a partnership is lacking between animal welfare researchers and the public or its political representatives. Congress passed this law because it thought that researchers have a moral obligation to provide primates psychological well-being. Yet, at the time, primatologists, biomedical researchers, and animal welfare investigators possessed little factual knowledge about what promotes or constitutes psychological well-being in primate species. Many scientists complained to regulatory authorities that psychological well-being could not be defined or measured and had no basis in scientific fact.[40] Panels and meetings were convened to learn what was known about primate psychological well-being so that intelligent government regulations pursuant to the statute could be formulated.[41] Much of the confusion and controversy has arisen from the fact that there is widespread disagreement about what the term psychological well-being means (and even more about what would promote it), about how to define the word stress, and about whether psychological well-being can be equated with environmental enrichment.[42] The regulations enacted in February 1991 by the USDA were relatively tame. For example, regarding opportunities for socialization with other primates, provisions are to be made "in accordance with currently accepted professional standards, as cited in professional journals or reference guides, and as directed by the consulting veterinarian."[43] There are few such standards, and the regulation appears to give virtually unbridled discretion to consulting laboratory veterinarians, few of whom even consider themselves experts in primate psychology. Nevertheless, many researchers still objected to the regulations as an unwarranted and factually questionable intrusion into the scientific enterprise.[44]

Congress acted without appreciating the state of knowledge regarding primate psychological well-being, and without considering the many ethical and conceptual issues that regulators, biomedical researchers, and animal welfare investigators face in exploring levels of acceptable welfare for different species of primates. Perhaps some of the controversy could have been avoided had the public's representatives, biomedical researchers, primatologists, veterinarians, and ethicists been involved from the start in a cooperative investigation of these animals' welfare.

Major ethical issues relating to animal welfare

The number, range, and difficulty of ethical issues that now confront the field of welfare are staggering. The Appendix that follows lists some of these issues. The Appendix does not purport to set forth all important ethical issues relating to animal welfare. Moreover, some of the questions listed are quite general and contain or imply scores of further questions. For example, there are hundreds of standard techniques in the handling of farm or laboratory animals that raise interesting welfare issues. To a certain extent, the questions one lists as relevant to welfare will be a function of one's own value judgments. Thus, those who oppose, say, the use of animals in research, would maintain that the appropriate question should not be whether certain techniques or practices are conducive to welfare, but whether animals ought to be used in experimentation at all. I have attempted to include questions that would be regarded as important by some significant proportion of veterinarians, animal welfare investigators, direct users of animals, and members of the public. I have tried to phrase the questions in a neutral manner, without indicating what answer might be appropriate.

The significance and difficulty of these questions (and undoubtedly of others the reader will supply) provide the strongest reason possible for the inclusion of serious ethical investigations within the field of welfare.

Conclusion

The field of animal welfare will make progress in understanding and improving the lives of animals if it is recognized as a separate discipline, but one that is inherently interdisciplinary in nature.

Because the fundamental motivation for studying and promoting welfare is ethical, and because the very concept of animal welfare forces one to make and rationally defend value judgments about what ways of treating animals are appropriate, ethics is among those disciplines that must comprise the field of welfare. Veterinarians should be proud that their profession is playing a pre-eminent role in the science and ethics of animal welfare.

Appendix: Major ethical issues relating to animal welfare

Farm Animal Welfare

To what extent, if any, do standard agricultural practices (eg, indoor confinement rearing of pigs, intensive battery cages for laying hens, castration of cattle and pigs without anesthesia, debeaking of chicks, administration of subtherapeutic doses of antibiotics) make inappropriate compromises in welfare? Where an inappropriate compromise might be made, are there alternative methods that satisfactorily reconcile the interests of animals, farmers, and the public?

How do various methods of stockmanship (including different kinds of contact between handlers and animals) affect welfare?

Can modification in the design and construction of animal production equipment improve welfare consistent with legitimate economic needs?

To what extent, if any, should farmers and veterinarians concentrate upon the welfare or productivity of herds rather than of individual animals?

To what extent, if any, is it proper to tolerate disease in individual animals in order to promote overall productivity or profitability?

Do conventional methods of handling and moving animals on farms comport with proper regard for welfare?

Do present methods of transporting animals to feedlots and slaughterhouses comport with proper regard for welfare?

Are animals treated properly while at markets?

Should improvements be made in welfare aspects of slaughter and preslaughter procedures?

To what extent, if any, should veterinarians argue for or insist upon procedures to further the patient's welfare when doing so is opposed by or runs counter to the client's economic interests?

To what extent are emerging techniques in biotechnology designed to enhance production (eg, bovine growth hormone for dairy cows) conducive to welfare?

Laboratory Animal Welfare

What are the welfare implications of variations in general housing and environmental conditions (eg, size and construction materials of cages, temperature, ventilation, quantity and quality of food, lighting, nature and quantity of bedding for nesting animals, ability to come in contact with other animals, opportunity for exercise)?

To what extent should negative mental states such as discomfort, stress, distress, pain, and suffering be lessened or eliminated to comply with acceptable levels of welfare? Has there been sufficient attention to the development of anesthetics and analgesics for laboratory animals?

Does laboratory animal welfare include positive mental states such as pleasure and psychological well-being, and if so, to what extent, if any, should such experiences be provided to laboratory animals?

To what extent, if any, should certain practices in cancer and immunology studies (eg, growth of large implanted tumors, use of complete Freund adjuvant) be modified or abandoned to comport with appropriate levels of welfare?

To what extent, if any, is it permissible to cause pain to or otherwise compromise the welfare of animals used in psychological experiments?

What methods of euthanasia are appropriate in various circumstances and for various species? When do welfare considerations require euthanasia rather than continuing the experiment or allowing death as an experimental endpoint?

Is general animal welfare furthered or diminished by prohibiting the use of animals abandoned to pounds and shelters?

In general, how should welfare considerations be weighed against economic costs of providing enhanced welfare or potential effects on research projects?

Are certain species (eg, chimpanzees, certain primate species) entitled to have certain aspects of their welfare respected such that they should never be used in research, or if used, may be used only in the most important and practically beneficial studies? To what extent, if any, is it appropriate to be more concerned about the welfare of certain ("higher") species than about other ("lower") ones?

To what extent, if any, is it justifiable to compromise welfare in basic as distinguished from practically-oriented research?

Are certain testing methods (eg, LD_{50}, Draize eye irritant test) sufficiently respectful of welfare? Does the moral appropriateness of such tests vary with the kind of substance or product (eg, medicine vs cosmetics) being tested?

To what extent is it possible or appropriate to reduce the use of animals in research or to replace animals with non-animal modalities?

Companion Animal Welfare

Are certain breed standards in dogs and cats so detrimental to health that they constitute an

impermissible diminution in welfare? What should be the position of the veterinary profession regarding breed standards that have negative effects on welfare?

Should veterinarians dock the tails or crop the ears of dogs?

Under what conditions might welfare considerations argue against the declawing of cats and the debarking of dogs?

How should veterinarians respond when clients do not want to provide their animals with medical care that would protect or promote these animals' welfare?

How should veterinarians respond when clients cannot afford medical care that would protect or promote their animals' welfare?

How should veterinarians approach clients who abuse or neglect their animals or whose ignorance about proper pet care leads them to harm their animals' welfare?

When does due consideration for welfare argue in favor of euthanatizing an ill or injured animal? How should veterinarians respond when clients elect to continue treatment when doing so causes the patient to suffer or to experience a greatly diminished quality of life? How should euthanasia be performed in order to protect welfare?

Does the practice of euthanatizing healthy, well-behaved animals "on demand" affect the ability of the veterinary profession to promote itself as a protector of animal welfare?

To what extent are low-cost rabies and spay/neuter clinics consistent with due regard for patient welfare?

Is there sufficient protection of the welfare of puppies bred in and transported from so-called "puppy mills"?

Sport and Entertainment Animal Welfare

To what extent, if any, do certain pharmacological, medical, or surgical procedures (eg, precompetition administration of drugs) pay due regard to performance animal welfare?

Should the design (including track materials, track geometry, moisture in tracks) and maintenance of tracks and racing surfaces be improved to promote welfare?

To what extent are conditions under which racing animals are stabled or kenneled sufficiently conducive to welfare?

Are conditions of training sufficiently respectful of welfare?

To what extent do current practices regarding the provision of emergency medical care and euthanasia of injured racing animals pay due regard to welfare?

Do current practices relating to preexamination and track veterinary supervision sufficiently protect welfare?

To what extent might animals be raced beyond the time when it is humane to do so? In general, is there sufficient respect for the welfare of animals that can no longer race or cannot meet the economic expectations of owners?

To what extent should veterinarians argue for or insist upon the provision of medical care to protect the patient's welfare when doing so is opposed for economic reasons by trainers or owners?

Should surplus Greyhound racing dogs be used in medical research?

To what extent are conditions under which circus or amusement park animals housed and trained sufficiently respectful of welfare? Are some kinds of animal performance "acts" injurious to welfare?

To what extent might certain current practices in the sport of rodeo be insufficiently respectful of welfare?

Do current regulatory or voluntary procedures sufficiently protect the welfare of racing horses and dogs and show horses?

Wild and Exotic Animal Welfare

Do welfare considerations argue against the keeping of certain species (eg, reptiles, amphibians, wolves) as pets?

To what extent do various commercial and environmental practices (eg, discharge of treated or untreated sewage into the ocean, air pollution, deforestation, location of homes or farms in proximity to wildlife areas) affect the welfare of wild air, sea, and land animals?

To what extent do various recreational practices (eg, motor-boating, whale-watching, human activities at national parks) affect the welfare of wildlife?

Are current commercial or sport hunting and trapping practices sufficiently respectful of welfare?

Is it preferable for government authorities to permit hunts of overpopulated groups of wild animals or to allow these animals to compete for limited resources on their own? How should authorities deal with wild animal populations that pose a threat to public health or safety?

To what extent, if any, do welfare considerations argue against confining wild animals in zoos or aquaria? Is it ever inappropriate to confine certain species merely for human entertainment? What kinds of conditions or facilities are preferable from a welfare standpoint?

To what extent should farmers, veterinarians, and the public be interested in or concerned

about the welfare of fish in aquaculture facilities?

Is sufficient attention paid to the welfare of surplus zoo animals that are auctioned or sold to private owners?

When, if ever, should veterinarians treat wild animals that are not members of endangered or threatened species?

To what extent are certain scientific practices used in the study of wildlife behavior and habitat (eg, implantation of radio transmitters, various kinds of tagging) sufficiently respectful of welfare? Should scientists who come across injured or sick wild animals attempt to help them?

Is it right to attempt to improve the welfare of animals in the wild by improving their environment, protecting them from predators, or treating them for illness or injury?

In general, should veterinarians, scientists, and members of the public be concerned about the survival and welfare of individual wild animals as opposed to species or groups of animals or indeed of entire ecosystems?

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A European perspective on farm animal welfare

Rev Anthony L. Birbeck

It is a privilege and an honor to take part in the Animal Welfare Forum. I understand there is a growing interest in farm animal welfare in the United States, which will be welcomed by the veterinary profession. In the United Kingdom, we often regard ourselves as followers of practices or fashions from the United States, but in this instance we seem to have moved earlier and further. I hope it will be helpful and encouraging to share my experiences in the United Kingdom as a member of the Farm Animal Welfare Council (FAWC), and provide you with the background to developments in farm animal welfare.

I am going to begin by mentioning how well we are provided with legislation in the United Kingdom, and explain what the FAWC is, and then say what I believe are the main types of issues that must be given attention for there to be improved welfare. I am also going to refer to difficulties caused by people's attachment to positions and interests, before saying that progress is being made and there is generally cause for optimism in Britain and Europe. I hope this will give you added determination and encouragement.

Legislation

We have a situation of free trade within the European Economic Community and we know that it is no use creating situations or restrictions that will place the British farmer at a disadvantage compared with his counterparts in, say, France or Denmark. That will be an important consideration here, too, because producers in one state will resist giving advantage to those in others.

In the United Kingdom, we possess a substantial body of law and advice on animal welfare. The basic piece of legislation is the Agriculture (Miscellaneous Provisions) Act of 1968, and there are many other regulations that govern what can and cannot be done to farm animals. The Welfare Codes for each species of farm animal are made under a section of the 1968 Act and breach of provisions in them can be used as evidence in cases of prosecution.

From the Farm Animal Welfare Council, Wells, Somerset, England, BA5 2JQ.

We have so many legal provisions that we see ourselves as being in advance of other countries in the European Economic Community in this respect, and considerable effort is being given to the creation and harmonization of animal health and welfare legislation in the Community. Of necessity, all legislation emphasizes the avoidance of cruelty, neglect, and disease. We are seeking a shift in emphasis, from negative to positive welfare. Positive welfare has to do with the creation of circumstances, situations, and practices designed to enhance animals' welfare to the point of giving them the benefit of the doubt, or being generous in the way they are treated from birth until death.

Farm Animal Welfare Council

The FAWC itself is an important part of the British background. It was created in 1979 by the Minister of Agriculture, Fisheries and Food, and was given the responsibility of reviewing the welfare of farm animals on agricultural land, at markets, in transit, and at the place of slaughter. It is an independent advisory body, and important strengths it has are the rights to initiate its own inquiries, to consult whom it wishes, and to publish its advice. Of course, the Minister may or may not accept, or may partly accept, any of these initiatives. The FAWC has exercised these rights on a considerable scale. The Minister invites members to serve on the FAWC, and it is important that its composition includes those who represent a wide range of experience. At present there are 23 members, 3 of which belong to the veterinary profession, as well as 2 agricultural scientists and 1 animal behavioral scientist. There are 6 farmers, 1 lawyer, 3 welfarists, and members with expert knowledge of and experience in transport, markets, education, and public relations. One of these, I am glad to say, is Ruth Harrison, who, in publishing her book *Animal Machines* in 1964, became the catalyst for the reaction in which the Brambell Committee was created.[1]

Unnecessary pain and distress

The Brambell Report (1965) stated that welfare is a wide term and embraces both the physical

and mental well-being of animals. The Act of 1968 makes it an offense to cause an animal "unnecessary pain or unnecessary distress." There are difficulties in enforcement, one of which is being able to define and measure animal welfare. This also affects the possibility of conducting rational debate among people with different interests and standpoints. Pain, stress, and suffering are impossible to measure scientifically, but are central to discussions and work involving the welfare of farmed animals. The fact that the measurement and evaluation of welfare is inexact will continue to be among the reasons used to resist change and classify major improvements, particularly in husbandry practices, as being unnecessary.

Dr. Marian Dawkins of Oxford University, in her book *Animal Suffering* suggests differences between "stress" and "suffering." Suffering includes fear and frustration as well as pain or physical damage. Stress includes situations where an animal wants to take defensive or compensatory action (fight or flight), but where neither is possible.[2] These terms and definitions help initiate a discussion of the various animal welfare issues.

Welfare issues

There is a wide range of issues to be addressed in improving welfare and not all are wildly exciting; many need strategic thinking and dedicated effort over a long time. Basically, they relate to what I call the six"-ings": housing, rearing, feeding, transporting, marketing, and killing. My experience suggests they must be tackled under three main headings, all of which have been and continue to be of concern to us in Europe, and to which we have devoted much attention on the FAWC.

Husbandry—Husbandry systems (how animals are kept), are the cause of much of the loudest debate about welfare. Laying hens, poultry, veal calves, pigs, and even mink and fox are reared in intensive systems, the acceptability of which is increasingly being challenged. Practical alternatives and improved systems of production for enhanced animal welfare are needed, as are the research and development which will objectively support them.

Design and upkeep—Design and upkeep of the plant and materials used is important both to avoid hurting animals, and to fulfill, to a high standard, the purposes for which they were intended. Plant and materials includes such things as truck design and the means of loading and unloading animals; lairage and race design; the design of safe and comfortable farm buildings, pens, boxes, and conveyors; and stunning equipment at slaughter houses. Of course, animals are the ultimate beneficiaries. Even in human affairs, it is all too easy, as many of us know, for designers and technicians to prescribe and build without adequately consulting those who have to live with the consequences and make them work. Although we cannot consult hens, calves, or pigs about their preferences, there are plenty of scientists, practitioners, and operators whose advice, if sought, could lead to many practical improvements and some innovation which would take account of animals' instincts and behavior. Adequately funded research and development is needed here, too.

Management and handling—Systems involving animals are, within their own limitations, run only as well as they are managed and operated—excellently, indifferently, or badly. Important parts of management and operation concern both how animals are handled and how their needs are understood. Legislation takes you only so far in ensuring the welfare of the animal. An individual's behavior is the outcome of choice. Choices can only be made properly when people are aware of the options open to them and the effects of what they do. We have to get people to behave in ways that respect animals and birds as creatures, rather than treating them as inanimate production line units. There is also a problem over the transport of livestock, including the lengths of journey times and feeding and watering during these journeys. These issues must be managed within the framework of legislation which we seek to have upheld in greater detail.

Education and training

People must be educated and trained to understand more about the nature of the animals in their care and how they should be treated in the conditions that we have developed. We have made links, in the United Kingdom, with schools and colleges of agriculture, and in October 1990 created the possibility of a regular link with animal husbandry teachers from seven British veterinary schools. The Agricultural Training Board is keen to ensure that training in welfare practices is an integral part of every relevant course in the large program provided for farm workers. It is possible that the Board's remit will soon be widened to empower it to train those working in related activities off-farm, for example, in markets and slaughter houses.

Second only to continuing reassessment of basic husbandry systems, we must continue to be concerned with the handling of animals by those catching and transporting poultry, by those in markets, and by those unloading, stunning, and slaughtering. Our pressure and concern to improve standards in such situations must be unremitting. We must seek to change management systems that encourage desensitized behavior on account of, say, methods of payment, and we must improve individual behavior and its supervision.

In a wider sense, we are also seeking to educate and inform people whose understanding about welfare issues could lead directly to changes of practice and to systems that we would judge to be

more welfare-friendly. I am thinking about the ultimate consumer as well as about key people in the major retailers, who, in Britain, have close and influential links with their producers. Producers, processors, and retailers often cite economic considerations as reasons for not seeking to improve welfare. However, it is beginning to become clear that positive welfare can be sold, with financial benefit, as it achieves a higher profile in the public eye and influences purchasing habits. We want an increasing number of people to be aware of the way in which animals used for agricultural purposes are treated, so as to provide more opportunity for informed choice.

Stances and loyalties

I know that the United States has much the same range of interest and advocacy groups concerned with animal welfare as we have in the United Kingdom. Groups at one extreme say there is no problem and that attempts to identify areas for improvement in the way farm animals are treated are misinformed and foolish and an attack on their personal values and integrity. Groups at the other extreme espouse violence in pursuit of animal rights. Between the nonviolent and the violent, there is a middle-of-the-road group on the continuum that we call welfarists. These people regard it as a human obligation to ensure the humane treatment of animals.

It is always difficult to find grounds for discussion, let alone cooperation, with extremists, absolutists, and others with particularly strong group loyalties. To move forward in addressing some of the issues I have described, as I believe we have in the United Kingdom, a coalition of people of the middle ground is needed. I can imagine few people that would deny the desirability of treating animals humanely, and that must be the starting point. Do not minimize the difficulties, however, which are the same as in other aspects of life. We are all caught up with our own loyalties and obligations to the groups or organizations to which we belong. Values can then appear unclear in the face of difficulties and dilemmas where there are choices of action or behavior. Values are in large measure conditioned by the group or organization to which we belong and it is difficult to stand back and take a fresh, independent look; that is the strength of peer groups.

I believe that the veterinary profession in the United States has a particularly important and influential role, though you, too, have similar loyalties and obligations to people, to organizations, and to animals. I believe that your reputation as professionals will be enhanced by raising your sights, not by compromising, and by consistently presenting an educational and influential view. Above all, being seen clearly and publicly to be on the side of animal welfare, proclaiming that it is desirable and sensible. Let's fight any image that animal welfare is the province of those who are cranky, subversive, or impractical.

Some areas of progress

I am glad to be able to say that progress is being made in the United Kingdom. Some, though, are impatient with the speed at which things move and we, of the FAWC, are often critical when either our ideas and proposals are not fully accepted within the Ministry or when the time it takes to bring legislation to Parliament is too long. There have been numerous changes in legislation, such as the banning of veal crates; the requirement that stockpersons must have access to copies of the relevant welfare codes and must have had instruction and guidance on them; detailed requirements relating to stunning and slaughter of animals and poultry, and to the conditions in which they are held while awaiting slaughter; the phasing out of the rotary casting pen; and pieces of legislation relating to operations and mutilations. These changes and others have been achieved in recent years.

More efforts are being made to ensure better welfare enforcement, recognizing that education, advice, and prevention are preferable, with prosecution a last resort, because by that time, the animal will have already suffered. There is an increased determination to improve collaboration between the State Veterinary Service, County Council Health Inspectors, and officers of the District Councils. Recently, we have begun what I hope will be regular discussions with officers of the National Farmers' Union.

Another recent development has been closer relationships with representatives of some of the major British food retailers. We may soon be able to establish welfare standards for livestock production systems, with retailers making compliance with the standards a contractual requirement for their suppliers. The British Retailers Association's Meat Committee has expressed considerable interest in the efforts being made to establish guidelines and production standards for livestock and is interested in being party to drawing them up. One of the market leaders has a set of welfare specifications and has sought further guidance from the FAWC Secretariat.

The gradual raising of the profile of welfare in public awareness is contributing to growing demands for food which is labelled as having been produced in accordance with certain standards. At least one major poultry producer, based in Northern Ireland, is rapidly developing alternative poultry production methods and has contracts with two of the best known retail chains. These contracts are for branded and private label products with labelling that details how the birds are raised. An interesting and significant factor is that this particular company has a clear strategy that is influenced by values, as well as a high level of management skill.

Both of these are applied consistently in dealing with people and poultry.

I regard this area to be significant and believe that it will have a marked impact on further developments. Indeed, there has been a gradual but noticeable change in attitudes recently, not least on the part of the British government. Whereas questions about farm animal welfare seemed to be regarded as an irritant, they are now seen as an area of increasing importance, and I believe the government is quite glad of the existence of the FAWC.

The power to help

Veterinarians are among those who have the power to help people and organizations make informed and ethically sound decisions in the animal welfare area. Responsibility is the more onerous when it resides with those who have specialist knowledge, with those who can interpret animal welfare and draw out the implications for others who are not so equipped. The relative neutrality of the veterinary profession puts it in the position of trusted, and this presents it with opportunities to transcend the fragmentation and politics of the various interest groups.

I have tried to share with you some of the experience of farm animal welfare promotion in the United Kingdom, over the last ten or so years. In that time I have come to the clear view that a range of people with different interests must collaborate in order to bring about improved standards of welfare for farm animals. It is a shared responsibility. We must understand that there is a range of issues, the most important of which will only be addressed when there is such collaboration among people from the scientific, veterinary, agricultural, and food production fields. I am sure there will be progress in the United States and the role of veterinarians in making it happen will be vital, both as individuals and as members of the AVMA.

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The veterinarian's role in the welfare of wildlife

James R. Scott, DVM

I have been asked why it is important for veterinarians to be concerned about the welfare of the wildlife around us. The answer is simple and yet complex. Simply stated, wild creatures, as part of our environment, share this earth with us and we need to respond to their needs. The complexity of the question is in the all-inclusive need for all of us, both as human beings and especially as veterinarians, to try to save all of our environment. We need to be concerned about the total interaction of all species. Our expertise as veterinarians gives us a unique gift to help the battle to save animals, birds, plants, and ourselves. The World Wildlife Fund, a wonderful, hard-hitting, hard-working organization, has spent more than $100,000,000 to save part of our world's wildlife; yet they estimate that we may kill as much as one-fifth of all species of life on this earth in the next 20 years without even firing a shot.

Working with wildlife

For more than 30 years, I have practiced both large and small animal medicine, and it is still great to go to work. As I approach 60, I feel that excitement can be credited to working with wildlife of many kinds, but more specifically with wild bird medicine. I have been asked, "Who pays for the birds that you treat?" I answer, "They do. They give me a chance to do something without the thought of gain." By watching a wonderful creature go back to its natural lifestyle, and by trying to give back to nature the small part of what she gives to me, I become a better human being. After all these years, part of my dream is evolving into an organization called the Bird Treatment and Learning Center (Bird TLC). Its goals are to provide primary care for wild birds and learning opportunities for people. Like most nonprofit organizations, it faces a constant struggle, but one that is shared by a large number of dedicated volunteers that also share in the rewards the birds give back to us.

In the spring, we get our great push in birds coming back to the North. They arrive when the snow is still on the mountains and they look for places to sit so they can start their nesting procedures. They arrive from places throughout the world. Because of its prime nesting areas, Alaska

From the Arctic Animal Hospital, 1600 E Tudor Rd, Anchorage, AK 99507.

has one of the largest breeding populations on this earth.

In the spring, eagles sit in the sounds, waiting for shorebirds, seabirds, and waterfowl to return, because they need a better food supply for the offspring that they'll soon produce. They nest in a large wooded area, mostly remote, sometimes along river systems. Also in the spring, many gulls return. Herring gulls, for instance, return to the coastal area and wait for the return of the salmon and the salmon fry from out of the rivers. They provide a constant source of food for the herring gulls' offspring.

Exxon Valdez

On March 23, 1989, Prince William Sound was a pristine wilderness with many small islands and lovely little beaches. On March 24, the Exxon Valdez spilled 11,000,000 gallons of oil into the water. As the oil moved off the water and hit the beaches, it soaked down into the sand, gravel, and rocks, and created a dark mousse that seemed to flow and ebb as the tide would flow and ebb. The oil kept stacking into corners and filling up small pockets, eventually covering shore lines longer than the entire eastern coast of the United States.

It had a tremendous impact on the birds of the coastal areas of Prince William Sound. Millions of birds were killed. Some were found and treated. A massive project to treat seabirds, waterfowl, and sea mammals was undertaken, for which Exxon provided the financial support. A great deal of work went on over a long period of time, involving a lot of dedicated people. The birds would come in completely covered with oil; sometimes, if they were lucky, only the bottom part of the chest area would be oiled. When the birds were brought in volunteers would spend hundreds of hours washing them and caring for them in various ways.

National symbol

At the same time, eagles were not getting the response that I felt they deserved. I was recovering from leg surgery, so I had quite a bit of time to think about the eagles. As I sat in my chair, I started making phone calls. I made phone calls for 8 hours a day for more than a week. Finally, we received a grant from Exxon for $102,000 to start construction on a building for the Bird TLC.

The building started with 9 mews, each one capable of housing 4 birds. Soon, 3 flight pens were added, each 90 feet long, 14 feet high, and 30 feet wide. All of this was built in 3.5 weeks, all with volunteer labor. We had people of every description you could imagine pounding nails, including doctors, attorneys, office workers, construction people, military personnel, and other people from every walk of life. As the structure went up, we got a great thrill out of what we were doing to try to help an unknown number of eagles. We were told that we would be receiving up to 100 eagles, and the US

Fish and Wildlife Service (USFWS) felt that this would be the place that the worst of the eagles would come. When we were finished, we had a structure in the middle of the Fort Richardson Army Post in an area called Camp Carroll, belonging to the Army National Guard. It was an ideal location, well protected from vandalism. We didn't have to worry about people disturbing the eagles, and we had all of the room we needed.

An open house was given and speeches were presented by officials from Exxon and the USFWS. It was well attended and the people were interested in everything that was said. Mostly, they wanted to see that the eagles got a fair shake. I had a friend who carved an eagle to set out in front of the building and two young native girls came and sat by it. They wanted to see a part of their national heritage and they were concerned about what was going to happen to the eagles. It was a "take pride in america" operation. We were taking pride in America and we were taking pride in our national symbol. We were pushing hard to make sure that the eagles received the treatment we felt they deserved.

The eagles that were recovered well enough to be moved from my office, the Arctic Animal Hospital, to the holding facility, looked at us with sort of a jaundiced eye or chewed us out because they didn't particularly like their accommodations. Most of them settled down when they realized that they had a place that allowed them a certain amount of freedom, and they began to set up their pecking order.

At the same time, we had many other eagles coming into the clinic, and these eagles were in extreme debilitation. Their various problems evolved from ingesting seabirds, shorebirds, or waterfowl that had been covered with oil. The ea-

gles found these oiled birds to be easy picking and they didn't realize the oil was any problem. They would eat the birds and become sick with hemhorragic enteritis, dehydration, and kidney and liver damage. When they came to the Arctic Animal Hospital they found an eagle "MASH" operation. We had volunteers from everywhere. A young Brazilian veterinarian, Celia Valverde, was a wonderful person to have there. She was a tireless worker and put in hundreds of hours trying to help birds both in my office and in the seabird centers in Homer and Seward, Alaska.

Treating wildlife injuries

We gave the birds a full examination, starting at the head and working to the toes, trying to find every single thing that could possible be wrong with them. There is a right way, and a wrong way, to put your finger in an eagle's mouth, and I have scars to prove that I've done it the wrong way. Eagles tend to be much more dangerous with their feet than with their beak, but don't let anyone ever tell you that they can't hurt you with that hook, because they can.

One of my technicians, Karen Chaviano, became an excellent bird technician. She worked her hours with Arctic Animal Hospital and then as a Bird TLC volunteer. We all had two jobs. We had a job to make our livelihood and a job to save eagles.

The injuries were many, often shoulder and wing tip injuries. Sometimes the shoulder injuries would heal and the bird could go on to the next phase of recovery. Sometimes they were beyond any help and the bird had to be euthanatized. Many birds arrived in comas and did not survive even though we gave blood transfusions and tried every way we could to reverse their conditions.

We had a very dedicated young woman who did not usually have much to do with veterinary medicine. Theresa Wrangham was a professional massage therapist. Because of the circulatory problems that evolved, the eagles had swollen feet and legs. She came every day to massage them. She did an amazing job in helping to get the eagles, literally, back on their feet. Many of the eagles that were released in the spring owe a great debt to this young lady.

Some of the wing tip damage was beyond any real repair and it had to scar in. This type of injury dictated that the bird would never be free again. These birds would go on to participate in educational activities. Several of the birds were sent from Alaska to the 48 contiguous states where they are now active in educational programs similar to the ones that we present.

Some of the birds would come in with injured feet, necessitating a ball bandage. In one case of fractured toes, I turned a ball bandage into a ball cast. When the bird woke up, it had to learn to walk on two boxing gloves, which it eventually did very well. It came out of the whole thing with the loss of only one toe. The bird's name was Miracle, and when it came to us it was in a deep coma because of the toxicity of the oil. Miracle did survive and was ultimately released to the wild.

When spring came after many hundreds of hours of care by teams of people cleaning, feeding, exercising, knocking the snow off the netting that covered the flight pens, and various other activities involved in the care of the eagles, we had 9 birds that would be released back into the wild. Three birds were left in the flight pens and were never released and 12 birds were lost very early from the toxicity of the oil.

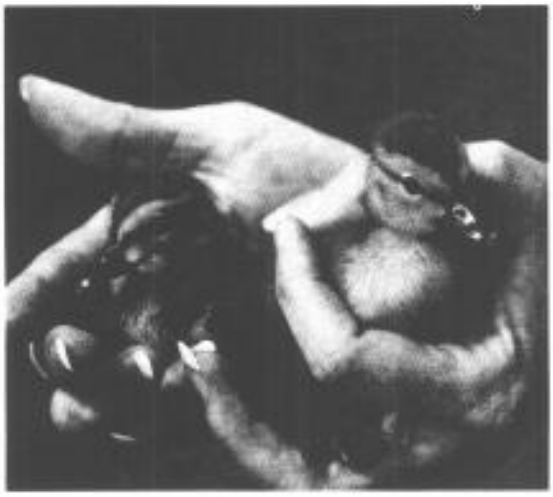
A group of volunteers loaded birds into one of the planes that Exxon provided to fly them to Cordova, a small coastal fishing village several hundred miles from the Anchorage. In the Cordova area, the birds had radio tracking devices placed on their tail feathers. All of these birds are part of a continuing study being done by the USFWS to show what happens to eagles after they have ingested crude oil. This will be the largest sampling of bald eagles ever studied as far as this type of information is concerned. Two birds were equipped with new satellite tracking harnesses; the first ever used on bald eagles. These birds will be studied for a prolonged period of time because that particular tracking unit lasts a long time.

The volunteers that came down to Cordova for the release were flown down as guests of Exxon. It was an excellent day of cooperation among Exxon, USFWS, and Bird TLC volunteers. We arrived safely in Cordova and drove out to an isolated, pristine bay. We carried the birds out in their crates, lined them up, and released them, one by one, back to the wild. By the end of that day there were very few dry eyes, but everybody was happy. As the birds left, we all realized that everything that we had done for the eagles during the past year was worth every minute of time expended.

Veterinary care in Alaska

We returned to Anchorage and found ourselves in the middle of the baby bird season. In the spring of each year, several hundred baby birds are brought into the office. Each year, we try to tell people that they shouldn't pick the small birds up, because the parents of the birds are there and are coming back to get them. The only time that they should be picked up is if they are threatened by a cat, a dog, or a car, but unfortunately these birds are so cute that it's really hard for people not to pick them up.

We get from 100 to 200 baby ducks each year. Baby ducks are one of the cutest little creatures, and we have lots of them in Alaska. There are lots of little ponds and lakes around Anchorage, so baby ducks are there in abundance. We raise them until they are nearly adults and then they are turned loose on a small pond behind my office to continue their growth; eventually, they fly away to join the wild flocks within the Anchorage area and migrate later on in the fall.



We get lots of little swallows in. People seem to feel that if they're sitting on a branch close to the ground, they must be in trouble. People bring them into the office and that often means that they must be cared for for an extended period of time. Even though they're just in their beginning flight stages or fledging, they look helpless. It's hard for people to understand they should be left alone. We work on it in our educational activities and we repeat these kinds of things at school programs. Each year I think we make a little progress, but we still seem to get in a lot of baby swallows.

We get a few baby shorebirds in and these are the most disheartening. Unfortunately we don't have a food source that typifies what they naturally eat in the wild. They are precocial little creatures and they can go about on their own from about the time they are hatched. The parent does a little bit of watching over them, but by and large these little birds run around and provide their own feeding activity. When we get a small shorebird in we usually try to get a small Coturnix quail or sometimes a Banty chicken to put in with it to try to teach it to peck around on the food that we can provide for it. We give it various kinds of live food that we get from aquarium supply stores, but it's not often that we raise many of these.

Some of the funnest birds that we get in are baby owls. Baby hawk owls were brought in a year or so back. It was a wonderful thing to watch them grow from little fuzz balls, on up into sub-adults, and then eventually to be released into the wild. They were driven to Soldotna, a small town about a 150 miles south of Anchorage. There they were "hacked out," which means putting them in an area where they can be fed each day, but are free to fly. They eventually fly off on their own.

Robins that come to us young tend to develop social attachments towards humans. As soon as their eyes open, great precautions are taken to feed them in such a manner that they don't realize that a human is feeding them. We use puppets, feeding them with paint brushes, or holding them with a sock puppet. Believe me, making a robin out of a sock is a pretty difficult thing to do. They finally grow up, and it's fun to release them. The volunteers who work with the baby birds often have children who get involved. The youngsters grow a tremendous amount by participating in this type of activity.

We get other kinds of baby things in, too. Baby moose are one of many that seem to come to my office in the spring. One year we had 13 that people brought to us in a 2-week period. Fortunately, that's a subject that we've been able to get out before the public, so we don't get nearly as many picked up by well-meaning people. Once they're picked up, it's awfully hard for people not to keep them around a few days. In the process they usually wind up with dehydration and dysentery, because they're fed the wrong kinds of things. It takes a pretty good effort to get them back on their feet. From my office they go to our little zoo that raises several moose calves each spring.

We have lots of interesting adult birds that come to us, too. A bristle-thighed curlew that had an injured wing, but no fracture, was delivered from the Prudhoe Bay area where it had been under study. Because there are so few bristle-thighed curlews left in the world today, this bird was important to try to save. They nest in the summer in Alaska and winter in the South Pacific. This bird was sent via 747 to Hawaii to join its counterparts in their natural migration. It stayed 2 or 3 weeks in Hawaii where it was banded, then released. The bird returned to Alaska last spring. We feel we had a good part in getting it back in the wild.

A 2-year-old bald eagle had very severe eagle pox with lesions inside the mouth, around the lips, and even around the eye. When we looked at its feet, it gave us cold shivers, because this bird had a really advanced case. We cleaned the feet on a

regular basis. It was not eating well and was very anemic. After trying all kinds of immune-stimulating drugs, none of which seemed to work very well, I decided to take the lesions off. I removed them with a radio surgical unit. I did this 2 different times. Ultimately, after the second removal we won. The feet still had a few scars where the lesions were, but the lesions healed, and the scales were slowly replaced. It no longer has lesions on its face or around the eyes. It is a very important bird and will soon become the foundation study bird for eagle pox at the National Wildlife Health Center in Madison, Wis. Hopefully, there will be a vaccine produced that will eradicate eagle pox.

A Canadian goose made the mistake of trying to land on a freshly tarred roof that looked like water. This bird got tar all over itself when it landed, and then was brought to the hospital. Several of my staff and some volunteers put on garbage sacks to cover their clothing as we used mineral oil to soften the tar. We then proceeded to wash and soften, and wash and soften. Finally, the bird was clean enough to be released back to its own family on one of the local marshes. Ultimately, releases are the kinds of things that give all of us the payback for the time that we put in. To see animals go back and recognize their own mate and have their own offspring join up with them, with all kinds of activity and talking back and forth, is a wonderful and rewarding experience for anyone to go through.

The saw-whet Owl is a wonderful little bird. We would rather that they didn't come in, but, owls, too, come in with injuries. One came in with a severely fractured wing. It was repaired by a technique that was developed by Dr. Pat Redig at the Raptor Center at the University of Minnesota. Dr. Redig is an expert in avian medicine, particularly raptor medicine. His technique is to place a plastic intramedullary pin within these small bones. The pins are light and don't have to be removed. They are held in place with methyl methacrylate, a bone cement. Ultimately, the little bird recovered from the surgery and grew up to be a big bird with adult feathering appearing. After spending the winter with us, it was shipped off to the East coast and the Tri-State Rehabilitation Organization, because their spring came much earlier than ours.

A beautiful Snowy Owl that came to us with a degenerative eye and CNS condition became a wonderful education bird. It stayed with us for about a year before its condition became so bad that it had to be euthanatized. This bird taught a lot of youngsters and adults about our environment and perhaps, with its short life, contributed more to our education than it would have in the wild.

We have lots of interaction with students. Many times, students join us at the Eagle Holding Facility, where they can see what we have done with the eagles and how the eagles have gotten along. These youngsters develop inquiring minds when they are able to see the procedures that are done during our educational activities. When they can see a banding project, even though it's a tiny little chickadee that's difficult to see in the hands of the bander, the youngsters grow. If started at this age, educational activities help children grow in such a way that they can carry the education on through their lives, and they'll have a better chance of helping our environment and the creatures that live in it. One little girl has grown an immense amount in the last year. She is the daughter of one of our volunteer couples. They live on Fort Richardson, close to where the eagles are kept. They check on the eagles at least once a day and she has had lots of exposure to the birds. She can talk about eagles in a manner that most adults can't. She's

going to be one of the first youngsters that works with the "Children Teaching Children" concept. This is where youngsters are taught about the birds and then, accompanied by an adult, go to their own classroom. The children, taking the bird in their hand, teach their classmates about a particular bird, a chickadee, a robin, or, in her case, a jay. These birds are injured to the point of not being releasable, but they can do an amazing amount of good by helping these youngsters teach their peers.

Many years ago, a pair of Trumpter Swans came in with wings injured by gunshots. They were returned to the wild at a time when Trumpters were few in number in the North American Continent and I like to feel that this pair helped to bring them back to what they are today. Through the Children Teaching Children program, we hope to create the possibility that children will grow up and help the environment by doing things such as putting these endangered species back into the wild.

My goals and the goals of Bird TLC are to give everyone an opportunity to see an eagle soar, to give everyone an opportunity to look back over a long lifetime of caring for the other species on this earth, and to look at a sunset that holds an eagle. When this happens, everyone grows inside and the whole world gains.

The vital link: Veterinarians in biomedical research and laboratory animal care

Robert A. Whitney Jr., DVM, MS

Veterinarians who specialize in laboratory animal medicine fill an indispensable role in managing and monitoring the humane care of animals used in complex experiments in today's biomedical research laboratories. But these veterinarians' responsibilities are not widely understood or recognized by the public or even by some of the scientists who conduct important research involving the use of animals. The laboratory animal veterinarian, in addition to helping ensure conformity with the laws, regulations, federal policies, and guidelines for sensitive, humane use of animals in the laboratory, actually fulfills several other important roles in animal research.

Veterinarians who specialize in laboratory animal medicine provide a vital link in several ways. Their work aims at providing good science while ensuring animal welfare. These veterinarians care deeply about the value of biomedical research to human welfare. They also care about the humane values governing proper care and use of the animals involved. Laboratory animal veterinarians are responsible to their colleagues—the scientists who depend upon their professional expertise—as well as to the officials and citizens who expect them to ensure proper ethical treatment of research animals.

Laboratory animal veterinarians also link progress in human medicine to advances in veterinary medicine, because developments in human medicine produced through research with animals contribute significantly to the practice of veterinary medicine. Some examples of these benefits are the development of new drugs and vaccines, new therapies, new diagnostic tools, and disease prevention procedures.

The innumerable contributions that biomedi-

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cal research with animals have made to human health are now being repaid. New medical advances are used by veterinarians to help pets, farm animals, and wildlife. From orthopedic surgery to pacemakers, animals now benefit from the medical "miracles" that they have made possible for human beings. Hundreds of drugs originally developed for human beings are now used in veterinary medicine, and this is a two-way street. Veterinary medical research performed specifically to benefit animals also benefits human beings. For example, the largest selling animal health product in the world, developed to kill parasites in livestock and heartworms in dogs, also attacks the parasites that cause river blindness, one of the most devastating human diseases in Africa.

The link forged between progress in human medicine and veterinary medicine through biomedical research does not receive the attention it deserves, but, in my remarks today, I will focus on the role of laboratory animal veterinarians in linking excellence in biomedical research with humane care and use of the animals required for that research.

History of biomedical research

The veterinarian did not always fill a direct role in human health-related research. Cohen and Loew, in *Laboratory Animal Medicine,* offer a historical examination into how this role evolved.[1]

In the great surge of biomedical research progress that began in the 19th century with Louis Pasteur, Claude Bernard, Robert Koch, and other familiar figures, diseases of both human beings and animals were studied. It became evident that naturally occurring diseases of animals could illuminate principles applicable to animals and human beings and lead to improved understanding of biology in general. American scientists, including veterinarians, were soon applying emerging scientific concepts in their research. Daniel Elmer Salmon, recipient of the first DVM awarded in the United States (by Cornell University in 1879), studied bacterial diseases; the ubiquitous *Salmonella* was named after him. Cooper Curtice, Theobald Smith, and others first demonstrated the role of arthropod vectors in disease transmission in their studies of Texas (bovine) fever.

Veterinarians were involved in biomedical research using animals early on, usually from the standpoint of public health or livestock diseases. But the development of laboratory animal medicine as a veterinary specialty did not begin until early in the 20th century, with the work of Simon Brimhall, VMD, at the Mayo Clinic in Rochester, Minn. Dr. Brimhall joined the Mayo staff in 1915. He and his successors managed the animal facilities, developed animal breeding colonies, investigated lab animal diseases, and took part in collaborative and independent research.

This important decision to employ a veterinarian at the prestigious Mayo Clinic was significant in bridging a long-standing professional gulf between human medicine and veterinary medicine. It also marked the recognition that human health-related research could profit from veterinary medicine's contributions to experimental surgery and pathology, as well as the professional management of laboratory animal facilities.

Charles A. Griffin, DVM, a bacteriologist at the New York State Board of Health laboratories from 1919 to 1954, pioneered the development of disease-free research animal colonies.

The work of Karl F. Meyer, DVM, at the University of California, San Francisco, between 1924 and 1954 also contributed to development of the specialty. An internationally known epidemiologist, bacteriologist, and pathologist, Meyer developed a model animal facility, wrote an early review of laboratory animal disease, and was instrumental in the appointment of veterinarians at each of the university's major campuses.

In 1945, Nathan R. Brewer, a veterinarian and PhD physiologist, was appointed to manage the animal facilities at the University of Chicago. The appointment of a veterinarian to this position had been opposed by some scientists at the university who feared interference with their freedom, but the scientists who wanted Dr. Brewer prevailed. A key factor was the recognition that Dr. Brewer, by fulfilling his duties as a veterinarian, could increase public confidence in the university's animal care and use. Dr. Brewer's appointment and his subsequent role as leader and mentor to an expanding group of young veterinarians working at other medical schools is seen as the birth of the modern fields of laboratory animal medicine and science.

In 1945, our nation was initiating a new policy of massive expansion of biomedical research through grants to medical schools and other institutions, and a parallel expansion of the intramural research at the National Institutes of Health (NIH). The rapid progress that had come from special research projects during the war showed what great results could be achieved through this approach. The use of laboratory animals began to expand rapidly as part of this national endeavor. The need was clear for improvement in animal facilities and for greater expertise in laboratory animal care.

At the same time, public interest in humane care of laboratory animals was increasing, as was antivivisectionist activity aimed at ending animal research. In these earliest days of the development of laboratory animal medicine as a specialty, veterinarians who entered the field received many reminders that their role must involve both enhancing the scientific value of animal research *and* providing humane care to the animals of that research.

Laboratory animal care

Within a few years, other important events re-

lated to lab animal care occurred in the Chicago area. By 1949, veterinarians were managing the laboratory animal facilities at five Chicago-area medical research institutions. These veterinarians knew that a few of their colleagues elsewhere were engaged in the new professional activity that they were beginning to call "laboratory animal care." In 1950, these five Chicago veterinarians sent a letter to selected colleagues in the United States and Canada suggesting the development of a national organization. The response was favorable, and in November of that year a meeting attended by 75 persons founded an organization called the Animal Care Panel here in Chicago. Early activities of the Animal Care Panel focused on animal colony management, design of facilities and equipment, and descriptions of common laboratory animal diseases.

From its inception, the panel was concerned about establishing standards for animal care and use, and in 1963, it developed the first edition of the *Guide for Laboratory Animal Facilities and Care*. Today known as the *Guide for the Care and Use of Laboratory Animals*,[2] this revised publication is now the basic standard for assuring humane care and use of laboratory animals in American research institutions. The *Guide* was developed back in 1963, before the passage of the 1966 USDA Animal Welfare Act.

In 1967, the name of the Animal Care Panel was changed to the American Association for Laboratory Animal Science, or AALAS. Membership includes veterinarians, researchers, facility managers, and animal care technicians and technologists. This organization has become a significant centralizing force in the growing field of laboratory animal science. Today, AALAS has more than 2,300 individual members, many of them veterinarians, at 46 branches across the country. The AALAS annual meeting and its scientific journal, *Laboratory Animal Science*, are the leading means of scientific communication in the field.

Let me pause here a moment to pay tribute to one of the pioneers and visionaries in the specialty of laboratory animal medicine and the entire field of laboratory animal science—the late Dr. Bennett J. Cohen.[a] He founded the laboratory animal medicine unit and the laboratory animal medicine training program at the University of Michigan and directed it for 23 years. Dr. Cohen, a veterinarian who also had a doctorate in physiology, was one of the "Chicago Five" who helped found the Animal Care Panel, which became AALAS. He was an AALAS director and president and played a major part in the writing of the original *Guide for the Care and Use of Laboratory Animals*.

Dr. Cohen died on August 23, 1990, leaving numerous friends and admirers in AALAS, in academia, and in the nation's research laboratories, many of them staffed by his former students. He was a dedicated scientist and teacher who loved his work and inspired others in humanitarian efforts. Dr. Bennett Cohen was a force that will be missed. His accomplishments bring great credit to our profession.

In addition to AALAS, there is another prominent organization, also usually referred to by its acronym, in which Dr. Cohen had a founding role, the American College of Laboratory Animal Medicine (ACLAM). Dr. Cohen and others saw the need to establish standards of training and experience for veterinarians involved in laboratory animal medicine. In 1957 they convinced the American Veterinary Medical Association to recognize the veterinary specialty of laboratory animal medicine and to establish a specialty certification board. Today there are more than 400 veterinarians who are board certified by examination to become "diplomates" of the ACLAM.

These laboratory animal medicine veterinarians are research specialists, trained as postgraduates in all aspects of the scientific process. They speak the scientific dialect of the laboratory researcher. They assist scientists in selecting the suitable animal species to meet the research goals. They assist researchers by sharing the veterinarians' understanding of the many biological variables that can influence studies involving animals. Today, most veterinarians who are specialists in laboratory animal medicine attend graduate programs, not at schools of veterinary medicine, but at medical centers of major universities. They are colleagues of the physician-scientists in these medical schools; and they are colleagues as well of the many other medical researchers working at the forefront of science. The NIH National Center for Research Resources supports 16 such training programs at major institutions throughout the country.

In 1965, still another important organization in the field was created, the American Association for Accreditation of Laboratory Animal Care, or AAALAC. Again, veterinarians, including Dr. Cohen, played a prominent role in the founding of the organization. The AAALAC is a self-regulatory mechanism to implement standards of humane animal care and use. Institutions with animal facilities voluntarily seek to qualify for AAALAC accreditation. Today, this AAALAC accreditation is looked on as a "stamp of approval" assuring that the accredited institution meets or exceeds the highest standards for appropriate care for research animals, as determined by an outside, impartial, nongovernment organization.

All of the activities and organizations that I have mentioned so far—all aimed at improving conditions of animal care and use at research facilities—began before the passage of federal laws and government regulations seeking to meet the same goals. In 1966, Congress passed the Laboratory Animal Welfare Act to regulate commercial traffic

[a]See *J Am Vet Med Assoc* 1991;198:44.

in dogs, cats, monkeys, and other research animals and to establish standards for their housing, transportation, and care. The law has been broadened to become the Animal Welfare Act and today it covers more than 1,200 research facilities, subject to enforcement regulation of the USDA. The AVMA has been a consistent proponent of adequate funding for enforcement of this law.

My home base, the NIH, has long emphasized humane standards for animal care and use in research. In 1963, it was NIH that actually published the first edition of the *Guide for Laboratory Animal Facilities and Care*, developed by the Animal Care Panel, the precursor of AALAS. The revised *Guide* is the accepted measure for animal care and use standards. The *Guide* is used by NIH and other agencies to require compliance by their grantees and contractors at universities and other research institutions.

Veterinary roles

Three roles of the veterinarian in biomedical research are the role of clinician to the animals, the role of colleague to the researchers, and the role of animal welfare advocate.

Laboratory animal veterinarians serve as attending clinicians delivering medical care to their patients, the laboratory animals. This is a critical function in maintaining the health of these animals. Science cannot produce reliable results when its research animals are not in the best of health. For example, our veterinarians at NIH are called upon by researchers if they are puzzled by unexpected research results. Our veterinarians may find a latent infection or unobserved environmental conditions that have confounded research findings.

So it's clear that good laboratory animal care is not only humane, but that it is a scientific necessity. That is why we at NIH have a slogan, posted prominently in posters around the campus, saying, "Good animal care and good science go hand in hand."

A laboratory animal veterinarian is a colleague to fellow researchers. With a firm foundation in scientific methodology, he or she understands other researchers' needs and speaks the same language in the development of research protocols, the selection of appropriate animal models, the formulation and testing of hypotheses, and the collection of data by observation and experiment.

As a colleague, the veterinarian is also a teacher, providing instruction in the latest animal care and use concepts and practices to both researchers and the animal care technicians who care for the animals. The veterinarian is best informed about the most appropriate pharmaceutic, anesthetic, or surgical approach for a specific animal species. This role of colleague is a critical one for the veterinarian, who must demonstrate knowledge, rationality, and credibility to fellow researchers.

The third part played by the laboratory animal veterinarian is that of the animal welfare advocate, on guard to assure that the many guidelines and standards for humane animal care and use are observed.

Federal laws

Federal laws and regulations mandate responsibilities to laboratory animal veterinarians in two ways: as the institutional attending veterinarian and as a mandated member of the institutions' animal care and use committee.[3] As attending veterinarian, he or she has direct program responsibility for activities involving research animals at the institution. These responsibilities include providing adequate veterinary care; providing guidance regarding the care and use of animals, including the appropriate use of analgesic, anesthetic, and tranquilizing drugs; assuring that there is adequate pre- and postprocedural care; and consulting with researchers when procedures that could be painful are proposed.

As a mandated member of the institution's animal care and use committee, the veterinarian shares in responsibilities with the other members. Institutions performing biomedical research using animals must have such a committee, whose responsibilities include regular evaluation of the entire animal care and use program, based on the *Guide*, and reviewing each proposed animal research project to assure that:

1) Procedures causing any discomfort, distress, or pain to the animals are avoided or minimized.
2) If pain may be involved, pain-killing drugs are used whenever possible.
3) When appropriate, animals are painlessly sacrificed using methods of euthanasia consistent with the recommendations of the AVMA.
4) Living conditions of animals are appropriate for their species and contribute to their health and comfort.
5) Medical care is available, provided by a qualified veterinarian.
6) Personnel conducting procedures are properly qualified and trained.

The US Public Health Service Policy on Humane Care and Use of Laboratory Animals requires that every institutional animal care and use committee include a veterinarian with training and experience in laboratory animal science and medicine. Membership must also include practicing scientists experienced in animal research, at least one nonscientist, and one person not affiliated with the institution. Often this role of "lay" member of the committee is filled by the appointment of a member of the clergy, an ethicist, or other respected member of the community.

It is essential that the committee is properly appointed, properly charged, and properly managed and supported to perform its assigned tasks. Experience has shown that the committee functions best with a senior researcher as chairperson. Veterinarian members do not want to be considered the committee "enforcer." When it is necessary to discuss with a researcher some questionable aspect of a proposed project, this responsibility is best shared by several members.

Laboratory animal veterinarians' unique blend of training and experience, coupled with their concerns for the welfare of animals that originally led them into veterinary medicine, makes them extraordinary links between animal welfare and good science.

The administration of the NIH readily acknowledges the significance of the roles of the laboratory animal veterinarians in our intramural research program. Our staff of veterinarians certified in laboratory animal medicine has grown from less than a dozen 10 years ago to more than 40 today.

I believe that the public, justifiably concerned about safeguards for humane use of animals, appreciates that the seasoned hand of the laboratory animal veterinarian is a very reassuring presence whenever animals are used in research. Who else is professionally competent and appropriately motivated to provide this vital link between research advances and animal welfare? Who else but the veterinarian—a clinician, a colleague, and an animal welfare advocate?

Let me conclude this analysis of the roles of the laboratory animal veterinarian by quoting a statement from the Veterinarian's Oath:

> ". . . 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. . . ."

This defines the veterinarian's function as the vital link between biomedical research and animal welfare. I am proud to be a veterinarian specializing in laboratory animal medicine, and I am proud to be a clinician, a researcher, and an animal welfare advocate.

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Food animal production and human nutrition

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Food animal production, or simply animal production by itself, affects human nutrition in a variety of significant ways throughout the world. Animals provide meat, milk, blood, internal organs, income, draft power, and manure, all of which directly or indirectly affect human nutrition and/or the production of food.

As the population of earth expands, and many countries become "newly industrialized," an increasing number of people, with their rising disposable incomes, are demanding more food products. Animals, and in particular, ruminants, are uniquely suited in most countries to meet these needs due to topographic, climatologic, demographic, and cultural reasons. The major constraints to increased food animal production are feeds and feeding, breeding and selecting, and animal health care, which is intricately related to production. The challenge facing the global veterinary profession and animal scientists is one of overcoming each of these constraints to provide an expanding and safe supply of food.

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World production

From 1974-1986, cattle numbers in the world increased 6%; sheep and goats, 10%; chickens, 60%; swine, 18%; and buffalo and camels, 16%.[1]

Whereas economically developed countries comprise approximately 26% of the world's population, they produce about 65% of the world's meat, 77% of the milk, and 67% of the eggs. On the other hand, the nonindustrialized countries have 68% of the world's cattle and buffalo, 65% of the sheep and goats, 57% of the swine, and 52% of the poultry.[2]

The proteins of animal origin—those from milk, meat, and eggs—are not only palatable and highly digestible, but are also rich in the essential amino acids deficient or lacking in most plant pro-

teins. When given a choice for a varied diet, India's population of over 800 million has responded affirmatively to animal protein. According to a 1977 FAO report by Lall and Associates, over half the population had become nonvegetarian. The increased consumption of milk, eggs, chicken, and chevon results from increased income and social choices in the educated sector.

Milk has always been and continues to be a foundation for children's normal growth and development, and is used for the treatment of protein-calorie malnutrition. In a documented program where Heifer Project International (HPI) provided dairy goats, training, and technical services for rural women in Honduras, this intervention was proven to reduce malnutrition in children from 90% to < 20% within the first year.[3]

In economically developing countries, animals have a different significance for human quality of life than in the industrialized or so-called "developed" countries. In general and by definition, conditions in developing nations are vastly different. Illiteracy is rampant, primarily in women. Landlessness is widespread and growing most rapidly where foreign technology and the Green Revolution have been most invasive. Chronic persistent hunger is commonplace, and is linked to poverty and lack of opportunity.

Production in the Tropics

The rapidly changing scene in the northern hills of Thailand exemplifies the link between animal production and human nutrition. Because of land speculation and a burgeoning population, the traditional slash and burn or shifting cultivation methods are no longer viable. The Thai government is actually threatening to relocate villages that do not dramatically change their agricultural practices.

In order to subsist on a plot of land in these tropical highlands, in a sedentary farming system, animals are necessary for several reasons. First, water buffalo produce work to provide enough crop production to meet the family's needs. Second, they contribute to the nutrient cycle when, for example, manure is applied to crops and gardens, thereby enhancing the environment. Tropical soils cannot sustain crop production without rejuvenation with organic fertilizer. Third, animals represent security for the family in that they can be sold for food at the market should local crop failures occur. Crop failures caused by drought, floods, soil quality depletion, fires, disease, pests, and other reasons are common. Fourth, animals directly provide various types of food that enhance the nutrition of the family, and usually meet nutritional needs that are not met by any other locally available source. It is also important to mention the symbiotic relationship between the family and the buffalo. Usually, the young boys care for their charges and take them for daily cleaning and tick removal at a local water hole. The health or wellness of these animals is of paramount importance to the family. By the people's own admission, the animals are "members of the family."

In the case of landless people in the tropics, many of whom are bonded laborers, the only food they can eat is that which they can buy. Indeed, when they don't work, they don't eat. These dispossessed people are extremely vulnerable to unforeseen expenses. The vicious cycle of poor nutrition, seasonal labor, lowered output, and reduced income often leads to debilitation, disease, and death.

In China, between 1980 and 1987, the average annual increase in agricultural production was 4.6%, and the average per capita rural net income more than doubled. This was the period of economic/production liberalization. At the same time, the percentage share of the gross value for crops dropped 20%, while that for animals remained the same, and sideline activities increased 20%.[4] Thus, in a "window of opportunity" as seen by poor rural families, they opted for activities to increase their quality of life. Livestock were kept as a priority component of their integrated systems.

Animal health programs in the Tropics

Animals in tropical developing countries, despite their large numbers, are usually smaller, grow more slowly, mature later, and produce less than their counterparts in temperate zones. Considering the land, labor, and feed and technical resources, their production is reasonable in many areas. The very survival of these animals is almost always more important than a slightly higher production. This is because a family may have only one or two head, and the animals usually have a savings value. They are kept as a store of wealth and as a buffer against medical and other emergencies.

Feeding even the low-producing native species is often the major challenge facing rural families. However, even monogastrics such as swine and poultry are increasingly being fed with various crop and agricultural by-products. Even manure, when processed correctly, is fed successfully to cattle and buffalo. Cellulose is the most common material in plants and the most abundant renewable organic product on earth. Only ruminants and a few herbivores are capable of digesting it. China produces several hundred million swine per year, almost totally fed on crop byproducts and weeds/water plants. If only 5% of the world's cellulosic waste material were used, it would provide for nearly all the world's protein needs through ruminants.[3] Expanding cereal grain production is a short-term solution to the world's food problems. Exploiting animals' abilities to convert products of solar energy into food is the only viable long-term

[4]Dyer IA, et al. Animal protein for the world's population. Washington State University, Pullman, Wash: Unpublished data, 1974.

method.[5] The former system is already wrought with economic, political, and social problems. The latter is time-tested for milennia.

In Cambodia, HPI has sponsored an animal health program on a national level since 1980. The Director of Foreign Affairs of the Ministry of Agriculture, Mr. Bounthan, declared that Cambodia's number one concern was to raise rice production back to pre-Khmer Rouge levels—and to do that they needed increased numbers of draft animals.[b]

Through training of technicians (all veterinarians either left or were killed from 1975 to 1979) and production, distribution, and application of major vaccines, Cambodia saw its draft animal population rise from 800,000 to 2.8 million, and rice production come ever closer to self-sufficiency levels.

Work by ILCA and others has shown that it takes oxen about one day to plow a hectare, whereas, it takes people six days to do the same. The contribution of draft animals to food production for human beings is unmistakable and extremely vital. However, increased numbers and/or productivity of animals is not enough to address the global human nutrition needs we face. The answers are complex, multifaceted, and require increased human involvement.

Human nutrition

No single group or profession is as uniquely qualified to adequately address the defined constraints of animal production and human nutrition as veterinarians. Through management training, including nutrition, sanitation and housing, health care programs, and breeding/selecting advice, veterinarians can and do positively impact human health through enhanced animal production and wellness.

Women must also be more actively involved in planning and leading new programs geared to increase food production in the villages. They directly affect family size and the health and nutrition of the children. With increased income and quality of nutrition, their fertility decreases. In Africa, some 85% of rural women are involved in food production, and handle 80% of the food eaten by families.[6]

Credit must be made more readily available to those who produce food at the local level. The Rome-based IFAD has had tremendous success with its Grameen Bank approach in Bangladesh. Economic problems do not lie entirely outside of our borders. In 1988, some 32 million Americans lived below the official poverty line.[7]

Greater attention has to be focussed on environmental regeneration. As Robert Rodale stated, conservation is no longer enough. Can the world sustain rice production using fossil fuel-based fertilizers, pesticides, and insecticides? The Green Revolution crops have misleadingly been referred to as high yield varieties. In actuality, they are "high-input high-yield" varieties, mostly beyond the financial and technical limits of the small holders who owned the land before the Green Revolution concentrated it in the hands of the rich and politically connected.

Small farm systems need to be supported in tropical areas. These farms have proven to be the most effective by far for long-term, sustainable livelihood. These systems do not by-and-large use biotechnology. Recent advances in cellular and molecular biology are not short-cuts through conventional processes.[8]

Some promote the idea that citing a lack of education as a cause of hunger is a self-serving excuse of our "great universities" and development agencies, and is fallacious.[9] This attitude is not fallacious and those who hold otherwise are seriously misinformed and irresponsible, especially in today's world. Technical and social education among the rural poor, to facilitate their abilities to produce more food, is necessary.

The bottom line is opportunity. People who have the opportunity to produce food for their families usually do so in a sufficient manner. Healthy animals play vital direct and indirect roles. Veterinarians serve as key providers for this animal wellness and health.

The challenges to maintain and improve the quantity and quality of food for human health and nutrition are all around us. New solutions will lead to new problems. Animals will always play major roles. Veterinarians must continue to accept this challenge as professionals and as concerned citizens.

[b]Bounthan D. Director of Foreign Affairs of the Ministry of Agriculture, Phnom Penh, Cambodia: Personal communication, 1990.

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