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Letters

A Role for the Clergy in Animal Welfare?

In connection with M.W. Fox's and J. Rimbach's articles about the term "dominion" in the oft-quoted passage in Genesis (1:26) proclaiming man's dominion over all nonhuman animals (*Int J Stud Anim Prob* 3(3):178 and 198, respectively), I have two questions.

I would ask first whether there is any proof that the interpretation "dominion" is the correct translation for the word that appears in the original script. Rimbach's article seems successful in vindicating the Judeo-Christian religion of blame for our prevalent shabby attitude toward animals in general. However, culpable or not, have not the various religions *responsibility* for the righteous treatment of animals, and respect for their proper dignity?

Humanitarians, seeking cooperation from the preachers of these various religions, run into what seems to us to be an apathetic attitude on their part. I'm wondering whether these rabbis and preachers aren't simply at a loss to know *how* to incorporate animals' interests into their services. This is unfortunate—tragic, even—for the animals and animal welfare workers, and for the Church as well. We need the blessing of the Church in our endeavors, and the Church surely must be accountable on this ethical issue.

Second, I would ask: Should not the various religions establish official policies, general and specific, toward animals, and then provide training in such for their leaders?

Charlotte B. Parks
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Animal Suffering: Ethical Dimensions

Your comments about my discussion with Professor Dollery (over poisoning monkeys with paraquat) at the British Association for the Advancement of Science Meeting on January 26 (*Int J Stud Anim Prob* 3(3):254, 1983) are a little misleading. I did not imply that because the human patients were mainly suicide victims we should be any less concerned about helping them. I was merely making a point about *suffering* in animal experiments.

What I actually said, and I quote now from the official *BA Report of the Proceeding*, was:

> *The question I put when I gave this example was that I think there is a real ethical dilemma here, and I do not think it goes away by simply explaining why we did the experiment. It has been pointed out that the people dying from paraquat poisoning suffer severely. The animals dying from paraquat suffer extremely. I am asking what is the moral difference between animal suffering and human suffering. Peter Singer, whom I referred to, makes out a case for animal rights not on the premise that humans and animals are not different, but that the differences between them when considering the sorts of cases that we are considering, where we are inflicting suffering, are not morally relevant. It seems to me that the two alternatives—an animal dying in severe agony or a person dying in severe agony through an attempted suicide—pose a very real moral dilemma. I am not saying that I have any answers to it but I do think I have a right to put the question.*

Professor Dollery also missed the point.

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Firm Support for Culture Training

I notice that in a recent issue of the *Journal* (3(3):185, 1982) "alternatives" in Canada were discussed. There is, unfortunately, one small error in your report regarding support for Dr. Sergey Fedoroff's tissue culture training course at the University of Saskatchewan. As you may be aware, the course for several years was supported by grants from the Animal Welfare Foundation and the Canadian SPCA of Montreal.

In 1981, the Honourable John Roberts, Minister of State for Science and Technology, responded positively to the Canadian Council on Animal Care's (CCAC) request to the various federal and provincial government departments for support of the course on an annual basis, indicating that funds would be made available through the CCAC budget. Although the CCAC is co-funded by the Medical Research Council (MRC) and the Natural Sciences and Engineering Research Council (NSERC), it was the Minister of State for Science and Technology who authorized the support by the CCAC of the tissue culture training program. This support was begun this past summer.

In passing, I would like to emphasize that the 1983 announcement for the tissue culture course has already been advertised. It will be held as a satellite program of the International Society for Neurochemistry's annual meeting in Saskatoon, July 22-29, 1983. (Contact Dr. S. Federoff, Department of Anatomy, University of Saskatchewan, Saskatoon, Canada S7N 0W0.)

I recognize that this is a small point, but I would like to keep the record straight with respect to interest in the development of alternatives, not only of NSERC, but also the singular interest of our Minister of State of Science and Technology.

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Editorials

The LD50 — The Beginning of the End

Andrew N. Rowan

The Basis of the Argument

Measurement is very important in science. Early lessons in the science classroom involve teaching students to measure lengths, volumes, weights, specific gravities and anything else within the mental and economic compass of the teacher. At the same time, the question of *significance* is drummed into the students' heads. Thus, if one has a meter-rule which is subdivided into centimeters (but not millimeters), one is taught that the measurement of its length to one decimal point (for example, 10.3 cm) is acceptable, but that the addition of any more figures (for example, 10.325 cm) is mere braggadocio. The eye can only make a rough guess at the subdivision between the centimeter divisions, and adding more figures after the decimal point does not improve the accuracy of the estimate.

However, adding more numbers, without increasing the accuracy of the measurement, is precisely what is being attempted when the LD50 is used as a measure of the acute toxicity of chemicals. (The LD50 is the amount of a substance which, if administered in a single dose to a target group of animals, will kill 50 percent of them). Normally, 50 to 200 animals are used to estimate the LD50 *and* provide its standard deviation from the mean. For some reason, regulators and some toxicologists appear to believe that an LD50 with its fiducial limits is more accurate and more relevant than a *rough estimate* of the acute toxicity, an estimate that can be obtained by using as few as six animals (rather than the 50-200 animals needed for an LD50).

The point at issue, therefore, is simply this: Animal welfare groups and many toxicologists want to see the LD50 (performed on 50 or more animals) replaced within the next year by a rough estimate of acute toxicity. The regulatory authorities have so far resisted making the necessary changes.

History

In 1927, J.W. Trevan published his classic report on toxicity determination, in which he asserted that the median lethal dose (or LD50), done in a large (50-200) sample of animals, provided the most accurate index of a chemical's toxicity (*Proc Roy Acad Soc 101B*:483-514). He was, however, concerned mainly with the accurate standardization, by biological methods, of those drugs that are not available in a chemically pure form. For example, each new batch of such important drugs as digitalis extract, insulin, and diphtheria toxin had to be accurately standardized since the margin of safety between therapeutic and toxic doses is so small. Even today, the *U.S. Pharmacopoeia* requires a bioassay standardization of powdered digitalis that involves comparing the lethal dose in pigeons against a reference standard.

However, the number of LD50 determinations used to standardize potent biological therapeutics now represents only a small proportion of the LD50 tests conducted annually. Most LD50 testing is done to provide a figure for the toxicity

of other classes of chemicals. But somehow the LD50 figure has gained a totally undeserved position as *the* toxicological reference standard; it seems to be regarded in nearly the same light as such physical constants as melting point and specific gravity. But as Trevan and his colleagues recognized, the LD50 of a substance is not a fixed value; it varies according to many extraneous factors, sometimes by substantial amounts (see Tables 1 and 2).

In the last 15 years, however, the use of the LD50 as a toxicological standard has come in for increasing criticism among toxicologists (see *Arch Toxicol 47*: 77-99, 1981). It is not that they deny the need for some sort of rough numerical estimate of acute toxicity in a mammalian species. Rather, they deny the utility of the *precise statistical* figure that is provided by the usual LD50 test. It is most important that this point be clearly recognized. The immediate argument over the LD50 is not that we do not need acute toxicity data, but that we can get the kind of data we need from small-scale tests in a few animals. We do not need to kill as many animals as we do *merely* to provide statistical precision.

Protest Against the LD50

In the last decade, animal welfare criticism of the LD50 test has become increasingly vocal and sophisticated. In England, such criticism prompted a relatively unusual initiative from the Home Secretary. In 1977, he asked the Advisory Committee to the Cruelty to Animals Act, 1876, to review the extent of the use of the LD50 test, as well as the scientific necessity and justification for the test in its various applications. The Advisory Committee listened to extensive evidence from animal welfare critics and the scientific community. Interestingly, the scientific and regulatory groups, while more restrained in tone, were often just as critical of the LD50 test as the animal welfare groups.

The Association of the British Pharmaceutical Industry concluded that: "estimation of LD50 is not an essential requirement to ensure the safety of all new drugs. Adequate information regarding the acute toxicity, including the acute lethality, of new drugs can often be obtained by the use of smaller numbers of animals than are conventionally used in LD50 determinations." The Chemical Industries Association proposed that (1) regulatory agencies be discouraged from demanding precise LD50 figures; (2) emphasis be placed on the qualitative data obtainable from small-scale acute toxicity studies; and (3) no animal should be administered a quantity greater than 5 g (or 5 ml) of a substance per kg of body weight (the so-called Limit test). The Scottish Home and Health Department noted that "there is no case to be made for requiring LD50 tests to provide a value with small fiducial limits. An approximate estimate suffices."

By contrast, the Medical Research Council (MRC), after explaining that precise data on acute toxicity were not really necessary, concluded that "the LD50 test is the only reliable measure of acute toxicity and yields a result with the least possible expenditure of life." However, they followed this assertion with a statement that only a simple test, using a small number of animals, should be done to assess the *order of magnitude* of a chemical's toxicity. Clearly, when the MRC talked of the need for an LD50, they really meant that what we need to perform in most cases is a small-scale acute toxicity test.

Unfortunately, the MRC was not the only group to confuse the notion of small-scale acute toxicity testing with the LD50 test. When the Home Office report finally appeared in 1979, their first recommendation was that "LD50 tests should be allowed to continue." Although they qualified this recommendation by

advising that only a small numbers of animals need be used, the harm had been done: A government enquiry had found that LD50 tests needed to continue. I cannot say that I, personally, found the Committee's findings particularly surprising. When I gave testimony to the Committee (on behalf of FRAME—for whom I was working at the time), one of the expert advisors was almost plaintive in defending the toxicologist's need for a baseline figure for acute toxicity (*i.e.*, the LD50) and the other did not appear to accept the distinction between small-scale acute toxicity testing and the full LD50.

Recent Developments

Despite the setback presented by the 1979 report from the British Home Office, there are now some encouraging signs that an unlikely alliance of animal welfare and industrial organizations may prevail upon regulatory bodies and effect a revolution in acute toxicity testing. For example, if regulatory bodies would agree to prohibit the submission of LD50 figures except in those few cases where scientific justification can be provided for an LD50 determination, we would reduce the number of animals used in determining lethal doses by about 80-90 percent. Numerically, this would probably amount to 2-4 million animal lives saved every year. What events have occurred to change the climate of opinion since 1979?

First, an international coalition of animal welfare groups has been formed with the specific aim of abolishing the LD50 test. A similar coalition against the Draize test was very successful (see *Int J Stud Anim Prob* 3:94-97), and there is every reason to hope for similar success if a concerted campaign can be mounted over the next year. The immediate goal will be to get the regulatory agencies to switch from tacit or explicit requirements for LD50 data to an explicit prohibition on the submission of LD50 data, unless accompanied by scientific justification.

Second, on October 21, 1982, the Pharmaceutical Manufacturers Association (U.S.) called for a revision of government regulations so that fewer animals are used in drug safety evaluation. They specifically noted that "the classical LD50 test which utilizes many animals to determine an LD50 value with mathematical precision lacks justification..." They proposed that: (1) the *precise* determination of an LD50 should be limited to those rare cases where it is necessary; (2) an approximate lethal dose plus qualitative data usually represents adequate information on the acute toxicity of drugs; and (3) there should be an international effort to reach agreement among regulatory agencies that, for drugs, a precise LD50 determination is not necessary.

Third, at a number of recent scientific meetings, the overwhelming consensus has been that the LD50 is unnecessarily precise—qualitative and semi-quantitative data from small-scale acute toxicity tests is usually adequate. For example, at a FRAME conference, pharmaceutical company staff in the audience voted to abolish the LD50 test by 20 to 1 (*New Scientist*, November 4, 1982, p. 275). At a conference that specifically addressed the LD50 test in Sweden (September, 1981), a clinical toxicologist from the Karolinska Poison Information Center stated that the numerical information provided by an animal LD50 is virtually useless. Other scientific meetings on the use of animals in acute toxicity testing are planned. The indications are that these meetings will confirm the uselessness of precise LD50 data. All this activity on the part of scientists, combined with animal welfare protests, should escalate the pressure to the point that regulatory bodies are forced to take action.

Conclusion

A reassessment of the need for LD50 figures is long overdue. Bureaucrats may

not be comfortable with approximate lethal dose figures, but there are clearly few cases where LD50 determinations amount to anything more than pseudoscientific nonsense. LD50 testing continues, not because it receives broad endorsement, but because nobody feels sufficiently secure to take the decisive action that is necessary to eradicate 40 years of thoughtless tradition. Since death by poisoning cannot be particularly pleasant, regulatory agencies that are serious about animal welfare issues ought to begin to take steps to abolish unnecessary LD50 testing, especially since the scientific verdict against it is already in.

TABLE 1 Human Acute Lethal Doses and Animal LD50's (Oral)

	Human LDLo (mg/kg)	Animal LD50			
		Rat	Mouse	Rabbit	Dog
Amytal	43	560	—	575	—
Boric Acid	640	2660	3450	—	—
Caffeine	192	192	620	—	—
Carbofuran	11	5	2	—	—
Lindane	840	125	—	130	120
Fenflurazole	—	238	1600	28	—
Cycloheximide	—	3	133	—	65

Compiled from *CRC Handbook of Analytical Toxicology* and the NIOSH *Registry of Toxic Effects of Chemical Substances*

TABLE 2 Range of LD50 Values for Five Compounds Tested Under Similar Conditions in 65 Different European Toxicology Laboratories

Compound	LD50 Range (mg/kg)	
	Laboratories That Used Their Own Protocol	Laboratories That Used The Standard Protocol
PCP	46-522	74-2328
Na Salicylate	800-4150	930-2328
Aniline	350-1280	479-1169
Acetanilide	805-5420	723-3060
Cadmium Chloride	70-513	105-482

Compiled from *J Assoc Off Anal Chem* 62:864-873, 1979, and *Arch Toxicol* 47:77-98, 1981

Some Rights for Animal Therapists: Better Science and Better Welfare

Dana H. Murphy

"Animal-facilitated therapy." The phrase has a nice, solid ring to it, doesn't it? And it also sounds like an idea that nearly everyone could agree to endorse, like democracy and vacations. But a closer scrutiny of some of the available literature on the use of animals as adjuncts in situations like nursing homes and outpatient psychotherapy reveals a number of deficiencies. While there is probably nothing wrong with the fundamental concept—ideally, people and animals are helping each other to become more useful and independent—there *are* some real problems in two areas: the dubious level of scientific rigor in many of the reports on animal-facilitated therapy, and the scant consideration given to the welfare of the animal therapists themselves.

In a paper presented at the International Conference on the Human/Companion Animal Bond in October 1981, Michael McCulloch goes on at some length about the history of animals as therapeutic agents. He concludes each short narrative on a particular experiment with some version of the same refrain: "no quantitative information was recorded." Rather, he observes that the notion of animal-facilitated therapy is so popular, so much an idea that we all want to believe in, that anecdotal data and individual case studies have been accepted as sufficient proof of the hypothesis that animal therapy works. As a consequence of this dearth of real scientific analysis, the claims for this mode of therapy have occasionally been suspiciously inflated. In the process, such claims, because of the absence of an examination of the relative contribution of all the variables that might be involved in a given result, become magically protected from *dis*proof. Who can know, for example, whether an observed decrease in mortality at a nursing home that recently initiated regular visits by an appealing beagle might not have been influenced more by the long-awaited installation of a reliable thermostat?

McCulloch himself advocates a painstaking analytical procedure for anyone who wants to study the effects of animals in therapeutic situations: the fundamental mechanisms of the system of interaction between people and companion animals, the style of interaction, the location, and the outcome must all be carefully teased out. An excellent example of a study in which just this sort of caution was observed is "Animal Companions and One-Year Survival of Patients After Discharge from a Coronary Care Unit," by Erica Friedmann *et al.* (*Cal Vet* 36(8):45-50, 1982). Here, the authors, noting that research on survival after the onset of coronary heart disease has seldom included *both* physiological and psychosocial variables, attempted to correlate 1-year survival with a long list of potential causal factors. Pet ownership was but one item on an extensive social inventory given to each patient; psychological mood status and severity of disease were also measured at the same time. Precisely because all (or nearly all) of the factors that might have had an effect on the further course of the disease were included in the study, the authors were able to conclude, with a high degree of certainty, that pet ownership *was* a very important positive factor in determining whether a person survived heart disease, or merely succumbed. The authors were even able to rule out the variable of increased exercise, which might have been one reason why those

with dogs (which require more care, especially daily walks) lived on. In fact, the species of companion animal owned was found to have virtually no bearing on the 1-year survival data.

The scientific rigor necessary to arrive at a judgment on the effectiveness of animals in therapy is relatively easy to achieve, with a little thought. A far more difficult issue is how an animal being employed as a therapist ought to be treated, especially in light of the incredible range of conditions and environments that animals will probably be working in at some time in the near future.

As Michael Fox noted in the last issue of the *Journal* (*3*(4):267, 1982), our choice of language about animals both reflects and conditions the way we think about them. He discussed our desensitization to the plight of confinement farm animals through use of the phrase "production units," and of lab animals by the impersonal term "specimens." It is difficult to ignore the fact that much of the same insensitivity to animals' needs emerges from the literature on animal-facilitated therapy. A paper by Leo Bustad and Linda Hines (*Cal Vet 36*(8);37-44), in particular, speaks of companion animals as "prescription pets," and then cites another article by Samuel and Elizabeth Corson in which animals are reduced to the psychobabble of "bonding catalysts." Pets, claim Bustad and Hines, can provide the elderly with someone to "lord it over." McCulloch views visiting companion animals as "entertainers" for those who are forced to waste away their hours in places like hospitals.

It does seem, then, that some of the aspects of animal-facilitated therapy need a bit of careful reconsideration before we begin to gush euphorically over its potential. First, we need better-controlled studies on the outcomes of treatments that employ animals. Next, we need some reasonably specific guidelines on the care and welfare of the animals so used. At a minimum, we can say that these animals should never be treated as "living library books," rented out on a short-term basis in a way that is probably confusing to the animals, to people who may mistreat them or, perhaps worse, may come to love their animal-guests too much, only to lose them at the end of an evening. And finally, we had best take a closer look at a society that exiles its old people to human warehouses, where they are left to exist without activity or purpose, so that animals, once again, are compelled to assume the tasks that we would simply prefer to avoid.

Occlusion of Vision in Old English Sheepdogs

Michael W. Fox

The show standards established for many breeds of dogs have been linked with a number of genetically related abnormalities that can result in unnecessary suffering. The facial skin folds and shortened face of bulldogs, which respectively lead to chronic dermatitis and respiratory difficulties, are two dramatic examples. Likewise, ear-cropping is an ethically questionable mutilation that conveys no benefit upon the dog. Another serious welfare concern relates to a practice that is common among owners of Old English sheepdogs and other breeds with long facial hair: allowing the hair to cover the animal's eyes. This feature is considered a desirable show point. It is additionally justified by the widespread belief

that it is necessary to keep the hair over the dog's eyes in order to protect them from sunlight. In fact, when the hair is lifted up to expose the eyes to daylight, a photophobic reaction (blinking, lacrimation, etc.) does occur, which leads the owner to the erroneous conclusion that the eyes actually need to be left covered. However, it is a self-fulfilling prophecy that an animal whose eyes are almost totally obscured from any contact with daylight will show photophobia when the eyes *are* exposed. This is no reason for keeping an animal's eyes permanently covered. Furthermore, the eyes, since they are continually being irritated by hair, are likely to develop chronic conjunctivitis, which may in turn lead to corneal ulceration and other ophthalmic problems.

Many owners of Old English sheepdogs and other breeds with long facial hair believe that, since the hair covers the dog's eyes, it must be "natural" or serve some beneficial purpose that was deliberately introduced as a trait through selective breeding. Such myths need to be dispelled for the health and welfare of these breeds. Instead, owners are advised to either trim the hair away from their dog's eyes or tie it up on top of the animal's head with a ribbon or elastic band.

Dogs entered in shows with facial hair deliberately groomed over the eyes should be excluded from competition, since this show standard, in and out of the ring, places the animal's welfare in jeopardy. There is also evidence of dramatic temperament changes in sheepdogs whose visual occlusion has been corrected by cutting the hair away from their eyes; shy, timid, and unpredictable dogs suddenly become tractable, responsive and, emotionally stable companions. Little wonder.

News & Analysis

Preliminary Verdict for Electro-Immobilization

What a electronic immobilizer *does* is easy to see—after electric current from the device is passed through an animal's body, the animal is "locked" into immobility, and procedures such as branding can be performed with a minimum of hassle. But how it works, and whether pain is partially or completely blocked by the procedure, are a great deal harder to figure out. The manufacturers of one such device, the Feenix Stockstill, claim that pain is indeed blocked during the duration of immobility. But the Scientific Advisory Panel of the World Society for the Protection of Animals, in a memo dated September 22, 1982, voiced some skepticism about the effectiveness of these devices. Specifically, they wanted to know whether the equipment:

1. Is safe for subject and operator.
2. Induces anesthesia (or analgesia), or merely a state of immobility that prevents the animal from displaying typical signs of pain.
3. Should be restricted to qualified persons, or could be used by laymen safely and humanely.

In response to a letter from Michael Fox which, among other items, raised these questions, James F. Amend, D.V.M, Ph.D. (University of Nebraska, Lincoln) summarized his recent results with the Vet-Master animal immobilizer. That response is reproduced here.

I am pleased to respond to your inquiry concerning the Vet-Master animal immobilizer, currently produced by Ag-Tronic, Inc., of Hastings, NE. My laboratory has been engaged for a period of time in the investigation of physiological and clinical effects of this device as it is applied in management procedures for beef calves.

As you may be aware, use of electric currents for manipulating muscles, reducing pain sensations, producing therapeutic sleep, or providing general surgical anesthesia has been studied in many species of animals, and in man, since the pioneering work of LeDuc in 1902. Numerous research reports presented over the past 80 years have produced two critical concerns in relation to design of this type of device. First, one must choose with great care the manner of electrical contact between device and subject, and second, one must determine very precisely the properties of the electric current applied. Our studies with the beef calves have addressed these two concerns as we have participated in evaluation of the Vet-Master animal immobilizer.

With regard to the manner of electrical contact between device and subject, earlier investigators thought it was essential to deliver electrical current directly into body fluids, thereby providing a low-resistance path for the current, avoiding electrical burns of the skin and delivering an adequate amount of electrical energy to the subject. In development of the Vet-Master, which makes electrical contact with the animal in the relatively contaminated regions of mouth and anus, we were concerned that penetration of the skin with any type of needle to reach the body fluids would create risk of infection, as well as cause pain upon application of the contacts. We therefore developed nontraumatic rectal probes and lip contacts, which deliver current to the body fluids by way of the moist rectal surface, and saliva within the mouth, respectively. These contacts have proved to be excellent low-resistance routes through which electric current can be delivered. No tissue trauma has been observed at these sites in any animal we have immobilized with the Vet-Master. Absence of pain upon attachment reduces the need for initial physical restraint as well.

The second issue, relating to properties of the electrical current suitable for the purpose of the device, has been extensively examined by a number of investigators. In general, it appears that alternating currents or repetitive pulses of current are more useful than direct current, and further, that higher frequencies of alternation or repetition tend to be more satisfactory than the lower frequencies. Certain investigators who have tried these types of devices on themselves have reported that lower frequencies (less than 100 cycles per second) can create considerable discomfort. We have examined a range of different frequencies in working with the Vet-Master, and find the most satisfactory immobilization occurs with frequencies at or near 100 cycles per second, provided that the duration of cyclic application of current (length of pulse) is properly selected. Preliminary evaluation of enzyme profiles from calves subjected to electronic immobilization in our lab would suggest that higher frequencies may result in milder metabolic disturbances in tissue than do lower frequencies.

There are two additional concerns that relate to the properties of the electrical current. First, in order to avoid any struggling which might potentially injure an animal or add to the stresses of the procedure, it is necessary to apply sufficient initial current to assure complete immobilization. The requirement for this initial current is generally acknowledged to be a function of body size. The Vet-Master has been designed with high and low ranges of intensity, thus providing for more precise delivery of a proper quantity of electrical energy in relation to the size of the animal. Second, electronic devices that affect tissue functions through electrical currents are all subject to the phenomenon of "fading," a condition in which the physiological effects of the current decline over time. It is important, when increasing the intensity of the current, to compensate for this phenomenon; one must accurately supply the minimum additional current required. The Vet-Master is capable of providing fine adjustments in intensity in the lower range, as required by smaller animals, and more substantial controlled increases in the higher range, suitable for larger animals.

Currently, the Vet-Master animal immobilizer is available only to veterinarians, a judgment on the part of the manufacturer which I welcome, as it will assure that the early experiences with this new technology will occur under professional observation. I am, at the present time, sufficiently satisfied with my research results to encourage the use of the Vet-Master in adult beef cattle and growing calves. I have some reservations, based on limited experimental work, regarding responses of sheep to electronic immobilization, although careful use of the low range of the Vet-Master, with limited time exposure, has yielded reasonably satisfactory results. Others have reported the Vet-Master to be effective and useful in swine, and we hope to proceed with additional studies in this species. With regard to companion animals, such as dogs, cats, ponies, and horses, I am not prepared to encourage the use of electronic immobilization without careful selection of conditions and judicious use of sedation. We have used the Vet-Master in adequately sedated dogs, with acceptable results. Under no circumstance could I promote the use of electronic immobilization in the conscious horse. I do believe, however, that the device has great promise in providing postoperative restraint in the horse. Oftentimes, an equine surgeon will find that he needs additional time, beyond the duration of action of short-term anesthetics, but hesitates to give an additional dose of anesthetic for fear of prolonging recovery. In instances such as these, electronic restraint with the Vet-Master may provide needed time to complete the procedure, without additional drugs. The same is true of the potential for restraint when stormy recoveries occur, with attendant risk of injury to horse and handler. The Vet-Master may prove to be useful in reducing these dangers and stresses in the recovery period. One need only recall the sad story of the filly Ruffian, who was destroyed after successful surgery because she could not be controlled during recovery. I believe a device such as the Vet-Master might well

have provided for a happier outcome in such a situation.

In my opinion, the Vet-Master may be regarded as a potential contributor to reduction of stresses in the beef cattle management process, and as a means for improving the safety of man and animal as they interact in this process. Further investigation will no doubt also demonstrate its usefulness in other species.

It is important, at this point, to avoid the idea that any form of electronic immobilization works as an analgesic, or pain-relieving, technology. There is as yet no reliable evidence that this is so. On the other hand, my clinical judgment allows me to believe that physical immobilization with the Vet-Master provides a sufficiently strong distraction to diminish significantly the overall perception of discomfort in the animal. Certainly the efficiency of restraint offered by the Vet-Master will help to reduce the duration of any particular procedure, thus minimizing discomfort in that respect. — James F. Amend

Enforcement Powers for Humane Societies?

The New Jersey state senate has come up with a plan (Bill 1203) to give local humane societies more clout in making effective use of the state's animal cruelty laws. The bill would permit any humane society that has been established for 5 years to set up a "law enforcement department." The members of this unit would be legally deputized to enforce all of the laws and ordinances pertinent to animal protection. This means that humane society personnel would have the right to make arrests, and also to take into custody any animal whose owner had been charged with cruelty. The humane organization that instituted a particular action would become the beneficiary of any fines and penalties collected from those convicted.

And therein lies the rub. As reported in *Pet Supplies Marketing* (*36*(9):58, 1982), the Pet Industry Joint Advisory Council (PIJAC) has become quite alarmed by the bill because they claim that humane groups — whom they view as direct competitors to pet dealers in the "selling of dogs, cats, other animals and supplies" — would become involved with pet stores in a serious conflict of interest. The bill, in their opinion, would provide humane societies with considerable incentive to begin aggressively working to increase the number and amount of fines, simply for the sake of the cash involved, and also to start "harrassing legitimate pet shop owners."

A second proposed bill would permit the seizure of animals from anyone suspected of "alleged cruelty"; permanent injunctions could then be obtained to prevent those convicted from any further dealing or possession of animals. No exchange of funds involved here — and no complaints from PIJAC.

In a Natural Environment, Pig Behavior Resembles That of Wild Boars

An objective assessment of the welfare of a species requires adequate knowledge of its behavior and cognitive powers. In our domestic species, we know little about motivational systems and the interactions of those systems. To learn the behavioral repertoire of a species, it is necessary to study behavior in a variety of habitats.

With this aim in view, a pig park was set up at the Edinburgh School of Agriculture farm, Eastern Howgate, in which the animals are allowed as much freedom as possible. The park consists of an enclosure of 1.3 ha containing a small pine copse, gorse bushes, a stream, and a swampy wallow. A small population has been kept there for about 3 years. At present, this population consists of a boar, four adult females, a subadult male and a subadult female, together with any young from the females that

have not yet been removed. Normally, young have been removed when ready to be fattened, or at 12-13 weeks when they wean themselves.

The park is divided into two roughly equal halves. Initially identical populations were kept in each half. Observations were made using both scanning and focal animal techniques. The animals receive the same rations as in the pig unit, but are given extra when conditions are very severe. Feeding always occurs at a set position, which provides a reference point for many of the pigs' activities.

In the pig park, with its variety of environmental features and diversified social structure, the pigs' behavior closely resembles that described for the European wild boar. For sleeping, the pigs make a communal nest. Over the study period, a large number of these were constructed, so details about them can be tested for statistical reliability. They were located far from the feeding site, were protected against the prevailing winds, and had a wide view that allowed the pigs to see anything approaching the nest from certain directions. Before retiring to the nest, the animals tended to bring nesting material for the walls and to rearrange the nest. This was not a coordinated activity, but most pigs performed it. Some individuals carried more nesting material than others. On leaving the communal nest in the morning, the animals walk at least 5 m before urinating and defecating, the latter mainly on paths between bushes.

In autumn, 51 percent of the day is devoted to rooting. Much behavior takes place in the border of the wood and open vegetational zone. Here trees are used for marking, in which the facial area is rubbed, sometimes in one direction only.

Special relationships were found, e.g., a pair of sows might join together several days after farrowing and forage and sleep together. However, no cross-suckling has been seen in the litters of such animals. Special relationships have also been found in the young. Members of a litter of the same sex tend to stay together and to pay attention to one another's exploratory behavior. Young males also pay much attention to the activities of the subadult male and boar. Aggressive play appears to be more common among the young males. Both sexes show manipulative play.

Farrowing nests are constructed by the sows, usually far from the communal nest, and the site chosen is usually under a branch or fallen tree. After farrowing, the nest is protected against all pigs for about 5 days. From about that time, the sow may leave her litter for varying periods and piglets begin to explore their environment. Weaning finally takes place at about 12-13 weeks.

Following these observational studies, pigs were kept in small enclosures with or without natural environment features such as bushes, and it was found that with the reduction of space the main behavior patterns were still evident, provided the enclosure had certain environmental features such as bushes. Following these experiments, a new housing system was designed, incorporting many features that allow the pigs to express a wide range of behavior patterns. This system is now undergoing preliminary trials at the School of Agriculture, Edinburgh. (Authors' abstract, D.G.M. Wood-Gush and A. Stolba, *Appl Anim Ethol* 8(6): 583-584, 1982.)

Egg Producers Issue Guidelines for Destroying Baby Chicks

As Walter Jaksch related in an earlier issue of the *Journal* (2(4):2-3-213, 1981), the male chicks of laying hens are considered an unwanted and useless by-product to the egg industry. Since laying hens have been specifically bred to channel all of their available energy into producing eggs, layers gain weight poorly. So the males of these strains cannot be used for meat production, and they are usually destroyed when only a day old. However, since these male chicks are not

considered as food animals, there have been few regulations, in any country, on how they should be killed and disposed of.

Jaksch's article evaluated various methods for euthanizing chicks — which include decapitation, homogenization (after crushing), oxygen withdrawal, carbon dioxide or nitrogen gassing, and electrocution — according to a checklist of criteria:

- Speed
- Reliability of inducing unconsciousness and death
- Painlessness
- Ease of application
- Economy
- Safety
- Preservation of dead chicks for further use
- Aesthetics.

His conclusion was that no currently available method met all of the criteria, but that fumigation in a closed chamber was probably the best technique of a bad lot, since it is quick, economical, and fail-safe because the chamber's design assures rapid death for all of the birds.

This year, the Animal Welfare Committee of the United Egg Producers has drawn up a set of guidelines for destroying baby chicks, comprised of two sections. First, several methods are ruled out:

> *The practices of smothering unwanted baby chicks in barrels or plastic bags, or disposing of them by use of volatile liquids, such as carbon tetrachloride or chloroform, are not recommended.*

Then, instructions for use of CO_2 and some of its advantages are explained. For disposing of large numbers of chicks, it is advised that

> *A constant trickle of CO_2 be introduced into a large plastic-lined container...The container is then slowly filled with chicks. Each layer of chicks will be unconscious or dead before the next layer is added.*

Parenthetically, the guidelines note that "development of CO_2 chamber utilization is also encouraged."

Jaksch has reported that the CO_2 technique advocated by the UEP can be very satisfactory, as long as certain precautions are taken: (1) the sack must be adjusted to keep the chicks from falling to the bottom, and (2) if too many chicks are treated at one time, death can occur too rapidly — by suffocation. But, with care, the method assures that chicks will be unconscious within 10-15 seconds and dead within 5 minutes.

The guidelines, though, must still be approved by the UEP Board before they can become part of the UEP's general recommendations on husbandry practices.

Establishing Baselines for Domestic Animal Behavior

One of the most taxing problems for the field of applied ethology is determining precisely what elements comprise the baseline (or normal) behavioral repertoire of a given species. To overcome this problem, E.M. Banks (*J Anim Sci 54*: 434-445, 1982) has proposed a systematic method for compiling behavior catalogs, or "ethograms," of animal behavior. In addition, he has formulated quantitative procedures for determining whether apparent aberrations in behavior are just harmless adaptations, or manifestations of true maladaptive reactions to noxious environments.

The first step in deriving an ethogram is a pilot study, in which the most prominent behaviors observed are recorded and assigned to one of several categories: gross motor patterns, vocalizations, and odors. This is done for both individual and social behaviors. Animals should be studied in different housing systems, as well as in unconfined, natural situations. Concerning odors in particular, the author notes that "we are just beginning to appreciate the rich odor vocabulary used in various social contexts of domestic animals." Then, the behaviors listed in

the pilot study are subdivided into identifiable units, termed "modal action patterns"; these units must be defined in objective terms and then characterized in a quantitative sense by measures like frequency, duration, amplitude (intensity), and latency (the interval between presentation of a stimulus and the initiation of a response).

Finally, the major components of the completed ethogram for a species are compared by examining the effects of the widest possible range of commonly used housing and husbandry practices for that species. Any deviations from the baseline pattern, and their severity, are noted. These sorts of formal behavioral variables can be incorporated into traditional production-oriented research of factors like diet, temperature, etc., so that humane considerations can be taken into account at the same time—for purely ethical reasons, as well as for the role they play in overall productivity.

As an excellent candidate for study by ethogram, the author suggests poultry. He argues that the behavioral anomalies (and the widespread criticism) resulting from battery cages will not subside if the only change made is an arbitrarily chosen increase in the space allotted to each bird. Rather, the complete normal ethogram must be used as a control in a large-scale study of a variety of standard cages, as compared with those that have been designed to provide a better environment for the complete expression of the normal range of the birds' behavior.

A Farmer's Response to the "Downer" Cow Dilemma

As we reported in the last *Journal* (3(4):271-272, 1982), the difficult problem of the inhumane transport of downer cows for later slaughter has recently been tackled by Wisconsin's Administrator for Meat Inspection, Ed Baker. He has proposed legislation that, among other things, requires that such cows be killed prior to loading and sale. But while possible legislative action is discussed, debated, amended, and discussed some more, the problem continues.

The October 8, 1982 edition of *Agri-View,* a weekly newspaper from Wisconsin, devoted an entire page to analyzing the pro's and con's of the new rules for "downers." To those on the state's Meat Inspection Advisory Council, the chief advantage of a clear-cut policy on the fate of down cows would be economic: knowing what price could be expected for such an animal would make life much simpler. At the moment, it's hard for the several parties involved in downer cow removal—farmer, trucker, and packer—to establish how much should be paid for an animal while it is still on the farm, since nobody can be sure whether, at inspection, the animal will be considered fit for human consumption, or condemned to the dog dish. Another priority, voiced by a homemaker-council member from Monona, related to public perceptions of the farmer. Since people are now eating less and less red meat, she noted, "Anything we can do to improve the image of the meat industry needs to be done."

But a farmer in Nehoosa, WI, Mrs. Tom Martinson, has written to the *Journal* about the insensitivity that she sees in the way that both industry and government are thinking and talking about the downer cow problem. It is her firm belief that all of the verbiage about the economics of dealing with downers is irrelevant at best, and coldly callous at worst, because so little money is made from the sale of these animals, irrespective of how they are eventually graded. She writes:

I have enclosed this article (from Agri-View) to give you some insight into the handling and treatment of downer cows. No farmer will ever get rich—or poorer—by selling his downer cows alive. So little is paid for them, that it is really more a matter of convenience to get rid of the large carcass than it is a matter of money. The ones who do make money are the pro-

cessors, and possibly the truckers, to some extent.

I am a farmer. I raise breeding animals (polled Hereford cows), and I would never allow a live downer cow to leave my farm. The animals would have to be dead before removal. A young man who delivered hay to us last spring told me how these cows are piled on top of one another in the trucks, while still alive; of course, many of them soon die.

I realize that the cow has not been "humanized" like cats, dogs, and horses, but the cow is in some senses the mother of man, providing us with milk, hides, and other protein-rich foods. She should therefore be treated with the same consideration for her suffering as any other species.

Attitudes Toward Dogs and Cats

Two Missouri researchers have recently published some fascinating data from a survey of public attitudes toward dogs and cats (*J Small Anim Pract* 22:129-137, 1981). For example, of the 900-plus individuals surveyed, only 4 percent disliked dogs, whereas 28 percent disliked cats. The authors did not discuss this finding specifically, but they did draw attention to a study that describes the human/dog relationship as one of mutual benefit, whereas the human/cat relationship is construed as parasitic, in that the cat benefits at the expense of the human (*Vet Med/ Small Anim Clinic* 60:713-718, 1965). They also noted that cat owners as a group had more negative feelings about dogs than non-pet owners.

Other data indicated that: (1) women become more emotionally involved with their animals and derive a greater sense of security from pet ownership (with both dogs and cats) than do men; (2) individuals under 30 years of age expressed a significantly greater feeling of importance or vanity from dog ownership; and (3) the greatest degree of emotional need and companionship with cats was found in individuals under 20 years of age, while the least need occurred in individuals between 30 and 50 years of age.

Deaths in Primate Trade

The export of primates from source countries for biomedical research in Europe, America, and Japan has been declining steadily since the high point of the late fifties, when over 250,000 monkeys a year were being shipped, often under deplorable conditions. Economic factors and protests from animal protection groups resulted in significant improvements in transport conditions but, according to a report in *Oryx* (June 1982, p. 300), the situation is still not acceptable. For example, 16 percent of the 10,000 cynomolgus macaques that were shipped into the U.S. in 1978-1979 from Indonesia were either dead on arrival or died within 3 months. Furthermore, an Indonesian primate dealer reports that 43 percent of the cynomolgus die before export, and a further 25 percent are not fit for export because of wounds or disease.

Researching Research Methods

Most of the recent discussion on the issue of painful research in animals tends to assume that injections or blood-sampling are not, in themselves, causes for concern. It is assumed that a brief painful stimulus occurs as the needle penetrates the skin, but this is not considered serious. However, the actual extent of the disturbance caused by injections has been the subject of some recent research.

It is well known that some substances may cause discomfort or pain after injection and that this reaction may be indicated by the animal's lack of appetite,

restlessness, or reluctance to move. In the small rodents, these symptoms are not obvious, and sensitive methods are needed to detect them. Recently, John Herbert (Dundee University, U.K.), using a sensitive device to measure mouse activity, has found that injection of as little as 0.1 ml of a harmless substance (such as a 0.9 percent solution of sodium chloride) caused an increase in exploratory activity. By contrast, an injection of 1.0 ml of an irritant (10 percent peptone water) resulted in inactivity that lasted for 4 hours. This work is now being extended under a grant from the Universities Federation for Animal Welfare (*1981-1982 Annual Report,* UFAW).

Similar research was conducted at ICI Toxicology Laboratories (U.K.) on the maximum doses (volumes) that could be administered to rats and mice in toxicity tests before visible signs of distress appeared. In mice, the upper limit for oral doses appeared to be about 10 g/kg of body weight (or 0.2-0.3 g per mouse). Actual distension of the stomach was observed at doses of 50 g/kg. In intravenous dosing, hyperpnea became evident at doses of about 25 ml/kg. The equivalent upper dose limits in rats were 30 g/kg (oral) and 30 ml/kg (intravenous).

Cat Population Dynamics

An analysis of the domestic cat population of Manhattan, KS (*Am J Vet Res 43*:167-170, 1982) reveals that the rate of population change is about 1.18. This means that the domestic cat population is potentially increasing at an annual rate of 18 percent. However, if pet cat ownership does not increase at a corresponding rate among the 40,000 residents in Manhattan, then the extra animals will either be euthanized or end up as strays. The survey indicated that about 59 percent of the female cats of reproductive age had been spayed. The authors also calculated that, given a 50 percent reproductive rate among unspayed females, approximately 76 percent of all reproductive-age females will have to be spayed to produce zero population growth.

Dart Gun Modifications

It is well known that the use of anesthetic darts for the capture of wild animals carries a significant risk of injury and even death. Part of the problem is related to the weight of the dart. Recognition of this fact prompted the development of lightweight dart (*Nord Vet Med 34*:39-43, 1982). The dart has only a limited volume capacity, and thus concentrated drugs must be used, but it is very accurate up to 60 m, with a range of approximately 120 m.

Alternatives at NIH

The Appropriations Committees in the U.S. Senate and House of Representatives have an important say in the final funding allocations for federal agencies. As a result, their interests and wishes, as expressed in the reports which accompany the annual appropriations bills, carry considerable weight. In September, the Appropriations Committee that has responsibility for the National Institutes of Health budget included the following paragraph in the report that accompanied a 1983 appropriations bill.

> *DRR [Division of Research Resources] has taken the lead in planning the development of a new activity in 1983 entitled Biomedical Research Model Development. This activity will ascertain whether there are alternatives to the use of laboratory animals which can result in more reliable, economical, and efficient models to be used in biomedical research. In 1983, this activity will consist of initiating planning efforts through workshops and conferences aimed at understanding the problems, and identifying areas of research most likely to benefit from the development of models and the areas of technology most likely to yield usable research models. The Committee welcomes this effort to find alterna-*

tives to the use of laboratory animals for research. A report on the results of this effort should be made to the Committee at next year's hearings. If a program design is proposed, it should include estimates of total funding required, how such funds would be administered, the criteria for allocating funds, and the amounts recommended for fiscal year 1984.

This prose is very likely to encourage the Division of Research Resources to continue with its current Biomedical Research Model Development program and to seek additional funding support for alternatives.

Laboratory Animal Numbers

The number of animals used each year in research and testing in Great Britain continues to decline — the 1981 figure of 4.344 million animal experiments represents the lowest figure since 1963 (see Figure 1). The number of experiments involving distressing stimuli (*e.g.*, for inducing psychological stress) such as inoculations into the eye, infliction of physical trauma, or interference with the central nervous system has fallen steadily, from 568,000 in 1977 to 386,000 in 1981 (*Statistics of Experiments on Living Animals,* Home Office, 1982).

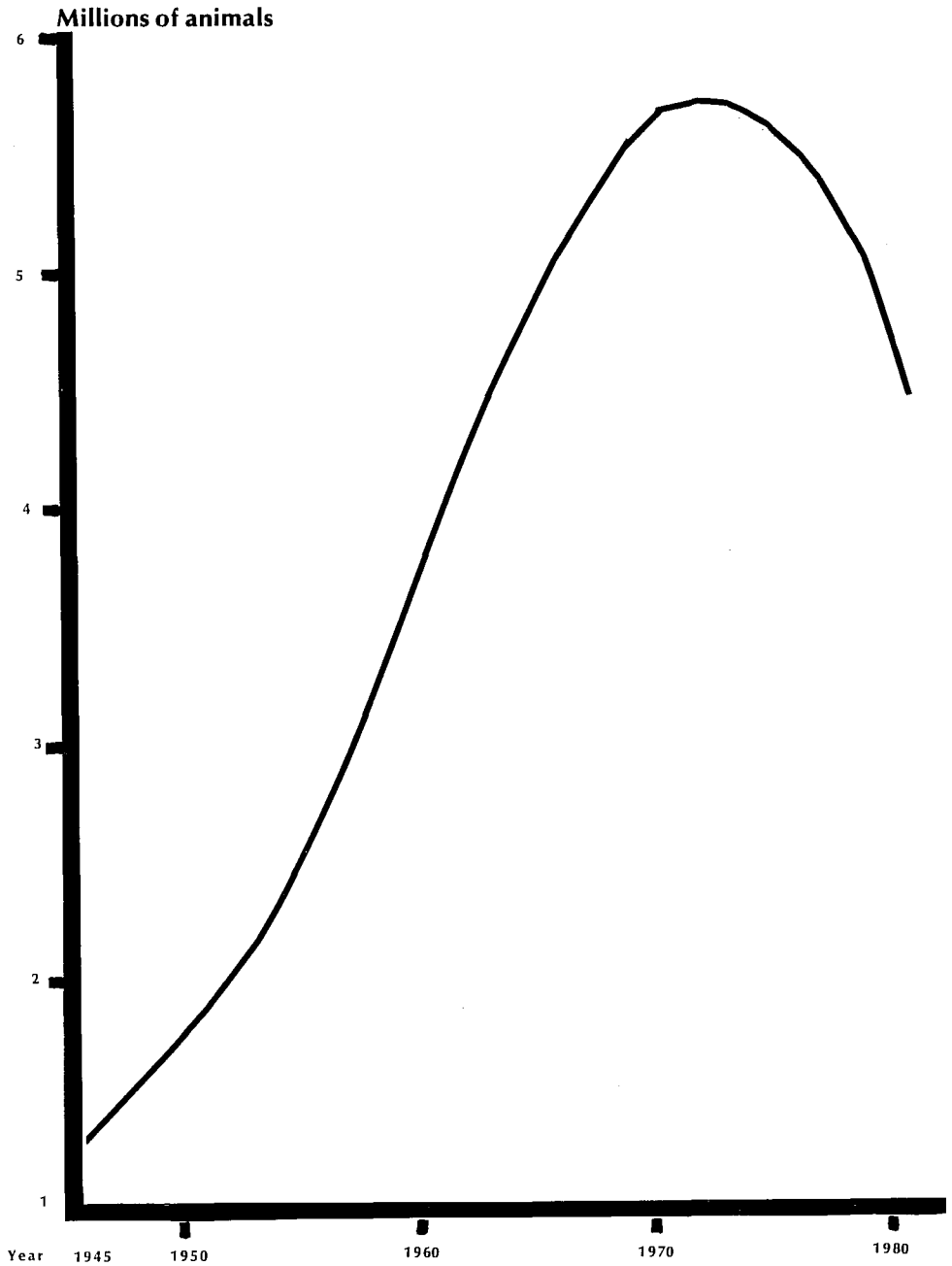
In the United States, there is considerable disagreement over the number of laboratory animals used each year. This is due to an apparent discrepancy in the published results of a survey undertaken by the Institute for Laboratory Animal Resources, which reported that 20 million laboratory animals were used in 1978 in the United States (*National Survey of Laboratory Animal Facilities and Resources,* National Institutes of Health, 1980). Seventy-two percent of the questionnaires on lab animal use sent out by ILAR were returned, and so these figures have come to be widely accepted. Nevertheless, all other available evidence indicates that the total number of laboratory animals used (that is, warm-blooded vertebrates) is at least at the 60 million mark, and may possibly be even higher. This evidence includes the following:

- In 1965, W.B. Saunders and Company analyzed NIH use of laboratory animals in conjunction with data on sales by commercial breeders. They reported that 60 million rodents and rabbits were used; it was projected that future use would rise to 97 million (*Inform Lab Anim Res* 9(3):10, 1966).
- In 1978, the National Cancer Institute, which accounts for approximately 12 percent of all biomedical research expenditures, used 6.5 million rodents. By extrapolatation, it would seem that national use approximated 55 million laboratory rodents (*1980 NCI Appropriations Hearings,* part 4, p. 486).
- In 1981, Alex Brown and Sons analyzed the financial prospects for Charles River stock. They reported that Charles River produces approximately 16 million rodents annually in the United States and controls 20 percent of the domestic market. Assuming that Charles River sells 4 million of its American-produced animals outside the United States, we can conclude that the American market involves the sale of 60 million laboratory rodents every year. Corroborating data is provided by the fact that Jackson Laboratories in Maine sells approximately 2 million rodents annually and has 3 percent of the American market.

Therefore, on the basis of this evidence, it would appear that at least 60 million laboratory rodents are used annually. Other laboratory vertebrates that would contribute substantially to the total numbers of animals consumed include rabbits, birds, frogs, and fish.

The reason for the very large discrepancy between the estimated figure above and the results from the ILAR survey is unknown. However, it is intriguing to note that the 72 percent return of ILAR surveys only accounted for $570 million of all NIH-supported animal research. This is probably 50 percent — or less — of all the NIH-supported animal research for 1978 (*Int J Stud Anim Prob* 3:191-192).

FIGURE 1



Comments

Vivisection and Misanthropy

George P. Cave

Part of the aftermath of the Edward Taub monkey case has been a spate of articles accusing the antivivisection movement of misanthropy. The latest example is Walter Goodman's essay, "Of Mice, Monkeys and Men" (*Newsweek,* August 9, 1982). While drawing essentially the same conclusion as his predecessors, Goodman opts for a milder version of the charge. Unlike William Raspberry ("Saving Monkeys, Ignoring People," *Washington Post,* October 14, 1981), who believes that antivivisectionists care *more* about animals than people, and Timothy Noah ("Monkey Business," *The New Republic,* June 2, 1982), who believes that they don't care about people *at all,* Goodman thinks they care about them more or less *equally,* and this, in his view, is "inhuman." He rounds off his essay with the statement:

> *Proscribing experiments on animals may mean prescribing them for people. But, then, carrying humane impulses to an inhuman end is one of the talents that distinguishes us from other species.*

To arrive at this conclusion, Goodman has even taken the trouble to go directly to a text which is widely regarded, within the animal rights movement, as one of the primary sources of animal rights ideology — Peter Singer's *Animal Liberation.*

Goodman recognizes that it is reasonable to question whether all experiments performed on animals really contribute to human welfare, and he even concedes that the use of animals in laboratories "could no doubt be reduced further without harm to humankind." On the other hand, it is quite clear that he is completely unaware of the sheer quantity of absolutely worthless experiments currently being conducted, and that he subscribes to the popular misconception, deliberately perpetrated by the research establishment, that animal experimentation is coextensive with biomedical research, thereby contributing directly to human welfare through the conquering of disease. Furthermore, Goodman seems to be largely ignorant of the extent to which nonanimal alternatives are *already* available to the researcher, a fact that those with a vested economic interest in perpetuating animal experimentation naturally play down.

Goodman is also aware that resolving the debate as to whether animal experimentation really benefits humans is not the end of the matter, ethically speaking. Unlike most critics of the antivivisection movement, who content themselves with the dogmatic assertion that experimentation helps humans and therefore (by traditional homocentric valuations), is *necessary,* he is at least willing to entertain the question as to whether "the prospective benefit to humans is sufficient justification." He is unsatisfied, however, with what he takes to be the antivisection movement's answer to this question, namely, that an experiment is not justified unless it is done "for the benefit of the animal involved." Goodman assumes that this statement, made by William A. Cave, President of the American Anti-Vivisection Society, summarizes the unanimous opinion of

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the entire antivivisection movement. In point of fact, things are not that simple: there is considerable divergence of opinion within the antivivisection movement as to what experiments, if any, are justifiable. Not all antivivisectionists would agree with William A. Cave's position.

It is clear, however, that Goodman's rejection of this position rests on a fundamental misunderstanding of Peter Singer's argument. In *Animal Liberation,* Singer does *not* claim that human and nonhuman animals are equal, in the sense that they are morally entitled, in all cases, to *identical* treatment, nor that their lives are of equal value. What he claims is that they are entitled to *equal consideration of their interests.* Where there are relevant differences between humans and animals, different treatment is justified. A difference is relevant only if, by virtue of that difference, the animal will suffer no evil, or at least less evil, if treated differently. For example, a relevant difference between sheep and humans with respect to the question of voting is that sheep lack the capacity to understand the significance of voting, and hence suffer no evil if denied the right to vote. In this case unequal treatment is morally justified.

With respect to the question of physical, and in many cases, psychological pain, however, there are no relevant differences between humans and the vast majority of nonhuman animals. Pain is pain no matter who suffers it. To treat an animal differently in this respect simply because it is not human is speciesism, a form of prejudice that is precisely parallel to racism and sexism. Goodman thinks this parallel is insulting to blacks and women because he mistakenly attributes to Singer the view that all animals' lives are of equal value, something which Singer explicitly denies. Goodman states:

> *In thus equating animals with people, Singer exemplifies an ambiguous attitude toward human welfare that imbues much of the anti-experiment campaign.*

The question as to whether human life is of greater value than animal life is, however, here completely irrelevant. A chimpanzee does not suffer any less intensely from electric shock than a woman because his life has less value. Hence, if it is wrong to inflict pain on human beings to relieve greater suffering of other human beings, then it must be equally wrong to inflict it on nonhuman animals who are just as capable of suffering. There is no rational reason for regarding a human's physical pain as inherently worse than a chimpanzee's.

In cases where the experiment would result in the death of the subject, however, the value of the life *is* a relevant consideration. If one were forced to choose between experimenting on a chimpanzee or on a normal human being, the morally appropriate choice would be the chimpanzee, since the human life in this instance is presumably of greater value. We are not, however, forced to experiment on *anyone,* and this example only shows that in the case of terminal experiments it would usually be *less* wrong to experiment on chimpanzees. This does *not* mean that such experiments are ethically defensible. It is in order to make this argument clear that Singer cites the case of the retarded infant orphan. But no matter what standards one uses, it is obvious that the life of a healthy chimpanzee must be granted a greater value than the life of a human who is a hopelessly retarded infant orphan. In such a case, there can be no moral justification for choosing the chimpanzee over the orphan to serve in the experiment. If one does so, it can only be because of the orphan's membership in the species Homo sapiens — a morally irrelevant consideration. If, on the other hand, one is for some reason

unwilling to sacrifice the infant's life for the benefit of humanity, then one should be equally unwilling to do so with the chimpanzee.

In short, one may well agree with Goodman that there are significant "critical differences of mind or soul" between (normal) humans and other animals, without concluding that infliction of pain or death on these animals is justified for human benefit. The basis for William A. Cave's conclusions — that experiments on animals are justified only if they benefit the animals themselves — is not that human and animal life are identical in value, but that it is morally wrong to sacrifice the interests of the inferior for the interests of the superior. "Proscribing experiments on animals" does *not* mean "prescribing them for people," as Goodman asserts. It means doing without them. This is not misanthropy; this is *justice*.

Thoughtful Use of Animals

Hyram Kitchen

Introduction

As part of a symposium held in Cincinnati entitled, "Ethical Issues Related to the Use of Research Animals," I was asked by the program director to consider whether further legislation regarding the use of animals might be necessary to ensure more thoughtful use of animals at universities. The following is my response.

Change in Attitudes

Since I was a student, there have been enormous changes in attitude toward the way we use animals in biomedical research. It would be desirable to be able to attribute these changes to an increase in our sensitivity to humane values, and recognition of our responsibility to provide humane care. Although these considerations may have been the principal motivating factor for many people, much of the recent progress must be attributed to the passage of the Animal Welfare Act and its amendments. Legal responsibilities seem to have fostered moral awareness, and many constructive changes have followed. I have no proof — only a feeling — that concern for animal welfare peaked during the campus turmoils of the late 1960's and early 1970's when, at least superficially, our entire nation felt a resurgence of social conscience. Social causes were popular and it was considered very appropriate to speak out about them. While the amount of rhetoric may have declined in the last few years, I believe that there is still a broad-based and sincere interest in humane concerns. I also feel that constant monitoring and stimulation of our humane sensitivity is desirable. As a second critical factor, inflation has forced us to recognize the cost of using animals in experiments and teaching programs. Ever-increasing costs have stimulated greater scrutiny of live-animal experiments and of their role in experimental design. As a consequence of these changes, greatly improved animal care facilities and programs are a reality in most institutions. I believe that, when applied, present legislation coupled with the guidelines from NIH and ILAR is completely adequate to ensure proper usage of animals in live experiments. I further believe that future improvements must depend on changing the attitudes of individual investigators through education, and not on new legislation or spending more money.

Due, in part, to the Animal Welfare Act of 1966 and its amendment in 1977, federal, state, and private funds have been used to improve physical facilities for animal care at most of our institutions. The recognition of the need for adequate veterinary care, trained supervision, well-paid and informed animal caretakers, improved caging and management, and the sincere concern of administrators have all resulted in a dramatic improvement in the quality of animal care and physical plants. Animal health has improved as a result of better care and, most important, there has been a conscious effort to procure from breeding facilities animals that are sound and free of many diseases. In addition, there are

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new backup services on many campuses, such as diagnostic services and disease surveillance. However, animal facilities still differ among each other, and there is always room for improvement. Two areas with notable deficiencies are (1) transportation of animals, which has shown some improvement, and (2) the use of animals by investigators, which is completely dependent on the ethics and professionalism of the specific investigator.

Legislation has been used to stimulate institutions to improve their quality of animal care, but there is no way to formulate legislation to coerce changes in attitudes among individual investigators. Attitudes can only be altered through education. The important areas of animal use where differences in attitude are likely to occur are those aspects, such as experimental design, that are controlled by the investigators and teachers. These professionals provide the role models for students to follow, and their attitudes often are unconsciously adopted by these students who, in turn, later implement them in their own research or teaching. The question then bcomes, "Who will teach the teachers?," and the answer may be: ourselves. Education can bring about changes in attitude where legislation cannot.

Responsibility Through Education

Most informed persons believe that the humane use of lower animals to increase our knowledge in the life sciences and to achieve practical advancements in medicine, agriculture, animal husbandry, and the development of drugs is ethical. However, to quote Dr. Bob Hummer, "This same segment of the human population would raise some questions about the ethics of the scientific community if it were aware of the inadequate orientations afforded many of the new and young investigators in the proper care, handling and utilization of experimental animals." Of course, his statements are general, and they are especially directed toward the prevention and alleviation of pain before and after specific kinds of surgical or stress situations. But the implication of Dr. Hummer's statement is clear: there is a lack of educational guidance at the institutions that train young people to work in the life sciences. The passage of additional laws cannot provide us with the positive assurance that every experimental animal will receive compassion, concern, or even thoughtful care during experimental procedures.

I believe that in most cases, the lack of adequate care, the use of inhumane procedures, or simple callousness is a result of the investigator's ignorance or indifference, which is in turn caused by a lack of training in the broad area of animal care and surgical techniques. This lack of training may result from time demands in the curriculum, instead of any conscious setting of goals. For example, students, as they strive to absorb a large body of facts in a given time period, may find that they must devote themselves to one specific area in order to achieve mastery in their chosen discipline. This mastery is necessary for them to compete in a scientific world and, as a result, little time is allotted to training in the use of animals. Unfortunately, knowledge about using experimental animals is somewhat akin to knowledge about electronic instruments: students acquire it largely on their own. Another excuse for the relative dearth of training has been the inability — or the unwillingness — of people who do have the know-how to transmit their skills to individuals in other disciplines. I would further suggest that many curricula do not provide the channels for people who have the requisite know-how to transmit their knowledge.

The education of graduate students, in particular, has several shortcomings in regard to instruction in the use of animals. These inadequacies in graduate education can be corrected, and are being corrected; I believe this effort will result in important advancements in the quality of care afforded to the individual animal. We must convey to the student and to our colleagues our recognition that in the past animals have contributed enormously to human welfare, and that their use is a privilege, not a right. A thorough grounding in their proper treatment must be considered as a crucial prerequisite to gaining that privilege. In addition, researchers must be made aware that they need to be observant of the animals themselves and the setting in which they are held while under study; they must also give careful thought to the "why" of their experimental design and the role of animals in it. We must demonstrate that there are scientific as well as humanistic reasons for this concern. The scientific aspects deserve time in each graduate student's curriculum, because they constitute an integral part of the comprehensive knowledge that he or she must obtain in his or her discipline. No chemist would ever buy his sodium chloride from the grocery store; the chemist demands "reagent grade," and the animal component of biomedical research deserves equally sophisticated consideration.

Courses in the selection of animals, basic elements of animal care and husbandry, and experimental animal techniques should be a part of all graduate programs in biology in every institution. Many examples of this type of program are already available at medical schools; however, courses in this area are not always available at other colleges. In addition to formal courses, consultative services in animal use should be available to all investigators. Every graduate school or professional school should also expand the scope of its human subjects and animal care committees to develop a well-qualified animal concerns and usage committee, with the specific charges listed in Table 1.

Educational Resources

Many people believe that, in our western civilization, early religious training has a profound influence on the formation of our attitudes toward animals. The Christian doctrine, which proclaims the dominion of man over animals, can of course be interpreted in many ways. While most scholars hold that the concept of dominion does not release us from moral responsibility toward other creatures, our early attitudes may be influenced by our own personal interpretation of the word "dominion." Many people have unconsciously interpreted "dominion" to mean an absolute right to use animals, without concern for their lives or suffering.

Early education can also influence later behavior and attitudes. Positive educational experiences can be provided in early school years, by such means as the Ralston Purina Company filmstrip on responsible pet care, designed specifically for use in grades 3-6. Many similar audiovisual aids such as the movie, "The Animals Are Crying," are available through humane societies. Secondary school biology projects and science fairs, however, have not always contributed to the thoughtful use of animals, nor have they reinforced concern for animal welfare. Although I am aware that significant changes have been made in guidelines for use of animals by educational institutions at all levels, many projects using animals still do not receive proper supervision and guidance. This often results in thoughtless, repetitive, and inhumane treatment to animals, in the

TABLE 1 Animal Concerns and Usage Committee Charges

1. To encourage propriety and sound judgment in the assignment of animal resources in teaching and research programs.
2. To ensure appropriate use of animals as teaching and research resources.
3. To recommend alternatives to animal use, where feasible.
4. To continually monitor animal use and recommend policies that will ensure humane care and concern by faculty, staff, and students. This committee could coordinate and ensure the development of laboratory and experimental animal courses for graduate training as previously identified.

name of science. In contrast, there are the animal care programs conducted by groups such as 4H and the Boy Scouts, which can serve to build up a sense of responsibility and understanding in the student.

Recognition of the need to improve methods of animal use and care through educational endeavors has been provided by numerous organizations. Examples of these kinds of programs have been provided by the American Association of Laboratory Animal Science (AALAS), American College of Laboratory Animal Medicine (ACLAM), and the American Association for the Accreditation of Laboratory Animal Care (AAALAC), humane societies, and medical societies. *Standards for Accreditation for Laboratory Animal Facilities,* set by AAALAC, the *Guide for Care and Use of Laboratory Animals,* prepared by the Institute of Laboratory Animal Resources, National Research Council, and supported by the Animal Resources Program Division of Research Resources, NIH, are further examples of positive efforts. These organizations directly influence the educational programs that provide the stimuli for improvement of the ways in which experimental animals are used.

Scientific publications serve to disperse information among the scientific community, but can also serve to directly influence animal experimentation, through the wording of their guidelines for acceptance of papers. Thus, they can become one part of the educational process entailed in disseminating high standards for animal usage. Editors, referees, and staff should ensure that all contributors are made aware that a review of every paper will include a close scrutiny of adherence to the guidelines for the care of laboratory animals, while the experimental design will be examined as to the number and appropriateness of animals used. Refusal to publish results of experiments that are judged to have violated the guidelines or in which animal suffering is obvious can have a profound effect on investigators. Granting institutions are also in an excellent position to give similar instructions to applicants, through evaluations by peer review.

Another area of education that concerns all of us is communication between scientific investigators and individuals in the humane movement: each group must consider the concerns of the other. Some common misunderstandings between the two groups can be identified (Table 2). On the other hand, antivivisectionists tend to stereotype scientists with features such as those in Table 3. Most informed scientists and animal-oriented people have views that fall somewhere in between. Each side needs the other's involvement in its programs to gain new insights and an appreciation of

TABLE 2 Common Over-reactions

1. All anti-vivisectionists believe that it is unethical for humans to sacrifice lower animal life for the purposes of biomedical research.
2. The final goal of most anti-vivisectionists is the abolishment of animal research.
3. Anti-vivisectionists have no scientific understanding or insight into biomedical experiments.
4. Anti-vivisectionists are impractical and uncompromising in their demands.
5. Most anti-vivisectionists represent only the affluent class.
6. There is a bias in favor of the animals' interests over those of humans.
7. There is a distrust or fear of science and scientists.

TABLE 3 Anti-vivisectionists Stereotype the Scientist with the Following Features

1. That many or all of the experiments performed are useless.
2. That they cause unnecessary or unjustified pain.
3. That, in many cases, more animal life is sacrificed than would be necessary to achieve a stipulated result.
4. That many scientists are inhumane persons, so that society cannot rely upon the general anti-cruelty laws to control their sadistic behavior; additional legislation is necessary.

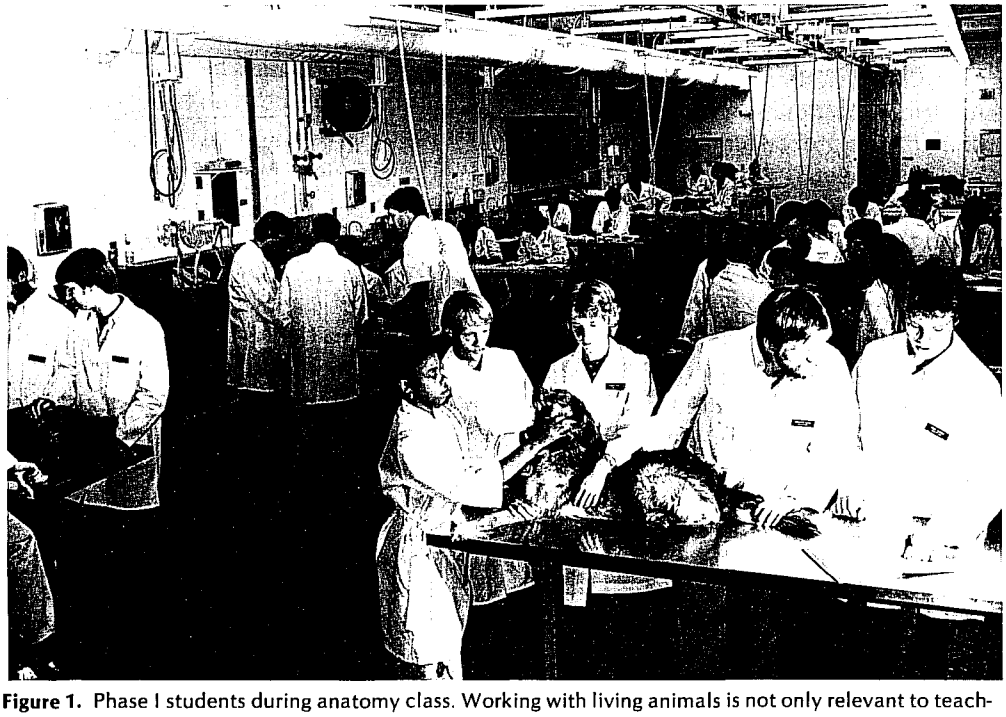

Figure 1. Phase I students during anatomy class. Working with living animals is not only relevant to teaching in clinical medicine, but also instills concern for animals and promotes proper handling and care.

the total problem. Mr. Roger Caras, in his keynote speech at the meeting of The Humane Society of the United States, San Diego, California, October 1977, remarked on the lack of trust between colleges of veterinary medicine and humane societies on the issue of the ethical use of animals, and that both groups should try to formulate a sensible approach, since all share a common goal. He suggested, for example, that the humane societies should become involved in selecting course content. In other words, they should become a part of the educational process so that veterinary students will come out of school "not thinking of us [the humane movement] as an enemy, but rather as an ally."

At the present time, this kind of involvement is operating in the other direction. Many humane societies, animal control groups, etc., include veterinarians, physicians, and other professionals in their efforts to better the understanding of people and animals. To quote another statement by Mr. Caras, "Many educators in this country still think of the humane movement as singularly and universally anti-vivisectionist, impractical, opposed to all aspects of wildlife management, and hostile to all biologists, doctors, and other scientists. They think of us as immovable. They are afraid to be associated with us."

The most forward step that could be made in the educational process is the stimulation of the type of communication that will allow all of us to appreciate that we do have a common goal, that of ensuring the health of all creatures by relieving suffering, pain, and fear. To cite one example, finding solutions to the skyrocketing overpopulation of unwanted pets is one problem shared by all of us. We also need to work together to provide educational programs for training science fair participants (both students and teachers), animal control personnel, and other community projects related to animal care. Another element in this sort of dialogue is informing the public about how scientific knowledge is developed and the gains that can be reasonably expected from science. It is particularly important that the public realize that the value of experiments cannot always be estimated before they are performed.

Veterinary Medical Education

Education in the respect for all animals starts with early influences, and never ends. Individual ethical values are largely determined by family influences and early childhood experiences which are, in turn, dependent upon cultural and religious forces. Professional development and the acquisition of moral values from educational experiences at professional schools are built on these early foundations. In reference to professional ethics, it has been generally presumed that the professionals themselves are in the best position to make such judgments and ascertain that members fulfill their obligations to the profession. However, given the complexity of today's knowledge, the need for specialized educational resources is clearly evident. I believe that we have an additional obligation relative to the humane education of those investigators who use animals. Through the generous contribution of the Merck, Sharp, and Dohme Company, the College of Veterinary Medicine, University of Tennessee, has such a program.

There are strong arguments for using animals in a veterinary teaching program, and I believe that their continued use is necessary (Fig. 1). Perhaps it would be best to start by citing some of the accusations that have been made about the misuse of animals in teaching programs in the past. First, students were sometimes exposed to animals before they had gained a thorough understanding of

pain, before their training in anesthesiology, and most certainly before any discussion of humane treatment. Second, little attention was given to proper surgical technique or the application of aseptic technique as part of the training in pharmacology, physiology, or the other preclinical sciences. Third, experiments were often too complex or lengthy for beginning students to accomplish. Fourth, when no one was concerned about whether the experimental animal lived or died, or was used for multiple procedures, a lack of humane consideration often ensued. Finally, there was little emphasis on instruction and training in postoperative care in the initial phases of the veterinary medical curriculum. In addition, some aspects of the misuse of animals can be attributed to overly sympathetic or overly calloused attitudes on the part of students.

Obviously, all these deficiencies cannot be blamed on any one college, but we have all participated to one degree or another in contributing to these sorts of misuse of animal resources. Every school must address the problem of how to correct its own problems. This means that curricula should be designed to include early exposure to the principles necessary for proper use of laboratory animals. Clinicians need to be involved at this early stage, in a manner that is consistent with the objectives of the chosen instructional model. Discussion of humane treatment and veterinarians' responsibility to animals, how the school purchases teaching animals, regulations for their control, and inventory and reporting procedures should be part of the first phase of the curriculum. Understanding of pain, and of its detection and recognition, should be included as early as possible in physiology classes. In addition, individual commitment by faculty members is an important element, as is the development of a faculty committee on animal usage. A thorough grounding in postoperative care should also be one of the instructional objectives. Further, strict adherence to accepted surgical procedures and techniques of postoperative care must be demanded by instructors.

The ingredients of thoughtful and appropriate use of animals in an educational setting include: (1) a soundly designed curriculum, (2) numerous discussions on the thoughtful use of animals and the responsibilities that this goal entails in appropriate courses; (3) good examples set by faculty and staff; and (4) establishment of particular faculty responsibilities by a committee on animal usage and concern. It is important that the curriculum design include a sequencing of courses, such that physiology, pharmacology, and the basic principles of anesthesiology can be taught at the earliest possible time. A course on the principles of anesthesia and analgesics prior to their use in animal procedures in which pain may be involved is a must, as is the insistence that the techniques of aseptic surgery be taught before all laboratory exercises in physiology, pharmacology, etc., that involve surgical procedures (Fig. 2). The inclusion of live animals in the initial phase of the curriculum is a must, for example, a functional anatomy section on palpation of muscle groups, skeletal processes, etc.

Other principles that should be followed include the elimination of any use of animals, in experimentation and teaching, that results in pain for which no anesthetic is given. Also, emphasis should be placed on comparative medicine, by using a variety of appropriate species to introduce students to the diversity that can be expected in veterinary medicine, instead of depending entirely on dogs and cats (Fig. 3). The appropriate use of demonstrations by devices such as videotapes to reduce the

Figure 2. Phase I students in surgery lab, second quarter. The principles of surgery must be taught at the earliest practical point in the curriculum.

number of animals needed is an obvious consideration in curriculum design. Students should be taught to think of all teaching animals as potential patients, to ensure that the principles of exemplary care and a humane approach are part of all teaching activities of the curriculum. Students also need a full explanation of the legal and moral responsibilities that bear upon animal use early in the curriculum, as well as a consideration of some of the emotional issues involved.

Recently, there has been considerable discussion on the use of animals in teaching surgery. I believe that tissue repair requires an appreciation for the actual sensation of working with tissue and the relationship among organs, as well as practice in the art of stabilizing incisions. Much of this can only be learned by experience. In teaching these techniques, however, multiple-survival surgical procedures should not be used. It is my opinion that the appropriate use of survival surgery instills an understanding of the elements of good pre- and postoperative care; without this training, callousness to animal life may develop. Also, survival surgery can help students learn other aspects of pre- and postoperative care, including how to process specimens for clinical pathology and other support procedures that will be required in veterinary practice (Fig. 4).

The program at the College of Veterinary Medicine, University of Tennessee is based on the premise that the education of future veterinarians, most of whom will devote their careers to animal-related problems, requires the development of concern and responsibility toward all animals. Let me close by noting that I have not used the phrase "animal rights" in this article. Personally, I believe that the thoughtful and humane use of animals in research, teaching, pro-

Figure 3. The use of a wide range of species during teaching is important.

Figure 4. Students giving preoperative care to their teaching dog. Students must be responsible for both pre- and postoperative care of animals.

duction, or other aspects of this society goes beyond the basic concept of rights. Rather, I feel that we have a moral responsibility toward animals, and that I have made a substantial commitment to this responsibility.

The principles of proper animal use in colleges of veterinary medicine cannot guarantee humane treatment in biomedical research. However, by setting a good example, our professionals can continue to contribute to improvement for the future, through education.

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Original/Review Articles

Abundance and Distribution of Large Mammals in the Upper Ogun Game Reserve, Oyo State, Nigeria

T.A. Afolayan, K.R.N. Milligan, and S.O. Salami

In this study, three indirect methods (counts of animal droppings, footprints, and tracks) were used as indices to estimate the abundance and distribution of large mammals in the Upper Ogun Game Reserve, which is located in a typical Southern Guinea savanna zone of Nigeria. Thirteen animal species were recorded; kob, bushbuck, hartebeest, roan antelope and duicker were the most abundant. The distribution of large mammals appears to be controlled by several factors: accessibility to the River Ogun (the main source of water in the reserve), availability of food and cover, and the extent of illegal hunting.

An analysis of questionnaires distributed to various people living in villages around the reserve revealed that these people depend heavily on bushmeat for their animal protein requirements. They also use other wildlife products to meet their economic, social, and cultural needs. It is recommended that adequate protection should be accorded to the game reserve for at least 5 years. After that time, the area could be opened up to tourism, and controlled hunting could be permitted in the buffer zone around the reserve.

Zusammenfassung

In dieser Studie wurden drei indirekte Anzeichen (Vorkommnis von Losung, Tierspuren und Wechsel) dafür verwendet, um die Zahl und Verbreitung von grossen Säugetieren im Oberen Ogun Wildreservat, welches in einer für Süd-Guinea charakteristischen Savannen-Zone liegt, abzuschätzen.

Dreizehn Tierarten wurden festgestellt, unter ihnen Kamas, rötlichgraue Antilopen, Wasserböcke, etc. Die Verbreitung der grossen Säugetiere scheint durch folgende Faktoren bestimmt: Zugänglichkeit zum Ogun Fluss (der bedeutendste Wasserlauf im Reservat), Vorhandensein von Nahrung und Deckung und das Ausmass illegaler Jagd.

Eine Analyse der Fragebögen, die an die Einwohner verschiedener Dörfer in der Umgebung des Reservats verteilt wurden, vermittelte die Information, dass diese Menschen hauptsächlich von Fleisch aus dem Busch für ihren Tierprotein-Bedarf abhängen. Sie verwenden auch andere Tierprodukte, um ihre wirtschaftlichen, sozialen

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und kulturellen Bedürfnisse zu decken. Es wird empfohlen, dem Wildtierreservat für mindestens fünf Jahre ausreichend Schutz zu gewähren. Nach dieser Periode könnte diese Gegend wieder dem Tourismus freigegeben und eine kontrollierte Jagd in der Pufferzone um das Reservat gestattet werden.

Introduction

There is a paucity of information on the abundance and distribution of large mammals in Nigerian wildlife reserves (*i.e.,* the National Park and other game reserves), and much of the data that are available were obtained mainly from mere guesses made by casual observers and visitors. Apart from Kainji Lake National Park, where some careful research work has been carried out, the available information for other reserves is inadequate, unreliable, and insufficiently scientific for efficient management of a game reserve. Even in Kainji Lake National Park, where some general population studies have been carried out (Child, 1974; Pelink, 1974; Milligan, 1979), no study has been conducted on the individual large-mammal species. Similarly, work in the Yankari Game Reserve in the northeastern area of Nigeria performed by Sykes (pers. comm.) and Geerling (1973) is not sufficiently comprehensive for developing a reliable management plan for that reserve.

Generally, very little is known about the wildlife populations of the 60 Nigerian wildlife reserves, which include the Upper Ogun Game Reserve, the most important game reserve in the Oyo state of Nigeria. We therefore decided to investigate the abundance and distribution of animal populations in this reserve. A second reason for our selection of the Upper Ogun was its importance to the people living in the villages that surround the reserve. Bushmeat (*i.e.,* the flesh of wild animals) from this game reserve and from the surrounding forest reserves contributes immensely to the socioeconomic and cultural life of the people. There is a high demand for bushmeat in this area as a source of dietary protein, and it also plays a major role in traditional medicine.

The game reserve has suffered from indiscriminate hunting for a long time—most of the more valuable species are approaching extinction and are hard to find. In summary, then, the main objectives of this study were to provide reliable information on the abundance and distribution of large mammals in the reserve and to investigate the impact of illegal hunting by the local communities on the wildlife populations in the area. It is hoped that this information will be useful in the formulation of a long-term management plan for the game reserve.

Study Area

Upper Ogun Game Reserve (Fig. 1) with a total area of 1,100 sq km, is situated in the northwestern region of Oyo state, between latitudes 3½ and 4½°E and longitudes 8½ and 9°N. The mean annual rainfall in the reserve is about 1,250 mm with a 5-month dry season (November to March). The mean minimum and maximum daily temperatures are about 20 and 34°C, respectively. The terrain is gently sloping, with some rocky hills and inselbergs located on the southeastern section, along the boundary of the reserve.

The main drainage system in the reserve is the River Ogun. It runs from north to south and flows through the whole length of the reserve. In addition, several other streams can be found east of the River Ogun. The soils are derived from undifferentiated basement complex materials. These soils are generally sandy and are classified as feruginous tropical soils on crystalline acid rocks.

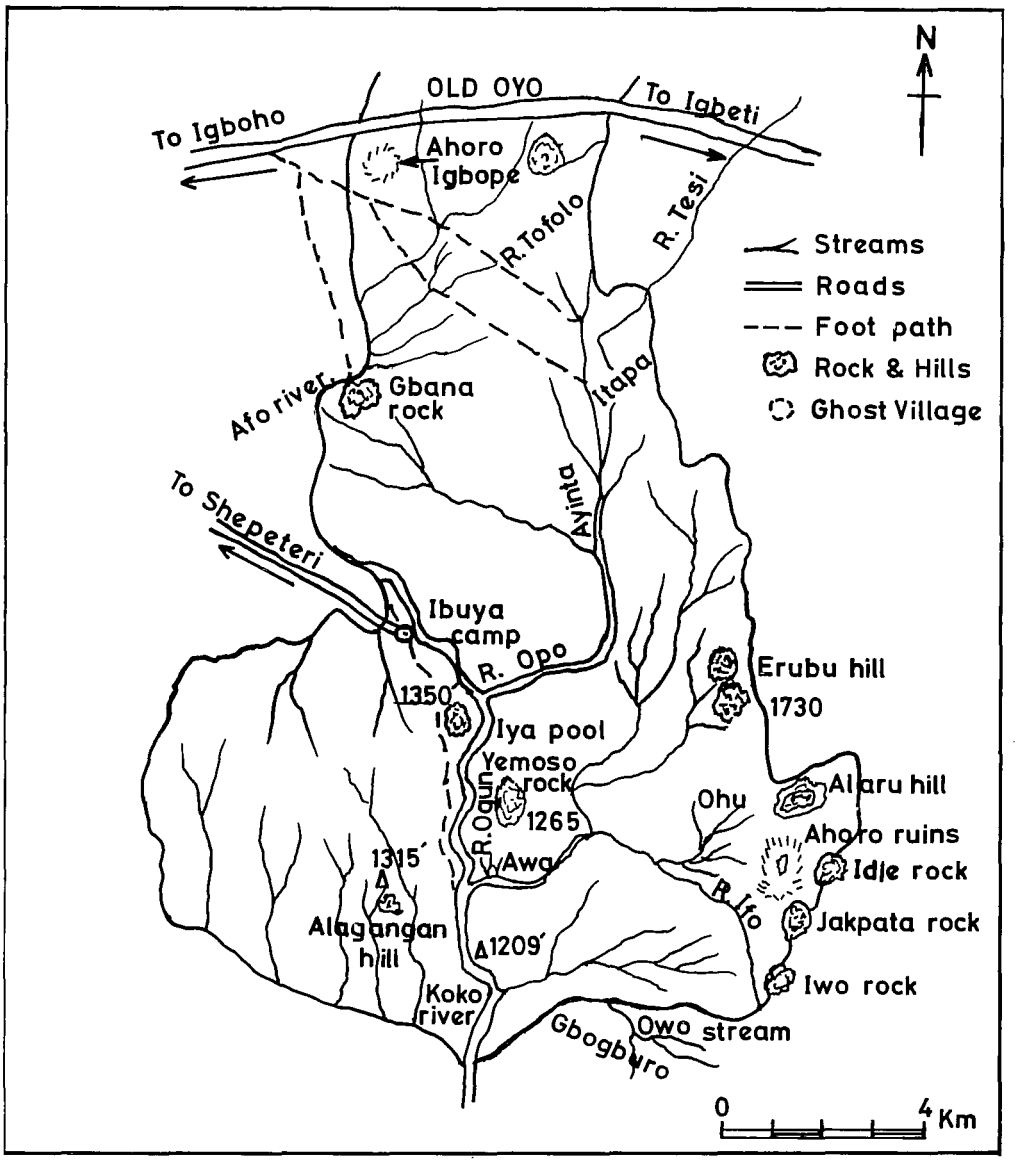

FIGURE 1 Physical features of Upper Ogun Game Reserve

The reserve is situated at the northern boundary of the forest-savanna mosaic. It lies in typical Southern Guinea savanna woodland, with fairly dense woodland and forest outliers found in the southern region (Geerling, 1973). In his analysis of vegetation, Geerling was able to identify the following principal vegetation types:

1. Dense woodland and forest outliers
2. Mixed open savanna woodland; *Terminalia macroptera* savanna
3. Ironstone and outcrop vegetation
4. Riparian grassland and fringing woodland, occupying the flood plains and the areas along the River Ogun, respectively.

Method

It was impossible to estimate the animal populations in the study area by direct methods because of poor visibility in the dense woodlands. We therefore resorted to indirect sampling techniques, which involved counting fecal droppings, animal tracks, and footprints. Similar indirect sampling methods have been used by Wing and Buss (1970) in Uganda and by Afolayan (1975) in the Kilimanjaro forest reserve in Tanzania to estimate elephant populations.

The most significant limitation in the use of these sorts of population indices is that they can only serve to indicate population trends over time and space and do not necessarily represent true head counts for the particular area under investigation. However, these methods were used in this study because they provided the only available means of obtaining information on animal activities and abundance in the study area. Only the animal species shown in Table 1 were included in this study.

The field study was carried out in the dry season of 1979. Ten transects were randomly selected, with a 100 X 20 m plot marked off along each transect. Indices of animal activities such as fecal droppings, trails, and tracks were observed on each of the plots. Information on types of vegetation and weather conditions at the time of observation were also recorded. After the droppings were counted for the first time, they were marked with wooden pegs and left for observation on a second occasion, to determine the nature and speed of decomposition over time.

Mathematical formulations were constructed for estimating populations from these data: Let d_i be the number of droppings accumulated in each plot for each species in the interval between the first and second observations (after decomposition). The mean for the whole sample is $\bar{d}_i$, and the estimated total number of droppings accumulated for the species, for the whole study area, $\hat{D}$ may be given by:

$$\hat{D}_i = N\bar{d}_i \quad (1)$$

$$\text{Where } N = \frac{\text{Area of the study area}}{\text{Area of plot}}$$

The population of each species P_i may be estimated using the formula

$$P_i = \frac{D_i}{R \times T_i} \quad (2)$$

where D_i is equal to its estimate $\hat{D}_i$ as above, R_i is the defecation rate per day of species i, and T_i is the number of days that elapsed between the first and second observations.

In the second part of the study, questionnaires were administered to determine the frequency of hunting activities, the value of the various wildlife species in terms of meat and medicinal uses, and the extent of protection afforded to the animals. A total of 150 of these questionnaires were distributed to hunters, market women, community leaders, and elders who resided in villages around the game reserve. The villages include Aha, Shepeteri, Agunrege, Ago-Amodu, and Ago-Omu.

Market prices for various kinds of bushmeat, trophies, and skins and bones were obtained from a sample of market women and hunters. Experienced hunters, patrolmen, elders, and community leaders were interviewed on the medicinal uses of wildlife. Data on the number of offenses and arrests, and information on compoundings and fines, was collected from the Game Management Headquarters of Oyo state.

Results

Table 1 lists the 13 species of large mammals studied in the reserve and the indices of their abundance, calculated from counts of droppings, tracks, and foot-

TABLE 1. Density of Animals (Number/Square Kilometer) in the Upper Ogun Game Reserve

Count	Pellet Group	Trail	Footprint	Average Density	Confidence Limits*
Kob	25.08	11.87	18.04	18.33	±6.60
Cane rat	3.37	1.60	1.77	2.24	±0.97
Hare	1.31	0.64	0.80	0.91	±0.34
Duicker	1.93	2.03	3.11	2.35	±0.65
Aardvark	1.00	0.80	0.93	0.91	±0.10
Bushbuck	4.11	5.61	8.19	5.97	±2.06
Hartebeest	3.01	2.81	4.63	3.48	±0.99
Roan antelope	1.96	2.08	3.55	2.53	±0.88
Buffalo	0.19	0.44	0.80	0.47	±0.30
Crocodile	0.04	0.03	0.04	0.03	±0.005
Spotted hyena	0.07	0.07	0.11	0.08	±0.02
Elephant	0	0.03	0.05	0.026	±0.02
Red River hog	0.01	0.01	0.01	0.01	±0.00
Total	**42.08**	**28.01**	**42.03**	**37.4**	**±8.10**

*Confidence limits were calculated at the 5 percent probability level.

prints. High counts for pellet groups, footprints, and trails were recorded for kob, cane rat, bushbuck, duicker, and hare in the riparian savanna grassland, while low counts were recorded for hartebeest and roan antelope. (The nomenclature for the animals discussed follows that of Dorst and Dandelot, 1970.)

In the mixed-savanna woodland, the following species were identified: kob, aardvark, bushbuck, hartebeest, and duicker. High pellet counts were recorded for these species, while low counts were noted for buffalo, elephant, and Red River hog.

Seven animal species were identified in the open savanna woodland. Here, there was a decrease in pellet, footprint, and trail counts for kob, cane rat, and hare but a rise in the counts for bushbuck.

In the dense woodland, a total of seven species was observed. Of these,

there were high counts for hartebeest, roan antelope, duicker, buffalo, and bushbuck. Nothing was recorded for hare, cane rat, and crocodile, but the first sign of a spotted hyena was recorded in this vegetation zone.

Considering the entire study area, and the 13 animal species studied, kob had the highest pellet, footprint, and trail counts, except in the dense savanna woodland. The density of kob populations was also highest (25.08/sq km, according to the pellet count index), followed by bushbuck (5.97/sq km). The average density of all animals in the reserve, calculated from the indices used, is 37.4/sq km.

Distribution of animals

Figure 2 shows the effect of the River Ogun on the distribution of large mammals in the game reserve. The distance from the river is presented on X axis, while the Y axis shows the abundance and distribution of pellets, trails, and footprints. Counts for pellets, trails, and footprints were higher along the river course; counts decreased gradually as the distance from the river increased. Variations in the distribution of animal species also appear among the different vegetation zones. For example, buffalo, hartebeest, and roan antelope were more frequent in the dense savanna woodland than in the other vegetation zones, while kobs were commonly seen in the riparian grassland and in the areas around the River Ogun.

Utilization of Wildlife

The analyses of the questionnaires showed that wildlife is a very important part of the life of the local people, in traditional medicine and witchcraft, and as a source of protein. A wide variety of wild animals are eaten by the local communities, including all of the wild ungul-

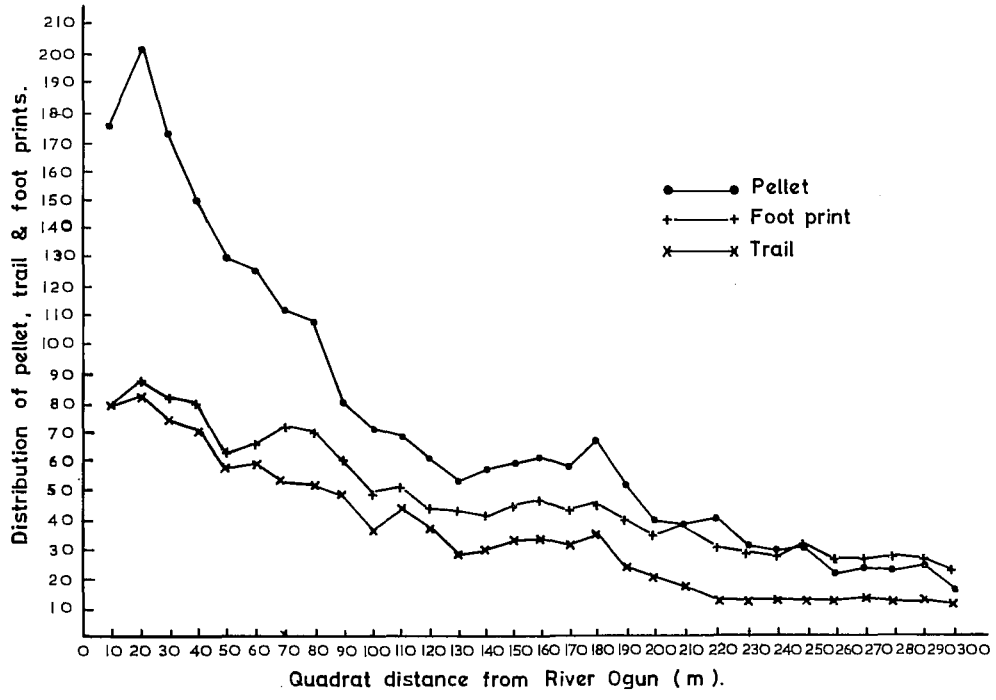

FIGURE 2 Effect of River Ogun on the distribution of large mammals in Upper Ogun Game Reserve

ates, primates, hyrax, rodents, birds, and reptiles. About 80 percent of the rural population depends on bushmeat, and approximately 40 percent take up hunting as a profession. About 65 percent of the hunters interviewed stated that kob is the most abundant animal species in the game reserve and that bushbuck, hartebeest, roan antelope, and duicker also occur in great numbers.

Among the Fulani, Hausa, and Bororo hunters, the weapons used for hunting range from bows and arrows to dane guns. Also, most of the local hunters use traps and ropes. About 90 percent of the hunters interviewed affirmed that they were aware that hunting in the reserve is illegal but claimed that they hunted only in the area outside the reserve. The migrant hunters set up camps and are able to remain in the reserve for as long as 3 weeks at a time. Hunting is carried out principally during the dry season, when the animals are easier to spot. The dressed carcass is often chopped up into small pieces, hard-roasted, and then packed into sacks.

About 40 percent of the hunters interviewed stated that they would prefer to send their children to school instead of training them to become future hunters. On the other hand, about 50 percent held the view that hunting represents an important tradition that ought to be passed down to future generations. The other 10 percent could not state categorically categorically whether it was preferable to train children to hunt or to educate them for other kinds of work.

Table 2 lists the 21 species of animals that were for sale in various markets around the reserve at the time of our study, including Aha, Ago-Amodu, Shepeteri, Iseyin, Agunrege, Ago-Omu, and Shaki. The average market price is given for each species. Note that these prices are not fixed: they fluctuate with time and region.

In Table 3, the number of arrests of hunters and the fines paid from 1967 to 1978 are presented. This information was obtained from the Game Management Headquarters in Oyo. A total of 151 arrests were made in 12 years; the total amount of fines collected was 2,610.39 Naira. Most of the arrests were made between December and May, but at least 1 person was arrested in every month.

Discussion

This study has revealed the importance of the River Ogun in determining the abundance and distribution of some ungulates and reptiles in the Upper Ogun Game Reserve. The animals that are more closely associated with the river during the dry season are kob, bushbuck, cane rat, duicker, and crocodile. Other species such as hartebeest and roan antelope were encountered at some distance from the riverine areas. These latter species are often referred to as typical upland savanna animals (Afolayan and Ajayi, 1980; Milligan, 1979). Their choice of habitat does not mean that these animals do not require water—they do visit watersides at least once daily, but then return to the upland savanna areas.

Studies carried out on kobs in Nigeria (Child, 1974; Pelinck, 1974; Milligan, 1979) and elsewhere in East Africa have shown that the animal is fairly sedentary. Normally, it does not travel farther than 5 km from a source of water.

Figure 2 also shows the effect of the River Ogun on the distribution of the riparian species mentioned above (*i.e.*, kob and allied species). High counts of pellets, footprints, and trails of these species are found along the River Ogun, but the counts decrease rapidly as one moves away from the river. A high relative population density was recorded for kob and the allied species that are more water-dependent, while lower densities were noted for hartebeest and roan ante-

lope, which are less dependent on water.

The importance of water, food, and cover in the distribution of ungulates has been shown by Afolayan (1976), who studied these species at the Mkomazi Game Reserve in Tanzania and by Field (1968), who also worked in East Africa. Field observed that ungulates require water for drinking, as well as for wallowing during hot weather. Geerling and

TABLE 2. Approximate Market Prices of Bushmeat, Trophies, and Skins of Some Large African Mammals

Animal species	Part of Animal Involved	Price (in Naira)
Bushbuck	Dressed carcass	50-90
Elephant	Dressed carcass	500-800
	Tusk	400-600
Buffalo	Dressed carcass	300
	Skin	80
Lion	Dresed carcass	100
	Skin	80
Leopard	Dressed carcass	110
	Skin	100
Red River hog	Dressed carcass	20
	Skin	10
Bush pig	Dressed carcass	120
Cane rat	Dressed carcass	2
Bush fowl	Dressed carcass	5
Duicker	Dressed carcass	20-30
Cane rat	Dressed carcass	10-15
Python	Dressed carcass	100
	Skin	60
Kob	Dressed carcass	70
	Skin	8
Warthog	Dressed carcass	20
Waterbuck	Dressed carcass	150
Roan Antelope	Dressed carcass	150
	Skin	20
Hartebeest	Dressed carcass	150
Oribi	Dressed carcass	10
Spotted hyena	Dressed carcass	60
	Skin	40
Aardvark	Dressed carcass	40
Dwarf mongoose	Dressed carcass	3

Data from interviews with market women in Ago Omu, Shepeteri, Agungere, Ago Amodu and Aha villages.

TABLE 3. Total Number of Hunters Arrested and Fined per Year in the Upper Ogun Game Reserve, 1967-1978

Year	No. of Arrests per Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Fine (in Naira)
1967	1	0	0	0	0	0	0	0	0	0	0	0	1	90
1968	10	0	0	1	0	0	2	0	0	1	3	1	2	11
1969	19	0	6	13	0	0	0	0	0	0	0	0	0	116.39
1970	16	0	0	11	4	1	0	0	0	0	0	0	0	18
1973*	16	1	0	0	0	13	0	0	1	0	0	0	1	215
1974	14	1	3	2	0	3	2	0	0	0	1	0	2	485
1975	17	2	0	13	2	0	0	0	0	0	0	0	0	705
1976	18	1	6	8	0	0	3	0	0	0	0	0	0	525
1977	8	1	0	0	4	2	0	1	0	0	0	0	0	305
1978	5	0	1	3	0	0	0	0	0	0	0	0	1	140
TOTAL	**124**	**6**	**16**	**51**	**10**	**19**	**7**	**1**	**1**	**1**	**4**	**1**	**7**	**2,610.39**

Data from the Regional Game Management Headquarters in Oyo town (Oyo state)
*No arrests were made in 1971 and 1972.

Bokdam (1973) classified the large-mammal species they identified in Comoe National Park, Ivory Coast, into three categories on the basis of the animals' water requirements. Kob, waterbuck, and red-flanked duicker were classified as species that reside near water. This was also found to be true for the kob and the other allied species that we studied in the Upper Ogun Game Reserve. Elephant and buffalo were classified as species that were partial to water and shade but that were also wide ranging. The third category included those species that do not have a daily need for water. Species in this category included hartebeest, roan antelope, warthog, oribi, and grey duicker.

The different vegetation zones also showed variations in the abundance and distribution of large mammals. This finding may be attributed in part to differences in plant species composition among the the several zones. For example, kob, cane rat, and hare were more abundant in the riparian grassland than in the other vegetation zones. This fact demonstrates that water is not the only factor that determines the distribution of large mammals; the relative availability of perennial grasses for feeding is crucial as well. The availability of food (especially browse species) and cover in the dense savanna woodland is responsible for the relatively high density of roan antelope, hartebeest, bushbuck, and the somewhat lower numbers of duickers in this area. This finding supports the conclusion of Odum (1971) that distribution of large mammals is affected by availability of food and cover. Napierbax and Sheldrick (1963) have also demonstrated the importance of browse plants in the distribution and abundance of herbivores.

Utilization of Wildlife in the Upper Ogun Area

It became clear from our study that bushmeat comprises the bulk of the animal protein consumed by the people around the Upper Ogun Game Reserve. They also depend upon wildlife trophies for traditional medicine and for invoking or appeasing the practices of witchcraft. Studies conducted by Ajayi (1971, 1978) and Asibey (1974) revealed that wildlife plays a significant role in the nutrition, dress, religion, and employment of the rural communities of the west African coast. In the study area, the hunters and other traders in bushmeat realize a high level of revenue from their illegal sales. They therefore strive to maintain a flourishing trade in animals, irrespective of the law and the counter-efforts made by game managers. The number of arrests made, and the cash received in fines realized from these arrests, are negligible when compared with the number of animals that are being killed illegally every day, especially during the hunting season.

Therefore, it must be particularly emphasized that illegal hunting greatly affects the abundance and distribution of the animals in the study area, and constitutes an important factor in determining population levels, in addition to the other crucial factors, water, food, and cover.

Conclusions and Recommendations

In this study, we found that the Upper Ogun Game Reserve, which is located in a typical Southern Guinea savanna of West Africa, still contains high densities of kob, bushbuck, hartebeest, and roan antelope. The important factors that were identified as affecting the abundance and distribution of large mammals in the reserve are: source of perennial water, food (browse and grass species), cover, and illegal hunting.

Future prospects for tourism, and consequent benefits to management, seem favorable if the present methods of protection can be improved upon. One means of ameliorating present con-

ditions might be to increase the number of patrolmen in the area. Those patrolmen who work only on a daily basis should be absorbed into the permanent service to ensure their effective cooperation and participation. Also, more patrol posts and stations should be built. Every effort should be made to encourage the participation of the local communities in every step taken by the state government to conserve wildlife in the area. The revenue realized from the management of the reserve should be used to develop the local communities, in order to ensure their confidence and cooperation, as well as the success of the whole program. We also suggest that the reserve not be opened to tourism until 5 years after an adequate level of protection has been achieved and maintained.

This study has shown that wildlife meat and trophies make a significant contribution to the socioeconomic and cultural life of the people in the area. We therefore recommend that hunting not be banned completely in the region. Instead, a buffer zone should be created around the reserve where controlled hunting can take place, while the reserve itself serves as a breeding and growing ground for the various wildlife species.

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Feral Dogs of the Galápagos Islands: Impact and Control

Bruce D. Barnett and Robert L. Rudd

Organisms introduced onto insular ecosystems, after they have become established, frequently increase to destructive numbers. Several species of mammals introduced onto the Galapagos Islands illustrate this ecological axiom. For example, domestic dogs intentionally introduced now exist as three major types: domestic, free-ranging or pariah, and feral. Problems derived from their presence are most apparent on the islands of Santa Cruz and Isabela. Feral and pariah dogs are both scavengers and predators. While other introduced mammals (chiefly feral cattle and pigs) have served as prey, in recent years severe depredations on the unique endemic Galapagan fauna have been caused by the dogs. The chief targets have included land and marine iguanas, tortoises, and colonially nesting marine birds. To counter this problem, a coordinated eradication and study program on all dog populations has been underway since 1979, and an eradication program on Isla Isabela, begun in 1981, continues with marked success. Control rests primarily on carefully placed flesh baits poisoned with Compound 1080 (sodium monofluoroacetate). Field studies on distribution, demography, behavior, and disease transmission also began on Isla Isabela in 1981. Particularly notable is the high incidence of filarial heartworm in several species of mammals, including the local human residents. Dogs are important reservoirs of this parasite. Descriptions of the problems created by the dogs and speculations on the nature of selective return to the wild state are presented.

Zusammenfassung

Lebewesen, die in insulare Oekosysteme eingeführt werden, vermehren sich nach ihrer Etablierung oft in einem zerstörenden Ausmass. Einige der Säugetierarten, die auf den Galapagos Inseln eingeführt wurden, illustrieren dieses ökologische Axiom. So existieren zum Beispiel Hunde, die mit Absicht eingeführt wurden, heute in drei Hauptgruppen: als Haustiere, als streunende Tiere oder Parias, und als wilde Tiere. Probleme, die sich aus deren Gegenwart ergeben, zeigen sich deutlich auf den Inseln Santa Cruz und Isabela. Wilde und streunende Hunde sind sowohl Aasfresser

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wie auch Raubtiere. Während andere eingeführte Säugetiere (hauptsächlich wilde Rinder und Schweine) als Beute gedient haben, haben kürzlich ernsthafte Verwüstungen der einzigartigen endemischen Galapagos-Fauna stattgefunden. Die hauptsächlichen Angriffe richteten sich gegen die Land- und Marine-Iguanas, Schildkröten und Seevögel, die in Kolonien nisten. Um diesem Problem zu begegnen, läuft seit dem Jahr 1979 ein koordiniertes Vernichtungs- und Studien-Programm in Bezug auf alle Hundepopulationen, und ein Vernichtungs-programm auf der Isla Isabela, begonnen in 1981, dauert noch an mit sichtlichem Erfolg. Die Vernichtungskampagne bedient sich hauptsächlich sorgfältig plazierter Fleischköder, die mit dem Compount 1080 (Sodium-Monofluoroazetat) vergiftet sind. Untersuchungen am Platz betreffend Verbreitung, Demographie, Verhaltensweisen und Uebertragung von Krankheitsvektoren begannen auf der Isla Isabela in 1981. Besonders bemerkenswert ist das häufige Auftreten von filariformen Herzwurm in einigen Säugetierarten inklusive Menschen. Hunde sind wichtige Reservoirs dieses Parasiten. Im folgenden sind die Probleme beschrieben, die durch die Hunde hervorgerufen werden, und Mutmassungen angestellt über die Art einer selektiven Rückkehr zum Urzustand.

Introduction

The introduction of organisms from other areas can easily upset the delicate balance of natural island communities, especially when such organisms are not faced with the natural checks to their increase that are normally found in the home environment. Their rapid and successful establishment in such circumstances is likely, and is normally followed by an increase in their numbers at the expense of native flora and fauna. In contrast, island organisms, which have been isolated for a long period of time from more complex continental ecosystems, have become specialized to a simplified island environment and are often incapable of withstanding competition with, or predation by, introduced species. At the same time, other critical factors come into play. MacArthur and Wilson (1967) pointed out that because a given land area can support far fewer numbers of predators than prey, predators will be relatively rare, even on large islands; smaller islands may maintain a carrying capacity too low to support any permanent predator population. Also, the likelihood of dispersal of large, terrestrial predators to islands decreases as the distance from the mainland increases, and on islands that do not normally support large predators, natural selection has not favored the emergence of avoidance behavior in the endemic fauna.

A dangerous illustration of these concepts presently exists in the Galápagos Archipelago, where feral dogs seriously threaten populations of endemic fauna on the islands of Santa Cruz and Isabela (Fig. 1). Research on feral and domestic dog populations on Isabela, currently being conducted in conjunction with the Charles Darwin Research Station and the Galápagos National Park Service, should aid in understanding the establishment and impact of these kinds of introduced predators. Studies of the ecology and population biology of the dogs can provide a basis for the development of effective methods for their long-term control on these islands and in other areas where similar problems exist.

History

The introduction of domestic dogs to the Galápagos followed soon after the original colonization of the Archipelago. In 1832, José Villamil, a native of Louisiana, was granted permission by

the Ecuadorian government to found a colony on the islands as compensation for his service in that country's war of liberation. He chose to settle on the island of Floreana (Charles), several kilometers inland from Black's Beach. Ten years later he left Floreana and founded a colony at Wreck Bay, on the island of San Cristóbal (Chatham). Since that early period, feral dogs have existed continuously on both islands (Melville, 1856; Salvin, 1876; Slevin, 1931, 1959; Thornton, 1971) and have only recently been exterminated by poisoning and shooting.

Wild dogs were first reported on the island of Isabela (Albemarle) in 1868 by a visiting British researcher (Salvin, 1876). The first permanent settlement on Isabela was founded by Antonio Gil in 1897, and when the Stanford Hopkins Expedition visited the village in 1898, they noted large-scale destruction of tortoise eggs by wild dogs along the nearby coast. By 1906 almost 200 people lived in the highland settlement of Santo Tomás. In the same year, passengers on the schooner "Academy" observed wild dogs in the grasslands above Santo Tomás and along the coast several miles from the Villamil community (Slevin, 1931, 1959). By 1913 the increasing number of feral dogs was described as a "terrible plague" on the cattle populations in the highlands.

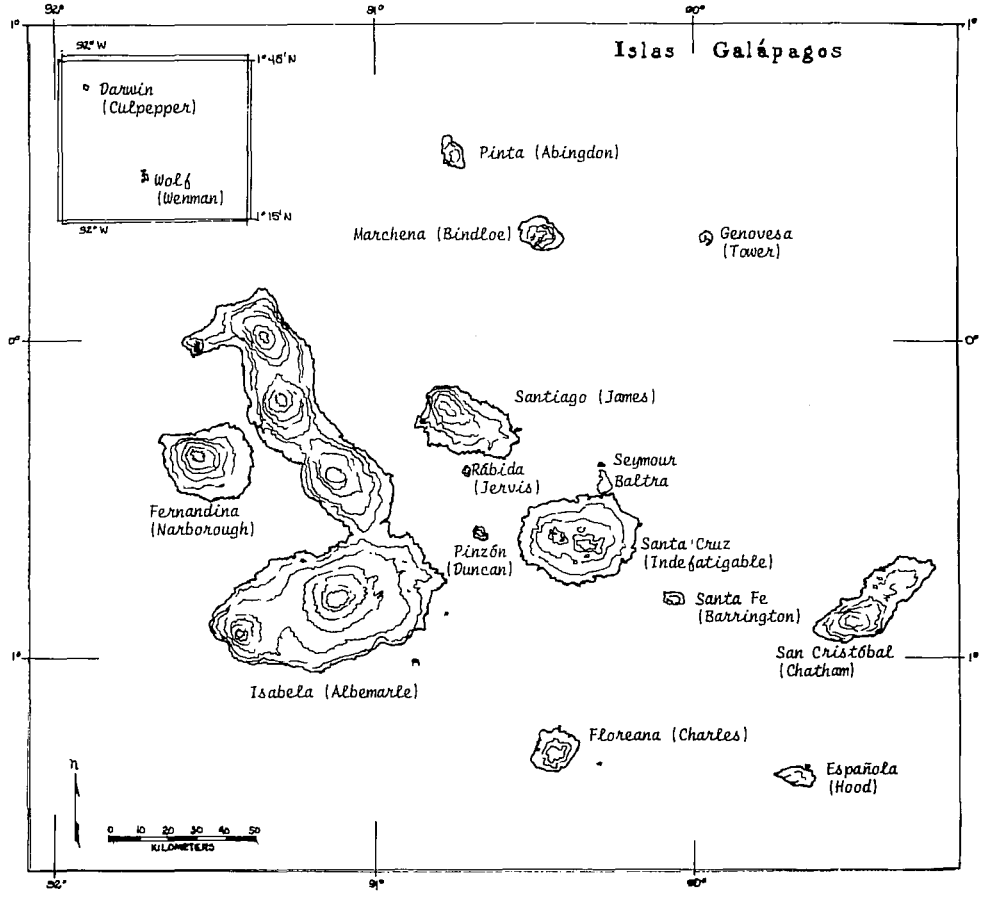

FIGURE 1 Map of the Galápagos Island. Historic English names are given parenthetically.

Wild dogs were first reported along the coast north of Sierra Negra in 1934 by a group of Americans studying marine iguanas in a small cove west of Elizabeth Bay (Robinson, 1936). Although it has been claimed that as many as 5,000 feral dogs may have inhabited southern Isabela in the past (Naveda, 1950), recent estimates indicate a total population of not more than 500 to 800 animals (Kruuk, 1979; Moore, 1981).

Within the last 100 years, there have been accounts of feral dogs on Santa Cruz as well, but little is known about the history of their introduction (Salvin, 1876; Heller, 1903; Beebe, 1923, 1924). Though their numbers are apparently not large (Naveda, 1950; Kruuk, 1979), their damage to island fauna has been severe (Anon., 1976).

Dogs of the Coast

At present, feral dogs occur along the coast of southern Isabela, from Elizabeth Bay on the Perry Isthmus to Punta Cristóbal. This portion of the island is characterized by extensive lava flows, which radiate from the numerous secondary cones that flank the major volcanoes of Sierra Negra and Cerro Azul (Fig. 2). These vast, basaltic lava fields support little animal life, and the dogs are confined to a narrow, 200-m strip of land along the coast, which also supports the many animals and birds that are associated with the marine environment. Some dogs also inhabit the Cartago Bay region on the eastern side of the isthmus, and the possibility of their continued northward migration toward Vólcan Alcedo (on the northern part of the island) threatens resident populations of land iguanas (*Conolophus subcristatus*), giant tortoises (*Geochelone elephantopus*), and breeding colonies of flightless cormorants (*Nannopterum harrisi*) and blue-footed boobies (*Sula nebouxi*).

The dogs present a singular and surprisingly uniform appearance (Figs. 3 and 4). They are large canids, measuring 50 to 70 cm high at the shoulder and attaining a length of 100 cm from head to tail root, with conspicuously large ears. Most of the animals are short-haired, and white with brown or black spots. There may be a reason for this consistency in appearance: Homeotherms exposed to high daily temperatures can benefit by maintaining certain characteristics within the population that reduce the cost of temperature regulation. Traits such as short hair, light coat color, and large ears may aid the dogs in effectively dissipating excess heat. Alternatively, the dogs in this region might look alike on account of geographical isolation, which may have caused a reduction in phenotypic variation within the closed breeding group.

Placental scars in the uteri of 15 female dogs destroyed during the first months of an eradication campaign instituted by the Galápagos National Park Service indicate an average litter size of five young (S.D. = 0.89). If one assumes that approximately 400 dogs live along this coastline and that half of these are female, then, given a reproductive interval of 6 months for domestic canids, as many as 2,000 new individuals may be introduced into the population each year. This high influx of new animals, however, is probably counterbalanced by high natal and juvenile mortality, combined with a relatively short lifespan for adult dogs. In fact, preliminary age estimates reveal that most of the animals are young, few living past 5 years of age. Common infestation by *Dirofilaria immitis*, a nematode heartworm transmitted by the endemic *Aedes taeniorhynchus* mosquito, together with the general hardships that are part of life in this environment, may explain the absence of older dogs.

Analysis of 169 fecal samples and the contents of 12 stomachs from coastal dogs indicates a diet of marine iguana

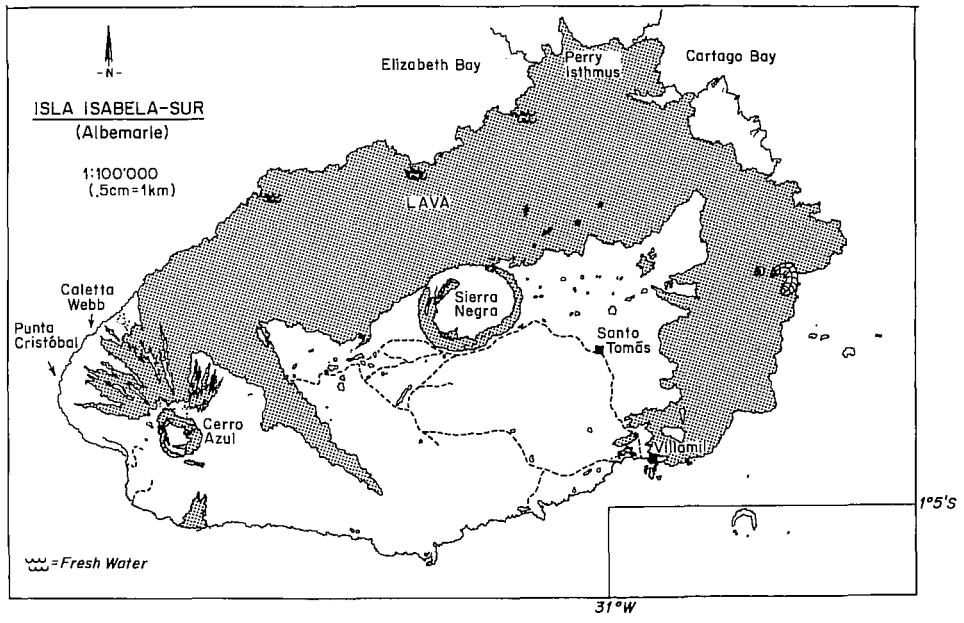

FIGURE 2 The southern portion of Isla Isabela, on which both an eradication and a coordinated field study program are in progress. Physical features and place names are mentioned in text.

(*Amblyrhynchus cristatus*) (35 percent), Galápagos penguin (*Spheniscus mendiculus*) (32 percent), juvenile sea lion (*Zalophus californicus*) and fur seal (*Arctocephalus australis*) (8 percent), Audubon shearwater (*Puffinus lherminieri*) (7 percent), pelican (*Pelicanus occidentalis*) and blue-footed booby (*Sula nebouxi*) (6 percent) and traces of dog, cat, and black rat (*Rattus rattus*) (2 percent). The predominance of small prey in the diet eliminates the need for large hunting packs—we have rarely observed groups of more than three individuals. Aggregations of up to 16 individuals have been seen on occasion though, usually near sources of fresh or brackish water. Although we have watched dogs apparently drinking seawater, it seems unlikely that they possess an excretory system efficient enough to salvage adequate amounts of fresh water. This drinking behavior may result from a deficiency in one or more minerals in the diet, but only further study of the dogs' physiology can answer this question with any degree of certainty.

A recent report on predation of marine iguanas by feral dogs (Kruuk and Snell, 1981) suggested that these predators annually consume 27 percent of the iguana population in the region of Caletta Webb alone (Fig. 5). This figure is based on the nutritive requirements of the dogs and their observed preference for larger iguanas. Two further sets of observations, the subsequent censusing of the iguana populations, which showed a predominance of small- and medium-sized individuals, and analysis of the prey remains left by the dogs and found in their feces, support Kruuk and Snell's original hypothesis. Ultimately, the removal of the larger, breeding members from the iguana populations will lead to a high mortality/production ratio and thus portend grave consequences for the iguanas on Isabela.

Galápagos penguins (*Spheniscus mendiculus*) have also become a preferred food item for the dogs in the past 2 years. The breeding range for this species is restricted to the northern coast of Isa-

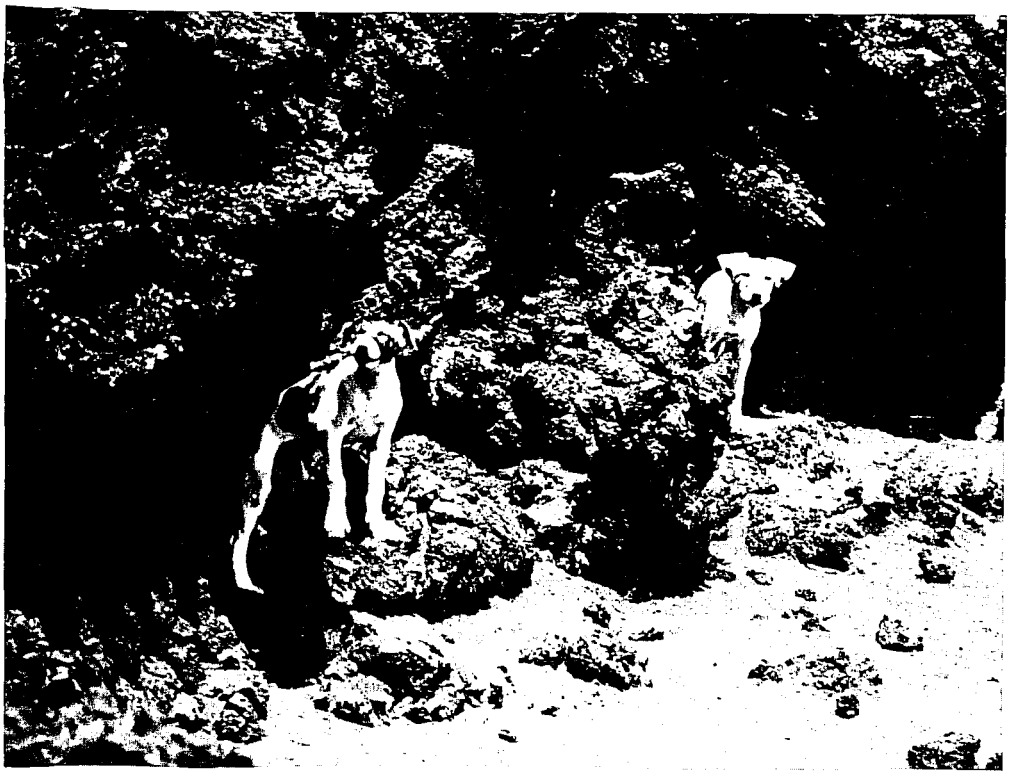

FIGURE 3 Pups on coast near Punta Cristóbal, Isla Isabela. Note refuges in lava recesses. (Photograph by Tui de R. Moore)

bela and the coast of Fernandina, where the cold waters of the Humboldt current flow through the Bolivar Strait (Houvenaghel, 1978). Penguin populations are extremely sensitive to intense predation pressure, and their continued existence in the Archipelago may therefore be threatened by this new dietary preference of the dogs.

Dogs of Cerro Azul

Cerro Azul, the Galápagos' second tallest volcano (1689 m), is situated on the western side of southern Isabela. The prevailing southeasterly winds and fog coming in from the sea are forced rapidly upwards and are thereby quickly cooled. More rain falls on the lower elevations of the volcano's southern slope than in any other southerly exposed coastal area on the islands. A mesophytic, deciduous, steppe forest predominates along the coast which slowly opens up until, at an altitude of about 250 m, it is replaced by open meadows or "pampas." Above 1,000 m the vegetation becomes xerophytic, becoming desert-like on the caldera rim (Hamann, 1981). Between 100 and 200 feral dogs live on the open pampas, which cover all but the north and northwest slopes.

The majority of the Cerro Azul dogs look quite like the coastal animals. Most are short-haired and white with brown or black spots, but longer-haired and darker-colored individuals are more common than along the coast (Fig. 6). Also, few of the highland dogs possess the noticeably large ears, perhaps because selection for heat-dissipating characters may not be a strong factor in a region with a considerably cooler climate.

Counts of placental scars in the uteri of six females revealed an average litter size of six (S.D. = 0.75). Adult dogs appear to have a longer lifespan than those of the coastal region, some reaching

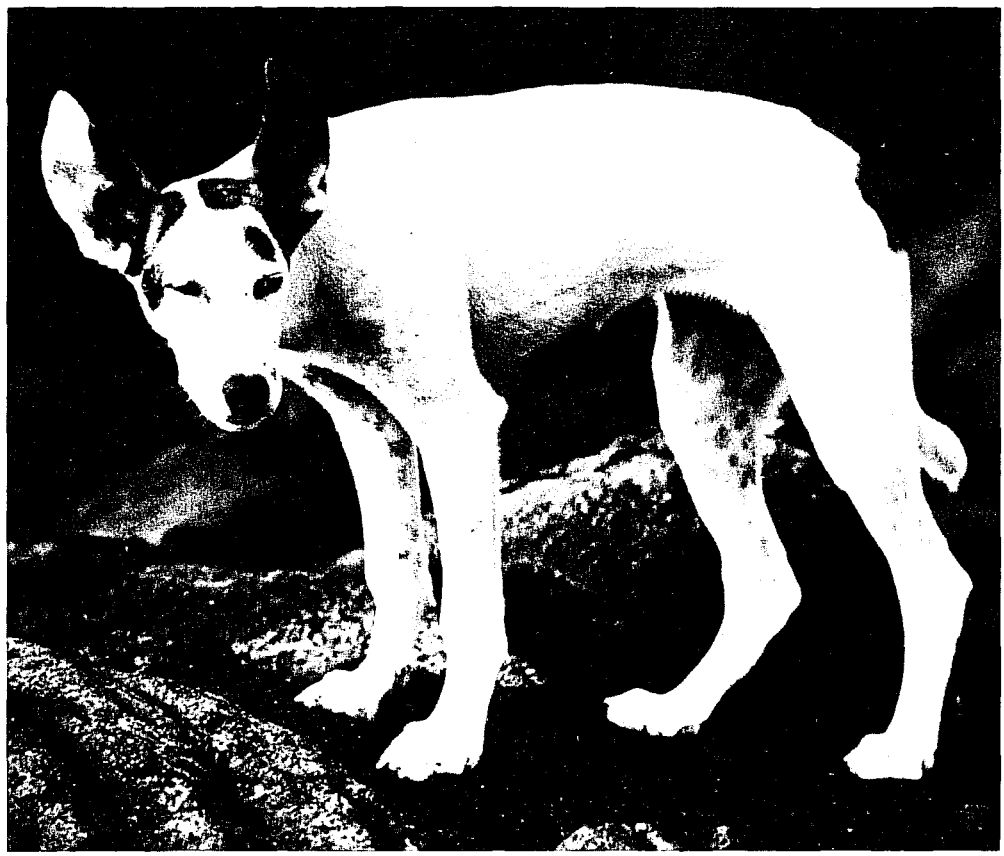

FIGURE 4 Juvenile female from the "coastal" population at Caletta Webb. (Photograph by Tui de R. Moore)

an age of 8 to 9 years. One reason for the more common occurrence of older animals may be that the *Aedes taeniorhynchus* mosquito is less abundant at higher altitudes, explaining why far fewer cases of *D. immitis* infestation were discovered within this population.

Cerro Azul also supports approximately 2,000 feral cattle, and these serve as a major food source for the dogs (Fig. 7), comprising 50 percent of their diet, the remainder of which includes coleopterans (14 percent), orthopterans (11 percent), grasses and ferns (8 percent), dog (6 percent), and traces of cat, ground finch (*Geospiza fuliginosa*), and black rat (8 percent). Though the cattle appear to be the main staple of the dogs' diet, surprisingly few successful kills have actually been witnessed. Harassment seems to be the usual method of attack; this "strategy" requires a smaller expenditure of energy and a reduced risk of injury to the attacker. In this kind of attack, sufficient damage may be sustained by the prey such that it later dies of its wounds. In light of the large number of cattle in the area, this approach would ensure an adequate food supply and allow the dogs to obtain most of their nourishment by scavenging the remains of their dead victims. Another explanation for the same strategy is possible, and involves modifications in the behavior and/or morphology of canids that have been subjected to the process of domestication. Domestication refers to changes in genetic characteristics by selective breeding practices applied to a given population of animals. Dogs, which have

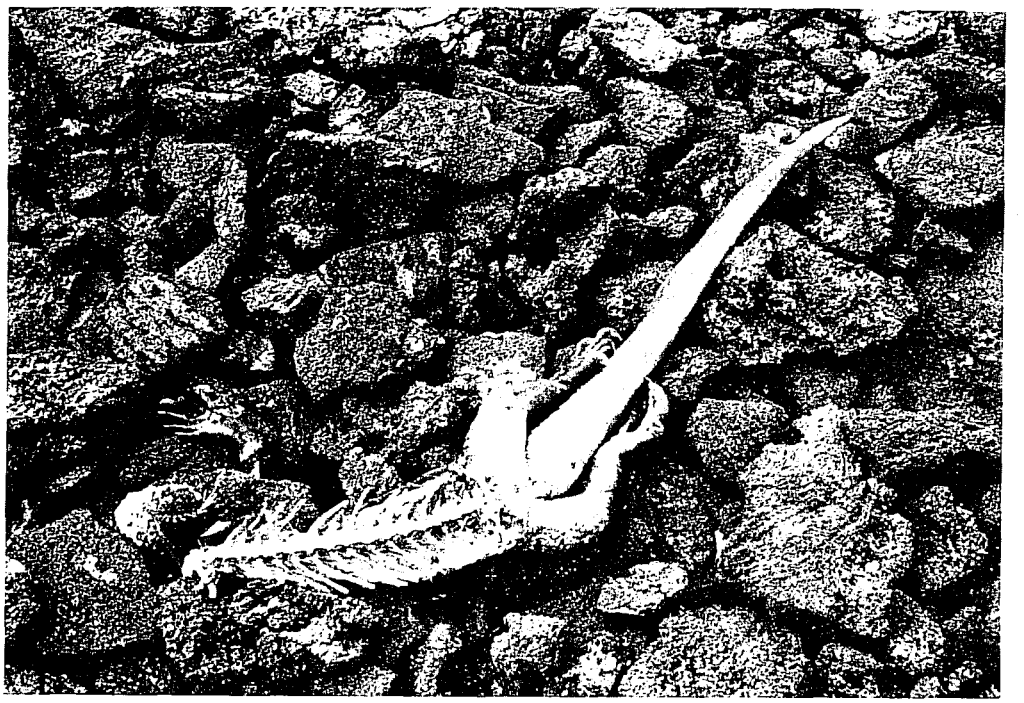

FIGURE 5 Marine iguana freshly killed and partially eaten by dogs at Punta Cristóbal, Isla Isabela. (Photograph by Tui de R. Moore)

FIGURE 6 Adult male dog from the "highland" population of Cerro Azul, Isla Isabela. (Photograph by Tui de R. Moore)

a history of almost 16,000 years of domestication (Brisbin, 1974, 1976), display morphological and behavioral traits that actually reduce their predatory abilities but increase their effectiveness as scavengers. Changes in tooth structure, for example, have resulted in modified molars in domestic canids—from the sharp-cusped, carnassial teeth used for ripping and tearing by their wild ancestors, to a more smooth-cusped form, so that they have come to resemble teeth used for grinding by more herbivorous species. The inhibition of a killing bite, observed in certain domestic breeds (Fox, 1978), may also influence the feeding strategy of the Cerro Azul dogs.

FIGURE 7 Feral (criollo or original Spanish) cattle, the chief sustenance of the "highland" dog population on Cerro Azul. (Photograph by Tui de R. Moore)

The hunting of large prey could explain the larger observed group sizes among the highland populations ($\bar{X} = 4$). Dogs from larger packs were commonly seen to break off into smaller groups for a time, only to later rejoin the same or another pack. While some domestic breeds exhibit a modification of behavior that prevents the establishment and maintenance of stable social relationships in closed-group situations, other breeds demonstrate a high tolerance to additions or removals from the pack (Fox, 1971). The fluid social structure observed in Cerro Azul populations could reflect similar domestic modifications of ancestral behavior patterns.

In the Cerro Azul highlands, then, we have a unique situation: a feral predator regulating the numbers of introduced herbivores. An even more critical aspect of this situation is that, because of their potential for moving down to the coast and thus endangering endemic island fauna, these dogs are being included in the eradication program of the National Park Service. The unfortunate result of this policy will be an unchecked growth of the cattle population, and 2,000 large herbivores can be very destructive to the flora of the pampas. These cattle have already transformed large areas into virtual shortgrass deserts by cropping a large portion of the native vegetation and endangering much of the remainder by destroying the natural watershed of the lower slopes.

Sierra Negra and the Origins of Feral Populations

Extending southward, forming a col that separates the volcanoes of Cerro Azul and Sierra Negra, is a narrow band of lava known as "El Quemado," or "the Burnt Forest" (see Fig. 2). It is composed of broken slabs of volcanic ejecta, with projecting knobs and ridges and abra-

sive, cutting edges that form huge barricades, making travel over them slow, painful, and dangerous. Also, the volcanic flow here occurred so recently that very little vegetation has colonized the hardened lava, and soil is practically nonexistent. Constant exposure to the hot, equatorial sun often drives temperatures to 35°C (95°F) and, though it is not more than 2.5 km wide at its narrowest point of crossing, the rugged topography and forbidding climate of the flow act as an effective barrier to the unchecked movement of terrestrial animal populations on Isabela. To the east lies the large southern slope of Sierra Negra, and the small settlements of Santo Tomás and Villamil lie in the shadow of the volcano. It is the domestic dogs associated with these communities that most likely serve as the origin of the feral dog populations on the island.

Thirty percent of the 70 families in Villamil own dogs. The sex and age distributions of this dog population are presented in Table 1. The highly skewed sex ratio in favor of male animals (3:1) is the result of the selection by local residents for superior performance as working and hunting animals. A small, but constant number of female dogs is maintained to compensate for a high mortality rate by continued production of a limited number of new individuals. Even though most of the dogs in this village are provided food by their owners, it is not uncommon to see animals combing the beachfront, taking an occasional lava lizard (*Tropidurus albemarlensis*), rat, or Sally Lightfoot crab (*Grapsus grapsus*) to supplement their diet.

In the smaller, more dispersed, highland district of Santo Tomás, 90 percent of the 42 resident families own dogs; un-

TABLE 1 Sex and Age Distributions of Domestic Dogs on Isabela

Island Santo Tomas	No. in age group		
	Male	Female	Total
0-6 months	20	10	30
6-12 months	17	8	25
1-2 years	11	7	18
2-3 years	14	7	21
3-4 years	10	4	14
4-5 years	13	5	18
5-6 years	3	0	3
6-7 years	0	0	0
over 7 years	2	0	2

Villamil	No. in age group		
	Male	Female	Total
0-6 months	7	3	10
6-12 months	8	3	11
1-2 years	5	1	6
2-3 years	3	1	4
3-4 years	0	1	1
4-5 years	2	1	3
5-6 years	2	0	2
6-7 years	0	0	0
over 7 years	3	1	4

like Villamil, where more than two dogs per household is rare, homes in this agricultural community support an average of four animals. A 2:1 sex ratio, favoring males, is apparent in this population as well, and females are similarly valued only for their reproductive contribution. Few of these village dogs live longer than 5 years. Juvenile mortality is high, with dog owners often controlling the size and composition of surviving litters. By choosing the fittest males to maintain effective hunting packs and the fittest females for breeding, these villagers are practicing a form of selection that illustrates man's role as a domesticator, determining the future genetic composition of the dog population and, by selection for males, reducing total population size.

The unavailability of firearms to the inhabitants of Santo Tomás necessitates the use of dogs as an aid in hunting game. It is not unusual for a dog to be injured during a hunt; since it is then of no further use to its owner, the animal is normally abandoned. Also, some dogs stray from the hunting party and, if they are unable to find their way home, they become forced to fend for themselves. It is these free-ranging individuals that occupy an intermediate stage between the truly domestic and truly feral populations.

It is important to distinguish clearly between truly feral and free-ranging dogs. A feral population is produced when domestic animals escape to a habitat that is similar to that of their wild ancestors and thereby come under the influence of natural selection. This process requires many generations for complete removal of the constraints imposed by artificial selection, but the process is rarely as clear-cut as one might suppose. If evolution is a continuous process which moves almost imperceptibly from one stage to another, consideration of some intermediate construct to aid in developing a conceptual framework for understanding this process is necessary. Brisbin (1977) labels animals in this free-ranging stage as "pariahs" and defines such populations in terms of those selective forces that act to determine their future genetic composition. The genetic composition in pariah populations is determined by breeding patterns that are influenced by, but not controlled by, the domesticator. This patterning is apparently the case among dogs lost or abandoned during hunting forays from Santo Tomás. Animals leading a pariah-type lifestyle assume a cautious, yet not quite fearful attitude toward man. A breakdown in the regimentation of social order may occur territorially; intragroup aggression decreases and there is a marked tendency to rely on scavenging more than on true predation to obtain food (Brisbin, 1977). By studying the differences in these behavioral patterns, it may be possible to gauge a given population's current position along the continuum of evolution from the domestic to the feral condition. Observed behavioral patterns may in turn provide insight into the historical pattern of dispersal of dogs throughout Isabela.

The dogs of Sierra Negra provide an example of differences in feeding habits between free-ranging (pariah) and truly feral canids. Most of their food is obtained by scavenging the remains of animals caught in snares placed by the hunting parties from Santo Tomás. These hunters may set up to 20 traps along any given animal trail, then return 1 to 2 weeks later to collect their catch. Many of the animals caught in these traps during the first days after they are set are no longer salvageable by the time that the hunters return, and they are therefore abandoned. Consequently, there is always a supply of surplus meat to support scavenging dogs. Analysis of dog feces in the area shows that 70 percent of their diet consists of feral cattle, pigs, and burros, and signs of dog activity are

plentiful around most trap-killed carcasses. These dogs, therefore, are still somewhat dependent on man for a constant food supply and, because the majority of them are either recently derived from village populations or may associate with village dogs in a breeding or other social context, their behavior can be characterized as that of a free-ranging or pariah population.

In contrast, dogs that have moved westward across the El Quemado lava flow and have come to inhabit the slopes of Cerro Azul practice a direct but rudimentary form of predation on the feral cattle populations of the area. They too ultimately rely on a form of scavenging to obtain their food. The difference between this strategy and that of the pariah animals resides in the fact that these dogs are themselves providing the carcasses, thereby precluding any dependence on humans for food. The likelihood of contact with village or pariah populations is also reduced by the presence of a significant geographical barrier, which further removes the dogs from the indirect influence of man.

The dogs of Isabela's northern coast are even more isolated from populations on Sierra Negra and Santo Tomás by the large and formidable lava fields that bisect the island on an east-west axis. These animals derive their sustenance by active predation on the endemic fauna of the coastal region and, by virtue of this behavior and their breeding patterns, may truly be regarded as feral.

The current investigation into the relative amount of phenotypic variation within these respective populations may further elucidate aspects of the discussion presented above and reveal a decrease in such variation with increasing distance from the source (or domestic) population. By this type of analysis, it may become possible to trace the history of feral dogs on Isabela and subsequently to apply similar techniques to the study of these problems on other islands.

Control

The Galápagos National Park Service, in cooperation with the Charles Darwin Research Station and the Frankfurt Zoological Society, has recently embarked on a campaign to eradicate populations of feral dogs on the islands of Santa Cruz and Isabela. The most effective method employed to date involves the use of sodium monofluoroacetate (Compound 1080). This substance was originally developed for controlling rodent populations, but it has been found to be differentially toxic to canids at doses as low as 0.05 mg/kg. And, while 1080 is highly toxic, it is undetectable in flesh baits. The lag period that follows ingestion before manifest effects appear minimizes the potential for bait shyness and association. The suggested use of Compound 1080 is controversial and in many countries is greatly restricted. The risk to nontarget species must be considered as well when any pesticide is used, and a detailed knowledge of the target animal's behavior and ecology is a prerequisite to safe and effective application of the substance (Rudd, 1964).

On the islands, poison baits, obtained by killing a small number of feral cattle, are placed at various locations within the dogs' known range. By exploiting the domestic trait of predilection for scavenging, a surprising degree of success in controlling populations has been achieved. Baits are well hidden to prevent removal and ingestion by the Galápagos hawks and short-eared owls that also inhabit the region. These avian predators, however, are 200 times more resistant to the poison than the dogs: a dosage of approximately 10 mg/kg is necessary before the compound becomes lethal. Since a single bait (1 kg) only contains enough poison to ensure the desired effect on canids (0.1 mg/kg), hawks and owls would

have to consume at least 100 such baits to incur any significant toxic effects. On the other hand, cats (0.2 mg/kg) and rats (2.1 to 3.1 mg/kg) are more susceptible to the substance, but their eradication would be a desirable, if unintended, consequence.

Any effective control program must consider all phases of the target animal's ecology, and although removing feral dog populations is one important aspect of the current effort, action must also be taken to limit the future introduction, establishment, and growth of such populations. In the case of dogs on Isabela, steps must be taken to curb reproduction in domestic populations and prevent their dispersal from areas of human habitation. In one sense, the residents of the island's two settlements already practice a form of reproductive control with their dogs by regulating the number and sex of the surviving young. However, the huge surplus of male animals all but guarantees the impregnation of the fewer females and thus maintains a steady production of new individuals. Therefore, a program directed at reducing the number of potent males in the population could effectively decrease the rate of reproduction to manageable levels. Surgical vasectomy of male dogs is one technique of contraception which avoids the problem of sexually interested males and unreceptive females that is associated with ovariectomy and ovariohysterectomy, and is preferable to orchidectomy (castration), which ultimately results in the diminution of male secondary sexual characteristics (Hopkins *et al.*, 1976). The latter method would be particularly undesirable in instances where males are valued for their aggressiveness. Surgical procedures, however, are time-consuming and expensive, and would be impractical in the present situation. But the recent development of a chemical vasectomizing agent offers considerable potential for providing a fast, low-cost, safe, and effective means of reducing fertility in domestic dog populations (Pineda, 1978). This compound (chlorhexidine digluconate) has been extensively studied for its safety and effectiveness for various applications as an antiseptic in both humans and animals. In the epididymis of the male testis, it acts as a sclerosing agent, which causes a proliferation of scar tissue in the epididymal tissue and eventual blockage of sperm passage through the tubule (Pineda *et al.*, 1977). There appear to be no qualitative changes in the seminiferous tubules or interstitial tissue after treatment, and hormone production is not impaired. Transient scrotal swelling may occur, but testicular palpation of test animals has shown no accompanying pain. This method of sterilization of large numbers of male dogs may reduce the number of pregnant females sufficiently to restrict total population growth. Moreover, if dominant males are rendered sterile without affecting their social dominance or aggressiveness, these dominants might prevent matings by their intact subordinates.

Future Research

Current control procedures have drastically reduced the size of feral dog populations along southern Isabela's northern coast and in the highlands of Cerro Azul and Sierra Negra. Where just 1 year ago an estimated 300 to 500 dogs roamed the coastal region, threatening the survival of marine iguanas, penguins, sea lions, and many species of seabirds, today less than 100 dogs remain. Efforts are also underway to remove the last individuals from the slopes of Cerro Azul. The effective reduction of these populations by the eradication program makes further studies at this time both impractical and difficult. The population sizes of introduced and endemic prey species are, however, being closely monitored to assess the impact of the remaining

feral dogs, and research is continuing into the relative amounts of phenotypic variation within the affected feral populations, through studies on the skull morphology and physical characteristics of the animals destroyed to date. Further, domestic dogs, endemic pinnipeds, and humans are being used as the subjects of an investigation into the epizootiology of canine heartworm. Radio tracking studies on these domestic animals and on the free-ranging dogs of Sierra Negra can be expected to produce information regarding their movements, activity patterns, social organization, and predatory habits. The testing of alternative contraceptive methods, including the use of the chemical sterilant chlorhexidine digluconate, is also planned for the coming year.

The study of feral dogs in the Galápagos islands presents opportunities for both basic and applied research and assumes particular relevance at a time when we are only beginning to understand and to compare general ecological patterns on earth. A well-planned, coordinated effort to control sympatric populations of feral animals in the Galápagos is badly needed. Dogs, cats, rats, pigs, burros, goats, cattle and, recently, guinea pigs and poultry have been introduced to the Archipelago and now present serious problems on all but a few of the Islands. The removal of only one of these species can actually benefit the survival and success of another by reducing competition for food or, as in the case of the dogs and cattle of Cerro Azul, eliminating the predation by one species on another. Understanding the complex ecological relationships among introduced populations and between them and the endemic fauna constitutes the first step toward developing sound and effective methods of control (Hutchins *et al.*, 1982). By studying these problems in relatively simple ecosystems like islands, we may be able to gain some insight into the general issue of the complex interactions between humans and their modified environments.

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The Effects of Ethostasis on Farm Animal Behavior: A Theoretical Overview

A.F. Fraser
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The solution of animal problems that occur on the farm requires a holistic and multidisciplinary orientation and analysis, as well as the acquisition of new investigatory tools by both veterinarians and animal scientists. Field studies may be modeled under more controlled laboratory conditions, but the most relevant investigations must take place on the farm, and the first level of analysis should be ethological. Domestic animal behavior can be monitored and quantified like any other factor in the animals' environment; yet it has been virtually ignored in the development of new livestock husbandry systems.

The relationships between husbandry systems, disease problems, and behavioral factors are extremely complex but are known to be interrelated and interdependent. It is postulated that severely constricting husbandry practices can generate anomalous behavior — a phenomenon termed ethostasis. Applied ethology now has a vital and central role to play in investigating the problems that have been created by modern intensive livestock production.

The purpose of this overview, therefore, is to delineate some of the husbandry factors that can give rise to behavioral anomalies, and to describe various categories of anomalous behavior that are of diagnostic value in clinical appraisals of stressful husbandry. Ready identification may facilitate recognition and correction of problems that may lead to lowered productivity, diseases, and economic losses; it may also foster concern for the animals' welfare from an ethical, as well as an economic, perspective. These circumstances highlight some of the contemporary animal husbandry problems that warrant further research and quantitative analysis.

Zusammenfassung

Die Lösung von Problemen mit landwirtschaftlichen Nutztieren erfordert eine holistische und multidisziplinäre Orientierung und Analyse sowie den Einsatz von neuen Untersuchungsmethoden durch Veterinäre und Wissenschaftler im tierischen Bereich. Untersuchungen ausserhalb von Laboratorien können nun an Hand von Modellen unter kontrollierten Bedingungen innerhalb von Laboratorien durchgeführt werden, aber die hauptsächlichsten Untersuchungen müssen auf der Farm stattfinden, und der erste Schritt in der Analyse sollte ethologischer Natur sein. Das Verhalten eines landwirtschaftlichen Nutztieres kann wie jeder andere Faktor in der Umwelt eines Tieres beobachtet und quantifiziert werden; dies wurde jedoch in den modernen Viehhaltungssystemen praktisch ignoriert.

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Die Beziehungen zwischen Viehhaltungssystemen, Krankheitsproblemen und Verhaltensfaktoren sind äusserst komplex, man weiss jedoch, dass sie miteinander verknüpft und voneinander abhängig sind. In diesem Artikel wird gezeigt, dass besonders einschränkende Viehhaltungspraktiken zu abnormalem Verhalten führen—ein Phänomen, das als *Ethostasis* bezeichnet werden kann. Die angewandte Ethologie spielt heute eine vitale und zentrale Rolle in der Unterschung der Probleme, welche die moderne intensive Tierhaltung mit sich bringt.

Zweck der folgenden Ausführungen ist es, einige der Faktoren in der Tierhaltung aufzuzeigen, die zu abnormalem Verhalten führen können, und die verschiedenen Kategorien von abnormalem Verhalten zu beschreiben, die von diagnostischem Wert sind in der klinischen Erfassung von Stress in der Tierzucht. Rechtzeitige Identifizierung ermöglicht das Erkennen und die Korrektur von Problemen, die zu verminderter Produktivität, Krankheiten und wirtschaftlichen Verlusten führen können; dies mag auch die Rücksicht auf die Wohlfahrt der Tiere stärken sowohl vom ethischen wie auch vom ökonomischen Gesichtspunkt aus. Diese Umstände werfen ein Licht auf die gegenwärtigen Viehzuchtprobleme, welche eine weitergehende Forschung und quantitative Analyse rechtfertigen.

Introduction

Interpretation

Classical ethology has frequently hesitated to pursue the interpretive aspects of behavior studies, taking instead a relatively narrow, objective approach, and concentrating on restrained examinations of observed behavior. Ultimately, however, as behavioral information accumulates, it begs some broader interpretation. This is particularly true in the case of ethology as it is applied to domesticated animals, whose behavior is extremely dependent upon the complexities of the control involved in their husbandry, especially when confinement and constraint are the main features. Veterinary ethologists, in particular, cannot escape the responsibility of interpreting some of the behavior patterns they study as dependent variables resulting from such control. Then, applied ethologists must begin to place these interpretations within a broader perspective. This article is an attempt to make some progress toward this goal.

The Role of Ethology and Its Limits

One important element in achieving a broader perspective involves the use of our intuition and sense of empathy. These can be valuable subjective tools in observing and understanding animal behavior, although they are often inhibited in the name of a quasi-scientific "objectivity." While objective description remains the essential ingredient of good science, a mechanistic and often reductionistic approach to ethology may lead to a very narrow or biased understanding of observations. Intuition and empathy are also valuable assets in practicing good animal husbandry and veterinary medicine. Use of these faculties does not mean the adoption of a simplistic anthropomorphic attitude toward animals but, rather, a willingness to place some trust in our sensitivity to animals, in order to facilitate the work of the ethologist, veterinarian, and animal husbandryman, as well as to benefit the animals under their care or investigation.

While it is not the intention here to examine the merits and limitations of the behavioral sciences, certain other values and attitudes relevant to applied ethology should be addressed. With farm animals, concentration on purely economic concerns and narrow utilitarian values can severely limit the capacity for responsible compassion, which is the primary ethical ingredient of good animal husbandry. The attitudes of the stockman and related variables should always be considered in any study of farm animal behavior.

Husbandry Systems

With the advent of new intensive methods of animal husbandry, many new behavior problems and new diseases have appeared, while others have become more common. In terms of economic losses and animal welfare, the need to learn the causes and best methods for control of diseases in farm livestock remains a major concern. Therefore, there is an even greater need for some comprehensive way of interpreting animal behavior. Husbandry systems that are now in widespread use require rigorous reappraisal in terms of their effects on behavior. However, because of economic constraints, it is virtually impossible to mimic field conditions under even ideal laboratory conditions. Thus, many systems are put into use without adequate field testing. It is our belief that severely restrictive husbandry leads to behavioral abnormalities; this phenomenon has been referred to as "ethostasis." Further, recognition of this phenomenon may comprise the essence of any appraisal of the acceptibility of innovative animal husbandry.

Concepts and Terminology

Among ethologists, there has often been some hesitancy to define the general terminology of their subject, but a common understanding of the meanings of these terms nevertheless does exist. Definitions of certain broad terms are required and are given in this review to serve as a basis for clear and orderly comprehension, to provide a sound base for exercises on interpretative ethology, in particular.

In applied ethology, *behavior* can be given a two-tier definition as follows. (1) Behavior is the overt form of the composite neurophysiological functions of animals, individually and collectively. (2) Behavior is, itself, the function by which the animal mediates dynamically with its environment. Normally, therefore, behavior is an adaptive response to some change in the internal (physiological) or external (physical/social) environment. The adaptive role of behavior will be discussed below.

There are numerous behavior patterns in animals. Each functional pattern has recognizable similarities in appropriate contexts of mediation. These similarities constitute the *norms* of behavior, for a given species and a particular environment, considering both the physical and social elements of that environment. However, departures from the established norms in behavior do occur.

Littlejohn (1969) has noted that since *normal* behavior can be shown to relate to relevant and complex circumstances, it must be possible to show that *abnormal* forms of behavior relate to their own specific circumstances as well. Littlejohn emphasized the need to recognize, in a systematic fashion, this relationship between abnormal behavior and its principal physical causes. In his work, he made exclusive reference to organic factors such as specific diseases.

Behavioral abnormalities can be considered to fall into three categories.

1. Idiosyncratic Behavior

Certain highly individualized forms of unusual behavior patterns can occur in some animals. Some examples include bulls adopting "dog-sitting" postures,

cows rolling their tongues, and horses knocking stable doors with their forefeet. These manifestations are analogous to vacuum activities, which become habits over time. Characteristically, they lack clinical or subclinical significance since they are entirely coexistent with other evidence of normal environmental mediation.

2. Clinical Behavior

In the manifestly sick animal, the array of signs and symptoms of illness or dysfunction frequently includes significant alterations of behavior. Such clinically aberrant behavior assists in drawing attention to the dysfunction and also aids in its precise identification. Clinical and subclinical behavioral signs combine organic (*i.e.*, infectious or nutritional) sickness and abnormal behavior. A subclinical nutritional deficiency, for example, may lead to cannibalistic behavior or pica.

3. Anomalous Behavior

Medical irregularities are termed *anomalies*. Irregular forms of behavior occur in animals that are not manifestly clinically ill. These behavioral anomalies exist in characteristic forms, each of which is an ethological entity with its own mediative significance.

The more commonly recognized forms of anomalies in veterinary science are physical, but behavioral anomalies can be classed as etho-anomalies. Some forms of anomalous behavior can be grouped into major syndromes. Such etho-anomalies occur, characteristically, in animals that have been placed under controlled environments, either in high-density groups at one extreme, or in a state of solitary confinement at the other (Bryant, 1972; Jackson, 1976; Wood-Gush, 1973).

Ethostasis

The term *ethostasis* (Fraser, 1974) has recently come into use to describe the circumstances in which management practices, by preventing or restricting the major behavioral patterns inherent in animals, can generate various types of abnormal behavior.

Stressful Factors

Many ambient factors can be seen to affect behavior by producing adaptive responses and, as such, are potential stressors (Table 1). The ambient factors that can cause abnormal behavior must be individually identified if they are to be appreciated and controlled. The cause-and-effect relationship between environmental stressors in chronic control conditions and anomalous behavior have already been investigated by applied ethologists who have worked independently, although along essentially parallel lines (Kiley-Worthington, 1977; Ewbank, 1978; Fraser, 1980; Fraser and Fox, 1978; Sambraus, 1981). These investigators have found that some forms of husbandry evidently create many stressors.

Stress Criteria

Formerly, it was generally considered that the presence of stress was difficult to determine in animals. However, a report delineating the valid use of the term *stress* in a veterinary context, by Fraser *et al.* (1975), has been so widely accepted that we can conclude that this problem has been satisfactorily addressed. That report states:

> *We cannot hope to delineate any single biological phenomenon or principle by defining the term stress, but we do require that the term be defined sufficiently that it can be used in a tangible way in discussing a variety of veterinary problems. The term should be used where there are extremes of bodily states, but should not imply any measurable parameter which necessarily summates various reactions to adversity. Furthermore, the term should encompass states of coping as well as those of collapse, and states involving disturbed behavior as well as those involving altered physiological function.*

TABLE 1 Variety of Environmental Stressors Associated with Chronic Control of Livestock That May Act Cumulatively on Animals

Stressor origin	Stressor item
Management	Improvident welfare
	Nutritional levels
	Husbandry standards
	Environmental variables
	Hygienic standards
	Noise levels
	Attritive management policies
Space	Social density
	Peck order status
	Group size
	Permitted movement
	Area per head
	Isolation
Constraint	Hardware controls (Stalls, Tethers, Races, Crushes)
	Special suppressive devices
	Restrictive housing systems

With these considerations in mind, we offer the following definition: An animal can be said to be in a state of stress if it is required to make abnormal or extreme adjustments in its physiology or behavior in order to cope with adverse aspects of its environment and management. Extreme behavioral adjustments (*i.e.*, dysstatic rather than homeostatic) can only be corrected by removing the animal from the pathogenic environment or by adjusting those factors in the environment that were responsible for creating the ethostatis (Table 2). Therefore we can say that a husbandry system can be considered stressful if it makes abnormal or extreme demands on the animal and thereby sets up a condition of ethostasis. Finally, an individual factor, such as an extreme of temperature, may be called a stressor if it contributes to the stressful nature of a particular system of husbandry. Social homeostasis, such as crowding together to keep warm, is adaptive, but a practice like this may have negative or maladaptive consequences if it interferes with food intake or other normal functions.

Accumulated observations now clearly show that appraisal and recognition of etho-anomalies comprise a sound and logical means whereby stress in animals can be identified. Furthermore, it is clear that biochemical or physiological data alone may be misleading or inconclusive (Anchel, 1976). It has been found, in studying anomalous behavior within various husbandry systems that, although stressors can be cumulative (Craig, 1981), animals *are* capable of tolerating a sum of stressors, up to a certain level. This critical level for combined stressors shows variability among individuals.

Confinement Husbandry Systems

Modern forms of animal husbandry are progressively developing into systems that usually increase the density of animals held in groups (Dougherty, 1976). Although some farm animal ethologists have begun to examine these newer methods of husbandry, there is inadequate knowledge about the responses of the animals kept under such management systems (Ewbank, 1969; Loew, 1972; Duncan, 1974; Kiley-Worthington, 1977; Sambraus, 1981). Some examples of restric-

tive husbandry practices currently in use are listed below:

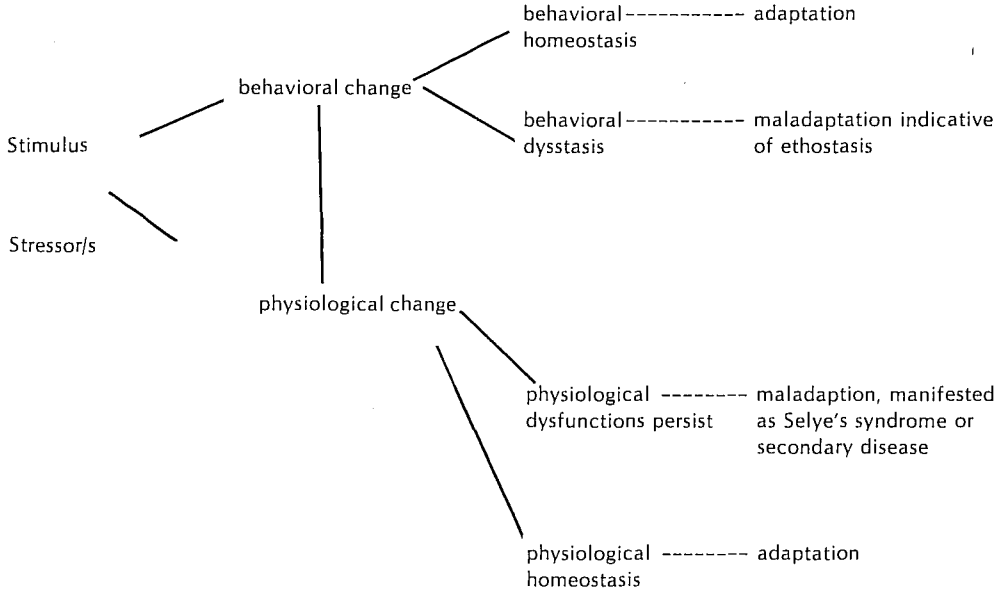
1. Prolonged enclosure within narrow stalls is a common feature in some forms of modern swine husbandry.
2. In association with (1), some swine practices also utilize a chain tether, which affixes a harness around the pig by a chain to a point on the floor.
3. Isolated stalls are used for the husbandry of calves in systems of veal production.
4. The flock densities of birds in enclosure systems now being used for laying hens in the poultry industry have reached an extreme level. Frequently, three birds are contained within one cage of spatial dimensions originally designed for one bird.
5. Fattening swine are frequently held in dense groups during the later stages of their growing periods.
6. Feeding cattle are kept in groups, the densities of which are still increasing.
7. Many dairy cattle operations now keep the animals in an indoor system, with set daily routines of movement from holding quarters to milking quarters and back.
8. Recreational horses are frequently maintained in separate stalls and are not given the same quantity and quality of work and exercise that they were formerly afforded.
9. Sheep are permanently restricted indoors in certain new husbandry systems.

These and many other examples of ethostatic circumstances may not appear to be particularly noxious events but, given frequent repetition over time, they can become significantly stressful (Fox, 1977).

Crowding

When population density reaches a level that produces etho-anomalies, it can be termed *crowding* (Davis, 1971). Even those species of domestic animals

TABLE 2 Possible Consequences of Environmental Stimuli/Stressors



that have become very adaptable to tightly packed conditions have a limited ability to adjust to population densities that are sufficiently high so as to prohibit social hierarchical systems from operating satisfactorily. For example, the form of aggression exhibited between animals to maintain a stable peck-order under lower-density conditions is usually no more than a gesture. But when the subordinate animal does not have adequate space to avoid the aggressor's gesture, the aggressor will begin to display true agonistic behavior. Space is required for avoidance. As soon as injuries result, subordinate animals that are marked by them become subjected to increased aggressive attention. Within a comparatively short time, injuries from agonistic encounters can be found on several of the animals in an affected group.

Observations

Species Forms of Etho-Anomalies

Swine. When confined within stalls such as feeding or farrowing stalls for extended periods of time, swine frequently exhibit anomalous behavior that takes the form of habitual mouthing of stall parts. Confined sows will indulge in chewing upon stall nipple-type automatic waterers for long periods of time. They will also engage in extended bar biting behavior on the metal piping at the front of their stalls. Further, swine crowded in pens will frequently show tail biting.

Cattle. In cattle, numerous forms of anomalous behavior can be seen in those systems of management that feature close confinement. Intersucking behavior can be observed in groups of young calves kept under crowded conditions within pens. Growing calves kept in confinement frequently display excessive self-grooming. They may also lick a pen fixture excessively, forming pools of saliva on the floor beneath such fixtures. Excessive grooming in calves can lead to the formation of hair balls in the alimentary canal, with such clinical consequences as acute obstruction and rumen ulceration.

Another form of anomalous oral behavior has been observed more recently in adult dairy cattle that are closely confined in pens during non-lactating periods. This etho-anomaly appears as "tongue-rolling," which involves extending the tongue and rolling it within the mouth (Fraser, 1980).

"Orthostasis" in calves is a further behavioral problem in which the calf spends a large proportion of its time each day in a static standing position. When newborn calves are confined in isolation, particularly when they are unable to see others and are confined on unsuitable or uncomfortable flooring, the total quantity of time spent each day in lying down is markedly reduced, compared with the norm. Orthostatic calves are subject to fatigue and, in due course, this fatigue predisposes them to neonatal disorders such as diarrhea (Fox, pers. comm., 1981).

Sheep. Among breeding ewes in experimental husbandry systems that involve chronic confinement within rows of pens of limited size, anomalous behavior, in the form of "wool-picking" or "wool-pulling," has been observed. The sheep pull with their mouths on the strands of wool on the backs of the sheep near them. Ultimately, subordinate sheep in the affected group lose their long-fiber wool over the back or even over the entire body (Fig. 1).

Poultry. The anomalous behaviors associated with crowding among poultry have become common knowledge. The principal one is cannibalism, a less drastic form of which is feather-picking. Cannibalism can be seen in adult poultry; it can also be seen in young poultry at the brooding and rearing stages. This behavior pattern has led to the widespread

FIGURE 1 Wool pulling in sheep. The sheep on the left still has its full fleece; that in the center has been almost completely "fleeced"; that on the right is partially fleeced.

and routine debeaking of young birds, which serves to obscure this anomalous behavior. Broiler poultry kept on deep litter may develop serious problems from ingesting large quantities of the litter. Boredom, social facilitation, and nutritional deficiency pica may be involved in this behavior.

Various forms of displacement activities in poultry have also been reported by Duncan and Wood-Gush (1974). These displacement activities, when increased in intensity and incidence, can become etho-anomalies.

Horses. Among domestic animals, the stable vices of horses probably constitute the most well-recognized form of anomalous behavior. These have recently been well reviewed by Houpt (1981). They are understood to be consequences of boredom that result when horses are kept in stables for long periods of time without the provision of adequate exercise or activity. The most common forms of such etho-anomalies include cribbing and wind-sucking. A horse is described as a cribber when it habitually sets its upper incisor teeth on a firm object such as a manger and sucks in air, usually making a characteristic grunting sound at the same time. In time, this aerophagia has a chronic adverse effect on the animal's health. Wind-sucking is simply a form of cribbing in which the horse does not need to bite onto an object while the air is being sucked in.

Weaving in horses is another form of stereotyped behavior. Stereotypes, previously documented by Fox (1971), can become etho-anomalies when their intensity and incidence become excessive. In weaving, the horse rocks from one side to the other. A similar etho-anomaly is stall-walking—when the animal moves back and forth in a repetitive, precise type of movement that usually involves stepping actions of the forefeet. This may be sustained for such long periods of time that the progressive drain on the animal's energy becomes significant. In these cases, the animal's physical condition deteriorates. Another etho-anomaly is commonly known as "sourness." The temperament of a sour horse

deteriorates as it passes feces that contain a significant proportion of undigested material. Then, it will participate only reluctantly in activities for which it has previously been adequately trained.

General Etho-Anomalous Entities

Many of those who are investigating etho-anomalies in farm animals suspect that animal producers are not sufficiently aware that their animals need quality and variety in the environment. Inadequate attention to either of these conditions can increase the stressful character of some forms of controlled environments to the point where etho-anomalies become inevitable. The range of etho-anomalies that can appear in this kind of situation is much greater than those described in the previous section and includes:

Freezing — This indicates tonic immobility or catatonic behavior. It can occasionally be observed in ruminants when an animal has been subjected to aversive stimulation in circumstances from which it is unable to escape. The behavior has various manifestations, but they are all characterized by a generalized hypotonic state that resembles conscious collapse.

Coprophagia — The eating of feces may be normal behavior in very young animals, but not in adults. In adult horses, it is usually observed in individuals that are kept under chronic control and are not provided with adequate exercise or diversionary activities. It occurs, together with "anal massage," in swine kept under intensive husbandry (Sambraus, 1979).

The Orosthenia Syndrome

Mouth-based stereotypies constitute a complex syndrome that covers a variety of manifestations of pathologically excessive mouthing behavior in animals. Several manifestations have already been described by Kiley-Worthington (1977). Most forms of orosthenia are associated with the simultaneous occurrence of chronic control, on the one hand, and hypostimulation (reduced stimulation), on the other. Examples of these kinds of behavior are shown in Table 3.

Discussion

The environmental circumstances, given here as forms of chronic control or chronic restriction, impose two main deficiencies in the physiology of perception, namely, hypostimulation and hypokinesthesia (diminished sense of body movement).

It is important to differentiate between *stimuli* and *stimulation*. Stimuli are perceptible external factors, whereas stimulation is the excitation process that occurs within the sensorium of the perceiving animal. The quantity of stimuli can affect the type of stimulation that results. Stimuli of the same type eventually lose their potential value for further stimulation, but a deficit in one type of stimulus can be compensated by an increase in another, alternative stimulus, *i.e.*, by variability. Stimuli contribute quantitatively to the quality of pooled stimulation through variability. Environmental quality, therefore, can be assessed on the basis of its potential for stimulus variability. In the absence of stimulus variability, it appears that anxious states can become established in an animal. These states then become manifested as etho-anomalies.

Abnormally decreased mobility and abnormally decreased motor function or activity are termed *hypokinesia*. This condition has multiple causes. The critical effect of this state is a marked reduction in the animal's sensation of its own movement.

The various forms of sense organs (in tendons, joints, and muscles) that respond to mechanical action, movement, position, touch, and pressure constitute a major source of the sensory input of animals. Among these kinds of input is gravity, which acts on the body variably, according to its movement and position. The sense of muscular effort that accompanies a voluntary motion of the body is termed kinesthesia. Dysfunctions of the

TABLE 3 Manifestations of Orosthenia Syndrome and Associated Clinical Sequelae

Examples of orosthenia	Clinical sequelae
Crib biting and aerophagia in horses	Deterioration of physical condition; occasional colic
Tail biting in swine	Deterioration of physical condition; abscessed hindquarters
Bar biting in swine	Reduced production and subfertility in sows
Intersucking in calves	Hair ball in calves
Excess grooming in calves	Hair ball in calves
Wool pulling in sheep	Loss of fleece and impairment of physical condition
Tongue rolling in cattle	Unknown—possibly deterioration in physical condition
Feather pecking in poultry	Loss of feather cover; trauma
Excessive water drinking in confined horses, sheep (polydipsia nervosa)	Excessive water intake to 2 to 3 times normal quantity; bloating; possible bowel torsion

sensory system resulting from reduced sensory input are evidently capable of causing adverse effects on environmental mediation, and anomalous forms of behavior are the result.

It is evident that altered behavior is one of the principal dysfunctions revealing stress, as it has been defined here. Altered behavior of this sort is manifested as frank anomalies. While it is generally recognized that stress alters behavior, the precise dose-response relationships remain to be elucidated. Thus, although many environmental features are clearly recognized as evident stressors, others are only putative stressors. This inconclusiveness is due to inadequate study of the subtle dose-responsiveness between stressors and behavior. For examples, noise *per se* is not necessarily a stressor, but an increase in this stimulus, in either volume or duration, will eventually lead to gross behavioral and physiological pathologies (Ekesbo, 1977).

However, we can say that the chronological sequence observed in many of the anomalous conditions described above shows such a close, well-defined temporal relationship between stressor and anomaly that the connection between the two has been clearly demonstrated. Establishing this temporal relationship must be considered a primary requirement for "proving" a cause-and-effect relationship between certain stressors and anomalous responses. It is believed by some investigators that a considerable number of as yet unidentified etho-anomalies still await our recognition, definition, and report (Campbell, 1975).

Conclusion

It is postulated here that behavioral anomalies in animals are products of a phenomenon of ethostasis and that they can be assumed to conform to certain laws.

Five primary postulates concerning etho-anomalies can be stated as follows:

1. Beyond a critical sum, stressors generate forms of anomalous animal behavior that are specific and peculiar in their manifestations.

2. Etho-anomalies characteristically persist once they become established. The frequency of their manifestation is affected by remissions and exacerbations of the associated causal factors.

3. Etho-anomalies are "enzootic" in nature; they are limited to given circumstances and transmissible by mimickry.

4. Anomalous behavior in animals is inconsistent with the attainment of optimum health, welfare, and production.

5. Etho-anomalies constitute *prima facie* evidence of stress in an individual, or within a group of represented animals.

In the final analysis, humane treatment, animal health, and financial profits are more interdependent than they are mutually exclusive (Fraser, 1973). As Brantas (1975) states "Welfare is a relative concept. Profit is a matter related to welfare [cited in Anon., *Poultry Welfare Report,* 1981]. Determining the relationship between welfare and profit is an ethical matter." Applied ethology, in addressing the behavioral needs of the animal that must be taken into consideration to promote optimal health, can create the essential bridge between ethics (and animal rights) and profits.

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Legislation & Regulation

At the end of World War II, there were only 14 zoos in Britain. This number slowly increased throughout the fifties until, in 1961, the number had reached 31. During the next 10 years almost 100 animal collections were added to this figure.

No statute governed the way in which wild animals were kept in captivity, and many proprietors were entirely ignorant of the requirements of the exotic species in their care. Their conduct fell short of overt cruelty and physical neglect, which would have left them amenable to prosecution, but many of the new wave of zoos were really substandard ghettos displaying inadequate standards of welfare, accommodation, and safety. These establishments appeared to exhibit wildlife simply for monetary gain.

Concern about the standards of zoo animal management, accommodation, and public and staff safety grew. By the early seventies, an attempt was made to introduce into Parliament a "Bill to Control Zoological Gardens." This bill was doomed from the outset for, while the better zoos of Britain accepted the idea that some form of control was needed, the commercialized zoos banded together in a concentrated effort to change the proposed legislation. The British government told the zoo world to "get its house in order" and return with concrete proposals, agreeable to all, at a later date.

The issue remained dormant for some years, despite protests from organizations like the RSPCA about the appalling conditions in a number of zoos, until the gauntlet was once again picked up, on this occasion by Lord Craigton, at that time Chairman of the Federation of Zoological Gardens of Great Britain and Ireland. Lord Craigton agreed to draft a bill to license zoos. Over a 2-year period, he consulted with many people in the zoo industry and the animal welfare field. In the winter of 1980 his bill was picked up by John Blackburn, and introduced, with some minor amendments, into the House of Commons.

One of the major stumbling blocks in this proposed piece of legislation was the question of enforcement or, more precisely, who was to be designated as the agent of enforcement? In the United Kingdom, the responsibility for enforcing much legislation devolves upon the local authority, such as the County Council or District Council, and many of the Acts relating to animal welfare legislation fall into this category. In the view of the RSPCA, in certain cases this enforcement has proven to be inadequate. So the RSPCA, and many of Britain's leading zoos, objected strongly to the suggestion that zoos should be inspected by the local authority. They felt that the science of captive animal management had advanced sufficiently in recent years to warrant zoo inspection by experts, and that local authorities were unlikely to have sufficient incentive to consult such experts.

It was also felt that the local authority might well have a personal interest in a zoo in his or her area; for instance, many authorities lease the land to the zoo. Even in those cases where there is no direct financial link between zoo and local authority, it is not uncommon for the council members to look upon the zoo as a free tourist attraction, especially when it is located in a coastal resort. Zoos also generate income: in the U.K. all property owners pay an annual tax to the local authority based on the notional value of the premises. Equally, some zoos felt that they might be subject to unfair restrictions if the council felt hostile to a particular collection. Lord Craigton accepted these points as matters of concern and consulted with the Secretary of State for the Environment. It was subsequently agreed that an independent panel of experts should be established for the purposes of zoo inspection. This panel would be known as the Secretary of State's List.

This new agreement represents an innovation in British legislation. What it

means, in practice, is that although a local authority functions as the licensing body for the purposes of the act and will make inspections of the zoo premises, it is obligated to include, among its inspection team, some members drawn from the Secretary of State's List. This novel provision must be read in conjunction with another significant section, entitled "Secretary of State's Standards," which reads: "After consulting such persons on the list and such other persons as he thinks fit, the Secretary of State may from time to time specify standards of modern zoo practice, that is, standards with respect to the management of zoos and the animals in them." This may seem a somewhat ambiguous statement that implies some degree of circularity. It certainly leaves the details of welfare conditions to be incorporated in a Code of Practice, but it clearly allows room for further maneuver if the legislation fails to improve standards adequately; and it does have the advantage that improvements in standards do not have to be won in Parliament. This is significant.

The Zoo Licensing (no. 2) Bill (as it was called) had a fairly stormy passage through Parliament, and many amendments that the RSPCA had hoped for were lost in the process. However, some progress was realized. A particularly worrying provision that related to the setting up of temporary seaside zoos was successfully removed as a result of Society pressure, and the RSPCA also obtained a tighter definition of what constitutes a zoo, removing one potential loophole involving trade in wild animals. The bill finally became an Act of Parliament on July 27, 1981.

It is therefore apparent why the RSPCA is not entirely satisfied with the completed Act, as there is little in the way of welfare considerations specifically written into it. And it is regrettable that the Act appears to rely solely on good faith; for upon the inspectors' interpretation of the Act, and the standards prescribed by the Code of Practice, will depend the quality of British zoos.

Nonetheless, it would be wrong to condemn this piece of legislation at this early stage. Since the Act was passed by Parliament, there has been consultation with the various bodies concerned with zoos, and a draft Code of Practice has subsequently been submitted to the government department concerned. This code is of a high standard, and if the quality of the inspectors matches it, and the legislation is enforced with vigor, it may well mean an end to the slum zoos of Britain.

At present, the Zoo Licensing Act has not yet been brought into force, pending decisions on the standards to be applied and the membership of the list. Once it is in force, the RSPCA will monitor its effect with interest. If it appears to fail in its objective, namely, an improvement in the welfare of captive animals, the Society will once again focus its attention on legislation, urging an interpretation more favorable to the welfare of zoo animals.

S.A. Ormrod
Chief Wildlife Officer
RSPCA

Current Events

MEETING REPORTS

American Association for Laboratory Animal Science — Annual Meeting

The 33rd Annual Session of AALAS, convened in Washington, DC, was principally concerned with keeping its members up to date on how to run an animal lab, with scant consideration given to the enormous ethical questions related to whether anyone ought to be running a lab at all. Typical sessions in this vein were "Diseases of Rodents and Rabbits"

and "Techniques for Pest Control." But there were several seminars that indicated, by both title and content, that the biomedical establishment is beginning to become aware of animal welfare concerns. Several of these relevant symposia are summarized here.

"Care and Use of Domestic Farm Animals in Research"

With the exception of Bernard Rollin (Colorado State University, Fort Collins) who stressed the innate moral relevance of animal interests and their individual and distinctive natures, one might have concluded from this session that the speakers had met beforehand and agreed to several assumptions about farm animals. First, no one questioned the notion that factory farms are a necessary element in a modern economy. R.L. Preston (Texas Technical University, Lubbock) noted that, since only 3-4 percent of the U.S. population feed the other 97 percent, confinement units are the only way that farmers can meet mass-consumer demands. Second, it was assumed that despite the problems that confinement introduces, it does convey considerable benefits. P.D. Gray (Animal Diseases Research Institute, Ontario, Canada) extolled the advantages of a totally controlled environment and implied that any stress-related problems that may show up in farm animals can be solved simply by a little more thought by any competent engineer. D.L. Brooks (College of Veterinary Medicine, University of California, Davis) offered the oft-repeated sentiment that "the pasture can cause more problems than the feedlot," since pasturing introduces complex problems like mud and weeds.

So when the speakers averred (most notably, Dr. Preston) that the standards used in domestic-animal research ought to be those of a "well-run farm," it could be concluded that they meant a well-run *confinement* operation. R.L. Preston began his talk with a list of eight assumptions, among them: man *does* have dominion over animals; farm animals are very flexible and adaptable; the animals found in a confinement unit today are derived from strains that have already adapted.

Yet evidence of concern about animal welfare did show up in some presentations. In this regard, two discussions demonstrated just how divergent the possible approaches to assessing animal welfare can be. P.J. Matthews (National Animal Disease Center, Ames, IA) outlined an arithmetical scale for determining well-being. In his technique, a list of elements presumed to be easily observable indicators of well-being is drawn up for each species (such as appetite, coat condition, cleanliness), and a score is given for each characteristic, for each animal (3, 2, 1, 0 for good, fair, poor, or negative indications, respectively). The total score provides an overall index of the animal's welfare.

Conversely, R.L. Brooks advocated that empathy be the main ingredient in judging an animal's well-being: "Just look the animal in the eye," he said.

"Current Federal Animal Welfare Policies and Regulations"

The first speaker, Connie Kagan (Cannon House Office Building, Washington, DC) summarized the provisions of H.R. 6928, currently pending legislation for regulating the care of lab animals. The bill's principal provisions include (1) promoting the development of alternative methods to animal tests, (2) mandatory accreditation for all labs, within 10 years, by a recognized agency like AALAC, and (3) a requirement that research proposals make some estimate of the animal stress involved in the study, and justify the necessity for such stress in terms of potential benefit.

She then ticked off the standard arguments advanced against the bill by the scientific community, and gave logical formulations to counter each argument. For example, researchers often claim that legislation isn't necessary, since their own standards are sufficiently high as to make self-regulation at least as effective as regulation by government. Dr. Kagan responded that, if this is true, why should laboratories resist requirements which only ask them to do what they are already doing anyway? In answer to pro-

testations that development of alternatives is expensive, and being done by industry and government already, Dr. Kagan stated that this is true to some extent, but it is also clear that specific legislation and funding would speed the rate of innovation of alternatives immensely and foster broader acceptance of them.

Recent changes in the administration of the Animal Plant and Health Inspection Service were detailed by Arnold Matchett of USDA. In terms of organization, there will now be two Directors under the Deputy Administrator for Animal Health Programs. One of these represents a new position: Director of Animal Care. Animal care staff (except for those in Compliance) will be transferred to the line operation of Veterinary Services, which supervises field enforcement. Compliance will become part of a new overall Compliance section, within the program services staff of Veterinary Services, to be headed up by the Director of Animal Care. In each area office, a veterinary officer will be designated to coordinate animal care activities. Under this new organizational structure, staff will be afforded direct control and communication with field personnel. The staff is also looking at ways to derive maximum benefit from attending veterinarians at registered research facilities, and at ways to ensure that inspections are carried out only by qualified and concerned personnel. Toward this end, a new field manual to assist in making proper inspections is being drafted, and a National Animal Welfare Advisory Board, comprised of representatives from industry, humane groups, dealers, and exhibitors, will be established.

Next, Paul Lepore of the FDA spoke on laboratory practices. His goal, the assurance that all toxicology data related to drugs be valid and reproducible, did mean that some minimal standards for lab animal care would have to be guaranteed, such as sufficient space for each animal, well-managed storage facilities, and adequate cleaning of all areas involved in housing and experiments. He stated that: "I see no conflict between adequate care and welfare, and good toxicology tests, since animals that are handled properly are the best study subjects."

Charles McCarthy of NIH stressed the role of individual responsibility which each laboratory must assume in using animals. Like many speakers at the conference, he referred to the Taub case, and declared that its verdict was "sad but necessary." He viewed the termination of Taub's studies as "a tragic waste." In general, however, he assured the audience that the whole sordid Taub affair represented an extreme rarity in animal care. Yet he did go on at some length about the increasing unease in society, reflected in research institutions, caused by a lack of confidence that current regulations can ensure even an adequate level of care for animals.

"Institutional Animal Care Committee"

Like many discussions that revolve around organizational and bureaucratic matters, the session on animal care committees entailed a good deal of highly abstract (and therefore vague) language, exhortations related to very little (if anything) of substance, and advocacy of a whole range of policies that could only be contradictory if actually put into practice. In short, it was dull. The only items of interest were a presentation on the successful efforts of the Canadian system of voluntary control, by H.C. Rowsell (Canadian Council on Animal Care), successful in part because of its tradition of involvement by the Canadian Federation of Humane Societies, and a discussion by David Phelan (Smith Kline and French Laboratories, Philadelphia), in which industry's distaste for *any* committees was expressed, and sole reliance on the attending veterinarian was proposed as a substitute for the ACC. — *D.H. Murphy*

Symposium on Veterinary Medical Education — Ethical Dimensions

Exploring ethical and value issues in veterinary medicine was the theme of the 8th Symposium on Veterinary Medical Education held on June 28-30, 1982

in Knoxville, TN. Sponsored by the Association of American Veterinary Medical Colleges, American Veterinary Medical Association (AVMA), National Science Foundation, and the University of Tennessee, the meeting was attended by administrators, faculty members, and students from all across North America.

The objective of the symposium was to develop an awareness among veterinary educators of the need to establish formal coursework in the veterinary curriculum that deals with values, ethical considerations, and moral judgments. The breadth of this subject was covered by utilizing speakers from quite diverse backgrounds, in conjunction with a number of different forums to present their material. A journalist, philosophers, academicians, and clinicians from both human and veterinary medicine presented lectures, workshops, clinical grand rounds, panel discussions, and a video vignette.

The symposium addressed the importance of, and the methodology by which, value dimensions can be taught, as well as specific ethical issues that face the profession.

AVMA president Dr. Jacob E. Mosier opened the symposium by stating that "caring is the first concept of this symposium." He discussed the need to teach ethical values as well as develop successful models in the learning process in order to find "new avenues for action."

The forces that induce a reconsideration of the significance of ethics in veterinary medical education were discussed by Dr. Hyram Kitchan, dean of the University of Tennessee Veterinary College. The value of animals is emotionally based, he noted, and also dependent on the nature of the companion animal/human bond. This bond may be the greatest force in changing the veterinary profession, he said. Just as the value placed upon animals in society is increasing, so is the sophistication of medicine and health care, and so the public expects veterinarians to be consumate experts in caring for animals. Referring to specific ethical issues facing the profession. Kitchen stated: "Economics shouldn't be used to maintain production methods, just as anthropomorphical projection should not be used to abolish or change them."

Society's expectations of veterinary medicine were also discussed by Roger Caras, an ABC news correspondent. He expressed concern over the adversary relationship some veterinarians have taken vis-a-vis local humane shelters regarding spay/neuter clinics. He noted that his correspondence over the years indicates that the public expects the veterinarians to know everything about animals, including areas outside the realm of traditional medicine, such as behavior, wildlife, and show animals.

An effective teaching model used at Colorado State University to teach ethics to veterinary students was presented by Dr. Harry Gorman and Bernard Rollin, Ph.D. They developed an antagonist/advocate role-playing session that is designed to contrapose students on the basic ethical issues relevant to veterinary medicine. These exercises challenge students to deal with the controversies they must face within the university, as well as those they will face when in practice, thereby giving them the opportunity to examine the process by which ethical decisions are made. Gorman and Rollin stressed that the simple regurgitation of facts does not facilitate building a code of ethics, and that students need exposure to social and moral issues problem solving, and consideration of nonempirical questions.

Looking to the future of veterinary medicine, Dr. William F. McCulloch of Texas A&M urged that the profession keep up with the public's perceptions of medicine and health care and advocated a more holistic approach. This involves the knowledge and use of ecological principles and the practice of preventive medicine. "Otherwise," he said, "outside forces will continue to have a greater effect on the profession than what we do within it."

Other highlights of the symposium included a survey on student concerns and value issues; clinical grand round case studies involving ethical issues in animal behavior, small- and large-animal medicine, public health and regulatory medicine; and a slide show on art in vet-

erinary medicine by Mariana R. Burt of the Massachusetts SPCA.

Scott Sanderson
School of Veterinary Medicine
University of Minnesota

Colloquium on "The Place of Animals in Religion"

This discussion, held at the University of Denver, September 30-October 1, 1982, was a lively, timely, and informative colloquium. Fresh moral and ethical dimensions, cultural perceptions, and metaphysical constructs were drawn from such diverse sources as Taoism, Judaism, Greco-Roman history, and American Indian anthropology. While no consensus was reached on any topic, minds were opened to new possibilities. The academic rigor and excellent scholarship that was demonstrated during this meeting of diverse minds can give us some hope that some more mature minds and dedicated souls are endeavoring to construct a conceptual and ethical framework to deal with their own existential *angst*, as well as the emotional, social, and economic and environmental ills that afflict civilized society today. But we will still have to be patient. For some minds are still lost in such conceptual games as the meaning and structure of reality; unreconciled, dialectic paradoxes; and the superiority of one conceptual structure or school over another.

Emphasis was, disappointingly, placed more on the environment than on wild and domesticated animals, though recognition was given to the plight of endangered species, whales, and factory-farmed animals. More than one participant expressed concern over the lack of focus on humans, whose psyche inevitably determines how we perceive, treat, and relate to animals and nature, and how we cope with anxiety and our fear of both life and death (fears that even motivate people to hold colloquia such as this, or write materials justifying factory farming, greater spending on military arms, and the stockpiling of nuclear weapons).

Professor Nero may have fiddled while contemporary Rome burned, but some of the fiddling in this symposium should have been heard by all. Sophie Jakowska, of the International Union for the Conservation of Nature & Natural Resources, detailed the more positve environmental stance that the Roman Catholic Church is now taking in Latin America. The paper of Po-Keugn Ip (University of Western Ontario) on "Taoism and the Foundation of Environmental Ethics" ought to be wallpapered throughout the Environmental Protection Agency and Department of the Interior and, for good measure, affixed to the ceilings in Gorshak's and Watt's offices, along with the inspiring paper of Gerard Reed (Point Loma College), "Homily on Black Elk," in which he described the native American environmental ethic.

J. Donald Hughes (University of Denver) exposed the Greek roots of Christianity that led to the "death" of Pan and his subsequent transmutation into a Satanic archetype in his presentation, "Pan: Environmental Ethics in Greek Polytheism." He traced the link between the desacralization of nature and the present state of our relationship with nature and God. Martin LaBar (Central Wesleyan College) examined the text of the Bible in his paper, "A Biblical Perspective on Nonhuman Organisms: Values, Moral Considerability and Moral Agency," to show that the Bible does indicate that animals are morally considerable, and that we as the sole moral agents on earth must realize the spiritual value of considering nature and all creatures morally. Jay McDaniel, Hendrix College, offered "Christianity and the Need for New Vision," and Bernard H. Baumrin (City University of New York) presented "Whose World? — A Jewish View of Man's Place in Nature." It became clear that the Old Testament (before the demise of Pan) reflects a far greater awareness of the sacramental aspects and ecological, ethical responsibilities in the human relationship with the rest of creation than does the New Testament (which is more concerned with how people treat each other).

Professor J. Donald Hughes announced the inception of a new journal, *Environmental Review*, to be published by

the American Society for Environmental History. For more information, write to him at Editorial Offices, *Environmental Review*, University of Denver, Denver, CO 80208.

AALAS—Pound Animal Meeting

For the second year running, the 1982 Annual Conference of the American Association for Laboratory Animal Science (Washington, DC) considered the issue of pound animals. As was pointed out by a member of the audience, the 1982 session covered a lot of the same ground that was covered in 1981, but there were one or two interesting new points raised. Ronald Flatt from Iowa State University told the audience about an agreement worked out with a local humane society in which veterinary students, after some instruction, polish their surgical skills by performing free spay/neuter work for the humane society. He also encouraged other institutions to adopt an open-door policy and noted that Iowa State now has a representative of the local humane society on their animal care committee.

The most disappointing talk was the one that dealt with alternatives to random-source dogs. The analysis of the suitability of different animal models was only superficial, and the speaker descended to the depths of banality when he said "I like to use dogs because I like dogs."

FORTHCOMING MEETINGS

Universities Federation for Animal Welfare and Laboratory Animal Science Association: Joint Symposium on Standards in Laboratory Animal Management, March 30-31, 1983, London, U.K. New U.K. legislation is expected to call for codes of practice on the housing and care of laboratory animals. This symposium will address several questions concerning the content of this legislation: (1) How can the comfort and well-being of laboratory animals be assessed? What are the physiological and behavioral needs of laboratory animals? Can the needs of the animal be compatible with the needs of the animal technician and the animal user? To answer these questions, reports of LASA/UFAW working groups on rats and mice, rabbits and guinea pigs, dogs and cats, and new and old world primates will be presented, as well as presentations by distinguished speakers and related poster sessions. Contact LASA/UFAW Symposium, 8, Hamilton Close, Potters Bar, Herts, EN6 3QD, U.K.

ASTM Committee E-47 on Biological Effects and Environmental Fate: 7th Symposium of Aquatic Toxicology, April 17-19, 1983, Milwaukee, WI. Papers are now being solicited for this meeting in the following subject areas: new methods and concepts for testing and assessing the aquatic hazard of materials (*e.g.*, chemicals, efflents); sublethal effects; bioavailability and recent advances in environmental chemistry; biological and ecological implications of responses of organisms to materials; and lab vs. field—how good is our predictive capability and what confounds extrapolation and assessment *in situ*. Contact Program Chairman, Dr. Rick D. Cardwell, Envirosphere Company, 400 112th Avenue N.E., Bellevue, WA 98004.

Association of Institutes for Tropical Veterinary Medicine: International Conference on Impact of Diseases on Livestock Production, May 9-13, 1983, Kissimmee, FL. Contact Dr. M.J. Burridge, Director, Center for Tropical Animal Health, College of Veterinary Medicine, Box J-136, University of Florida, Gainesville, FL 32610.

Latham Foundation, AVMA, and CVMA: Conference on the People/Animal Bond, June 17-18, 1983, Irvine, CA. Interdisciplinary perspectives on people-animal relationships and environments will comprise the focus of this event. Contact William J. Winchester, DVM, Department of Animal Resources, University of California, Irvine, CA 92717.

Latham Foundation, AVMA, and CVMA: Conference on the People/Animal Bond, University of Minnesota, June 21-22, 1983,

St. Paul, MN. This meeting will also provide a forum for an interdisciplinary discussion of "the bond"; many of the disciplines represented have not previously addressed the topic of human/animal bonding. Contact William J. Winchester, DVM, Department of Animal Resources, University of California, Irvine, CA 92717.

International Council for Laboratory Animal Science: "The Contribution of Laboratory Animals to the Welfare of Man and Animals: Past, Present, and Future," July 31-August 5, 1983, Vancouver, BC, Canada. Topics covered will include: a geographic overview of laboratory animal science; the animal model in gerontological studies; the development, status, and future of international quality in laboratory animals (standardization); and new and future trends in biotechnology. Contact Mr. D. Jol, ICLAS/ CALAS 1983, Box 286, 810 West Broadway, Vancouver, BC, Canada V5Z 1J8.

Australian Society for the Study of Animal Behavior and the Australian Academy of Sciences: 18th International Ethological Conference, August 29-September 6, 1983, Brisbane, Australia. Potential participants are being given early notification for this conference, since this is the first time an International Ethological Conference has been open to all behavioral scientists, and therefore no channels of communication have been established to reach all those who might be interested in attending. The content of the plenary sessions has not yet been determined, and the committee sponsoring the conference would welcome any suggestions on possible session topics. Plenary sessions will be strongly didactic, but will also provide a general overview of recent developments and highlight any problems or controversies. Contact Conference Secretary, Animal Behavior Unit, University of Queensland, St. Lucia, Australia 4067.

IEMT: International Symposium on Pets and Society on the 80th Birthday of Professor Konrad Lorenz, October 17-19, 1983, Vienna, Austria. Contract Secretary, IEMT, Johann-Blobner Gasse 2, A 1120, Vienna, Austria.

ANNOUNCEMENTS

"Psychology Experiments on Animals" from NEAVS

The New England Anti-Vivisection Society has published a concise and lucid summary of the arguments on one side of the debate about whether animals can (or should) serve as suitable models for human psychopathologies. In *Psychology Experiments on Animals*, author Brandon Kuker-Reines traces the development of the idea that animals can substitute for humans from the early days of psychological research. In their efforts to elevate psychology to the status of a true natural science, investigators locked onto the microbiological dictum of Koch's postulates, which state that proof of causation for infectious disease must be obtained in animal models. A second contributing factor to the premise that animal minds can be considered merely as simple analogs of human minds was the later work of Pavlov. Observing that certain sets of experimental conditions made dogs react in frustration by squealing and thrashing about, Pavlov assumed that he had found an animal parallel to human neurosis. In other hypnotized dogs, he thought he recognized the symptoms of schizophrenia.

The author argues that it is the very fact that using animals as models means guessing about which outside manifestations (symptoms) are clues to what's within, so that these symptoms can be duplicated in test animals, that has made psychological studies in animals, at best, simply a waste of time, when "psychologists are not even sure of what behaviors comprise the 'core symptoms' of each type of illness in people" (p. 17).

A set of four criteria, developed by W.E. Bunney, former head of the National Institute of Mental Health, is used as a benchmark for assessing the various animal models of human mental illness. According to the criteria, the animal model and the human illness must have similar causes, symptoms, responses to treatment, and underlying neurobiological mechanisms. The author then examines the current models for several types of illness (schizophrenia, depression, phobia and obsession, etc.) and demonstrates the woeful inadequacy of the animal models for each disease. At the end of the book, Kuker-Reines concludes that the differences between humans and other animals are sufficiently profound as to make any attempts at constructing cross-species analogies about mental pathologies a pointless task.

The book is available from NEAVS, 1 Bulfinch Place, Boston, MA 02114.

Farm Facts

The Farm Animal Care Trust has begun publication of a single-page newsletter, *FACT SHEET* (three-hole punched for inclusion in a binder), on farm animal problems and new husbandry systems to help alleviate the problems. Sample topics covered in recent issues:

- The Globovolg Egg System, a new non-intensive housing design for laying hens that features a central row of nest boxes along the length of the building, with wire floors placed over a manure pit on either side of the nest area. The nest areas are provided with perches, and above the nest boxes is a 5-m-wide platform that also runs the length of the building.
- The dubious nutrional quality of white veal, and some alternatives to special-feed veal operations.
- Antibiotics in animal feed; some statistics on the quantities used annually are given, with a discussion of the wide-ranging adverse effects of overuse of antibiotics, especially the creation of new antibiotic-resistant microbial strains.

To have your name placed on the *FACT SHEET* mailing list, write FACT, Inc., P.O. Box 14599, Chicago, IL 60614.

Anti-Cruelty Statutes, State by State

A useful guide for animal rights advocates, the "Analysis of Anti-Cruelty Statutes in Reference to Exemptions for Experimentation," is a distillation of a research project undertaken by the Society for Animal Rights on how the various state laws deal with animal cruelty in U.S. laboratories. Of the 50 states, 32 have no specific exemptions for research and testing activities, 6 have exemptions for certain research facilities, and the other 12 states grant a total exemption to all research and testing activities. The guide can be obtained from SAR, Inc., 421 South State Street, Clarks Summit, PA 18411.

Pharmaceutical Manufacturers Association Now Favors Modification of the Standard LD50

The PMA represents 149 research-based drug companies that, together, account for most of the new prescription drugs that are developed in the U.S. In October 1982, the PMA issued an official report in which the role of the median lethal dose (LD50) test was reassessed, in light of the real needs of toxicologists and clinical pharmacologists, as well as the actual context of the test: it is but one of a battery of tests used to determine the safety of a new drug.

The report notes that since

> *Scientific needs rarely require an exact value, practices and regulations should be changed to provide the option of obtaining adequate information on the acute toxicity of a drug, with fewer animals than the precise LD50 test demands....Just as meaningful information can be obtained with fewer animals.*

The LD50, the PMA states, also has inherent disadvantages: results are highly susceptible to the vagaries of the many experimental variables involved, and the LD50 value obtained has only limited utility in estimating dose levels for further subacute and chronic studies.

Therefore, the PMA recommends an alternative test procedure, which has been found acceptable to most U.S. regulatory agencies in non-rodents. The PMA group advises that this alternative technique be considered acceptable for tests in rodent species, too. In this technique, test substances are administered to the same small group of animals in increasing doses that are spaced over intervals of 1 to 4 days. The maximal tolerated dose and minimal lethal dose can be determined from the results, and an estimate of the LD50 made as well. At the same time, data can be collected on clinical signs of overdose and organ toxicity.

For a copy of the report, contact Pharmaceutical Manufacturers Association, 1100 15th Street, N.W., Washington, DC 20005.

Book News

The Canadian Seal Hunt: A Moral Issue (proceedings of a symposium sponsored by the Canadian Federation of Humane Societies, Toronto, Canada, 1982). In February of 1982, the CFHS held a conference that attempted to analyze the ethical aspects of sealing in a non-emotional fashion and, as part of this effort, to assess the costs and benefits of the seal hunt to both humans and animals. The published proceedings contains talks on "Moral Concern and the Ecosphere" by John Livingston, "Moral Concern and Animals" by Bernard Rollin, and "Moral Concern and the Harp Seal Hunt" by Wayne Sumner (a revised version of Dr. Sumner's paper appears in this issue of the *Journal*). A verbatim transcript of the panel session that followed the formal papers is also included.

Animals, Nature & Albert Schweitzer, edited with commentary by Ann Cottrell Free (available from and published in part by The Humane Society of the United States, Washington, DC, 1982). The life of Albert Schweitzer—his work, his ideals, and his sentiments on nature and human life—are set forth in this book, which is comprised principally of quotations by Schweitzer himself, with comments by editor Lee interspersed. The book is also a collection of photographs, of Schweitzer and the African people for whom he felt such a strong vocation, as well as the animals and plants with whom he felt so close a bond. Schweitzer's "reverence for life" philosophy emerges as a central theme, as his thoughts on lab animals, meat eating, hunting, falconry, animal rights, and euthanasia are explored.

Trends in Bioassay Methodology: In Vivo, In Vitro, and Mathematical Approaches (proceedings of a symposium sponsored by the National Institutes of Health, U.S. Department of Health and Human Services, NIH Publication No. 82-2382, Bethesda, MD, 1981). In an earlier issue of the *Journal* (2(3):151-156), we reported on an NIH-sponsored conference that was intended to establish the state-of-the-art in alternatives to the use of laboratory animals. The findings of the conference were to be used by Congress as part of the requisite data for an informed hearing on H.R. 4805, the Research Modernization Act, which was first introduced in mid-1979. At about the same time, NIH had begun to study its own procedures and funding mechanisms, to see what sorts of support it was giving to the development of alternatives; the Government Accounting Office, too, had expressed an interest in NIH policy on alternatives. Yet, with all this impetus, the meeting did not take place until February 1981, because of reluctance at NIH to hold any public forum at all on the topic of alternatives.

As detailed in the *Journal*, the symposium that did take place was limited in scope beforehand to the topic of bioassay techniques, on the premise that this area offered some more easily definable parameters on which to base a discussion, such as costs and legal requirements for testing. Now, the published proceedings provides copies of the papers presented and transcripts of the panel discussion sessions. Ironically, many of the papers focus on *animal* models. Some samples: "Animal Methodology for Toxicity Testing," "*In Vitro* and *In Vivo* Systems for Detection and Development of Anticancer Drugs," and "The Use of Chimpanzees in Biomedical Research."

Reckoning with the Beast: Animals, Pain, and Humanity in the Victorian Mind, James Turner (The Johns Hopkins University Press, Baltimore, 1980). "The History of the Victorian Age will never be written: we know too much about it." Or so lamented Lytton Strachey in his preface to *Eminent Victorians*. To explore this "singular epoch," Strachey counseled, the historian must "row out over that great ocean of material, and lower down into it, here and there, a little bucket, which will bring up to the light of day some characteristic specimen, from those far depths, to be examined with a careful curiosity."

In *Reckoning with the Beast*, James Turner dips his bucket into a sea alive with the reform of nineteenth-century manners and mores and brings it up dripping to exercise his particular curiosity upon the origins of the animal welfare movement in England and America. The result is a slender (140 pages of well-written text) but thoroughly documented (38 pages of very interesting notes) examination of the struggles of proper Victorians, both eminent and anonymous, to reconcile the ancient fear of the "animal" in man with the new understanding of man as animal; to accommodate the old spiritualism to the new materialism; to render the new urban — and largely industrial — life as tame as the old rural — and largely agrarian — one; and, ultimately, to proclaim a victor in the pitched battle between Science and Sensibility for control of public policy.

Turner chronicles the simultaneous burgeoning of empathy for the suffering of animals and their use in scientific experimentation. Abetting the inevitable and violent convergence of these two phenomena is the newfound abhorrence of pain: Science begins to learn to alleviate pain; people begin to hate pain as it is no longer an uncontrollable part of life on earth; the new sensitivity to pain in general leads to a revulsion at the pain inflicted by *Homo sapiens* (now, thanks to Science, acknowledged to be a member of the animal kingdom) upon his fellow animals; Science begins to inflict pain upon animals deliberately, in order to learn to alleviate it more effectively. Victorians cling tenaciously to the belief they inherit from the Enlightenment of the perfectibility of man; Science becomes the new vehicle of amelioration; Science's seemingly deliberate cruelty appears to be anything but a sign of an improved human spirit. As if that were not a bucketful already, this ironic drama is played out against the backdrop of the class-conscious doubts and fears of the Industrial Revolution.

Mr. Turner's principal hypothesis is that animal welfare got an early lead in the race for reforms and stayed out in front for much of the century because animal protection, unlike many of the movements to aid various segments of suffering humanity, posed no substantial threat to the established social order. He finds "compassion damned up behind a wall of convention, ideology, and interest." Sailing between the Scylla and Charbydis of "sympathy and social caution," compassionate Victorians could exercise their urge to succor upon the "one wholly acceptable object of benevolence: the suffering beast."

The conflicts of philosophies and desires in *Reckoning* are described in their full complexity; the players are not. The ravenous reader of history, sated upon a particular historian's bill of fare,

wipes his chin and wonders what might have been omitted from the menu. In Turner's case, it would seem that he has omitted any flavoring that would render the early animal welfare advocates—the perfervid antivivisectionists in particular—palatable to modern tastes. Could *all* of the founding mothers and fathers of the Humane Movement have been so unremittingly smug, snobbish, self-righteous, and strident as Turner portrays them?

But if the biographical sketches seem lopsided, Turner does credit Victorian animal protectionists with having "mobilized the humane sensibilities of those among the English and American middle classes too timid to venture into the more controversial efforts to relieve suffering." He acknowledges that the abhorrence of suffering, once learned on animals, bore many fruits in the social reforms that ameliorated conditions for children, laborers, the elderly, and other exploitable segments of society caught in the machinery of changing times. But perhaps the most fruitful legacy bequeathed to the Space Age by Victorian animal lovers was to make of the natural world and human ethics a laminate: the corollary concepts of reverence for life and animal rights. It will devolve to another historian a few generations hence to depict the good, bad, and curious consequences of these notions in the twentieth century. It is to be hoped that this future historian will possess Mr. Turner's articulateness and fidelity to the message of the drama, while at the same time showing just a shade more charity to the actors.

Anna Fesmire

Faith of Our Fathers Dept.

But still another inquiry remains; one often agitated by the more recondite Nantucketers. Whether owing to the almost omniscient look-outs at the mast-heads of the whale-ships, now penetrating even through Behring's straits, and into the remotest secret drawers and lockers of the world; and the thousand harpoons and lances darted along all continental coasts; the moot point is, whether Leviathan can long endure so wide a chase, and so remorseless a havoc; whether he must not at last be exterminated from the waters, and the last whale, like the last man, smoke his last pipe, and then himself evaporate in the final puff.

Comparing the humped herds of whales with the humped herds of buffalo, which, not forty years ago, overspread by tens of thousands the prairies of Illinois and Missouri, and shook their iron manes and scowled with their thunder-clotted brows upon the sites of populous river-capitals, where now the polite broker sells you land at a dollar an inch; in such a comparison an irresistible argument would seem furnished, to show that the hunted whale cannot now escape speedy extinction.

But you must look at this matter in every light. Though so short a period ago—not a good life-time—the census of the buffalo in Illinois exceeded the census of men now in London, and though at the present day not one horn or hoof of them remains in all that region; and though the cause of this wondrous extermination was the spear of man; yet the far different nature of the whale-hunt peremptorily forbids so inglorious an end to the Leviathan. Forty men in one ship hunting the Sperm Whale for forty-eight months think they have done extremely well, and thank God, if at last they carry home the oil of forty fish. Whereas, in the days of the old Canadian and Indian hunters and trappers of the West, when the far west (in whose sunset suns still rise) was a wilderness and a virgin, the same number of moccasined men, for the same number of months, mounted on horse instead of sailing in ships, would have slain not forty, but forty thousand and more buffaloes; a fact that, if need were, could be statistically stated.

Furthermore: concerning these last mentioned Leviathans, they have two firm fortresses, which, in all human probability, will for ever remain impregnable. And as upon the invasion of their valleys, the frosty Swiss have retreated to their mountains; so, hunted from the savannas and glades of the middle seas, the whale-bone whales can at last resort to their Polar citadels, and diving under the ultimate glassy barriers and walls there, come up among icy fields and floes; and in a charmed circle of everlasting December, bid defiance to all pursuit from man.

Wherefore, for all these things, we account the whale immortal in his species, however perishable in his individuality. He swam the seas before the continents broke water; he once swam over the site of the Tuileries, and Windsor Castle, and the Kremlin. In Noah's flood he despised Noah's Ark; and if ever the world is to be again flooded, like the Netherlands, to kill off its rats, then the eternal whale will still survive, and rearing upon the topmost crest of the equatorial flood, spout his frothed defiance to the skies.

Herman Mellville, Moby Dick

INTERNATIONAL JOURNAL FOR THE STUDY OF ANIMAL PROBLEMS

(Volume 3, Numbers 1-4)

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AUTHOR INDEX

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Manuscripts: — including footnotes, references, tables and figure legends — must be typewritten, double-spaced on 8½ x 11 inch bond paper leaving generous margins. Manuscripts must be in English using the preferred spelling in the *Webster's Third International Dictionary*. Submit original and two (2) copies.

Manuscript organization: Title page (pg. 1) containing title of the article (maximum of 48 characters), author(s), affiliation, present address, address where proofs should be sent; Abstract (pg. 2); Text (begin pg. 3), which includes introduction, methods/procedures, results, discussion, conclusion, acknowledgments, references, tables, and figure legends. Special instructions for the copy editor or printer should be affixed on the original copy.

Abbreviations and units: Standard dictionary abbreviations are generally accepted. Other abbreviations should be explained when first mentioned. SI units are preferred.

References: The Harvard System, not a numbering system, should be used for the citation of references in the text, e.g., Jones (1971) or (Jones and Smith, 1971) or (Jones *et al.*, 1971). Where more than one paper by the same author(s) has appeared in one year, the reference should be distinguished by "a," "b," "c," etc. (e.g., 1971a). The list of references should be arranged alphabetically by authors' names and chronologically per author. References cited with "*et al.*" in the text should include *all* authors' names in the reference list.

Titles: Journals should be abbreviated in accordance with the *Chemical Abstract Service Source Index*. References to books/monographs should include editors, edition/volume number, publisher, city and state/country where published and relevant page numbers. A paper in press may be referenced if it has been accepted for publication. References to personal communications and unpublished work are permitted in the text only.

Sample references

Smith, J. (1970) The effect of stress in swine on meat quality. *J Appl Ethol 5*:125-127.

Smith, J. and Jones, S. (1970) *Animals*, 2nd ed., Academic Press, New York, NY, pp. 8-14.

Tables: These should be concise and typed double-spaced throughout.

Figures: Submit 3 sets of glossy prints (no negatives) with identifying arrows and letters contrasting sharply with the background. Indicate on the back the author's name, figure number and "top."

Figure Legends: Captions should contain sufficient information allowing the figure to be clearly understood without reference to the text.

Types of articles: The following requirements are given as a guide only; one double-spaced, typed page contains approximately 250 words.

News and Comment Articles: 1000-2000 words and where necessary, brief references cited, e.g. (*Appl Ethol 10*:111, 1979) in the text.

Review Articles: 5000-8000 words with a comprehensive list of references to be used as source material.

Original Articles: Up to 5000 words or long enough to provide an adequate introduction (stating the objective of the study and why it is considered necessary), description of methods (including an outline on the treatment of the research animals and the number of animals used), and combined results/discussion section. Articles that deal with research involving animals must acknowledge the ethical dimensions of the work; concerning specifics, potential authors may want to consult the editorial office.

Refereeing: Major articles will be subject to refereeing by members of the Editorial Advisory Board and/or other selected experts. Insofar as is possible, both manuscripts and referees' reports will be anonymous.

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