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INSTRUCTIONS TO AUTHORS
Alternatives and Animal Rights: 
A Reply to Maurice Visscher

Andrew N. Rowan, Editor-in-Chief

Many scientists are uneasy about the idea of alternatives to the use of laboratory animals. One reason for their tentativeness could be the vigorous promotion of the alternatives concept by traditional enemies of the biomedical research establishment. As a result, innuendo, misinformation and emotion cloud a rational discussion of the topic. Too many simplistic claims have been made by opponents of biomedical research, but defenders of the present level of animal experimentation are also guilty of overgeneralization and faulty reasoning.

A classic example of such flawed argument, albeit superficially convincing, which is propounded by extreme elements in the research community, can be found in the recent article by Professor Maurice Visscher entitled "Animal Rights and Alternative Methods" (The Pharos [Fall] 11-19, 1979).

The author's first attack is aimed at a statement, attributed to animal liberation philosopher Peter Singer, that it would be no more immoral to perform painful and even lethal experiments on mentally defective human beings than on other animals. This misrepresents Singer's central argument that the criterion of rationality is an insufficient reason for regarding human beings as objects of greater moral concern than animals. Singer reasons that if rationality were to be our criterion for moral concern, then some animals would be included in that universe, or some mentally defective human beings would be excluded. He illustrates the consequences of such logic by arguing that, if we permit experiments on chimpanzees, then we should not object to similar experiments on certain severely mentally deficient human beings. However, Singer argues that rather than diminish the number of living creatures worthy of moral concern, we should expand that number to include many nonhuman species as well.

Visscher also takes exception to Singer's advice to students to refuse participation in animal experiments required for their courses and to demonstrate against those university departments which abuse animals. No doubt such activity would be uncomfortable for both the students and the academic staff, but the freedom to demonstrate in favor of certain moral values is one which Western society takes pains to defend. The forms of protest advocated by Singer are, therefore, legitimate.

Visscher objects to attempts to legislate what he terms "kindness" and argues that "our society" punishes criminal acts but does not "harass law-abiding citizens to prevent them from committing crimes." This is incorrect. Much of the American civil rights legislation attempts to legislate for "desirable" behavior patterns and, therefore, legislating for ethical values is not without precedent.

In October, 1977, the Federation of American Scientists (FAS) issued a report (FAS Public Interest Report 30(8):8, 1977) which was critical of the reactionary attitude of spokesmen for biomedical scientists toward animal welfare questions. The report suggested that a scientific association dedicated to the promotion of animal welfare be formed and, in due course, this suggestion came to fruition with the establishment of the Scientists' Center for Animal Welfare (SCAW). Visscher reacts strongly against the tone of the FAS report and the foundation of
SCAW and alludes darkly to the fact that several of the SCAW founders are British-trained. It is not particularly clear why several of the more prominent scientific representatives on animal welfare issues should either be English or trained in England, but whatever the reason, it provides no sound grounds for insinuating that their arguments are invalid.

Visscher also takes issue with the FAS report’s statement that “it is no longer possible to ignore the fact that animals have mental processes” and argues that, to his knowledge, no biologists have claimed that “lower animals do not have mental processes in varying degrees of development.” This may be so, but biologists have certainly argued that the rudimentary nature of such processes is an important feature in making moral judgments concerning the use of animals in experiments. In an earlier paper, Visscher himself argues that, “the basic justification...for acceptance of the ethic that says it is proper for man to use other animals in decent ways to serve his own purposes, lies in the large gap that exists between man and other beasts with respect to mental capacities.” (M. Visscher, Proc Am Phil Soc 116:157-162, 1972). As argued in the FAS report, recent research on primate (particularly ape) communication has indicated that the gap is by no means as large as was previously believed. Interestingly, Visscher’s argument could conceivably lead to the conclusion that it would be moral to use certain mentally subnormal human beings in “decent” experiments to serve the purpose of those who have vastly greater (i.e., normal) mental capacities.

In general, Visscher’s arguments are based on the age-old tactic of misrepresenting or simplifying the arguments of others in order to destroy their credibility. Recent animal rights arguments are categorized as “superficially more sophisticated” but “simplistic and unrealistically absolutist as, for example, in the naive assertion that ends can never justify means.” The more sophisticated animal rights philosophies do accept that the rights of human beings can sometimes supersede the rights of other animals. Furthermore, several academic philosophers now exploring these questions are attempting to establish ethical guidelines to help researchers decide when the rights of animals can be overridden for the benefit of humanity. Similar problems have arisen in human experimentation. The general consensus now appears to be that such research can be justified, but only when the hazards to the individual are properly explained and where the risks to the individual do not outweigh the possible benefits.

Visscher’s views are no longer (if they ever were) representative of biomedical scientists, and his arguments against scientists establishing dialogue with so-called “emotional advocates” are now beginning to rebound as the subjective basis of and errors in his own statements are pointed out. (For example, a British Prime Minister and the Council of Europe have not called for “absolute bans on certain types of toxicity testing” as claimed in the Pharos article.) Support for the animal liberation movement is, in part, a consequence of the unwillingness of biomedical organizations to accept that there are any abuses of animals in the laboratory and to discuss them in a constructive fashion with animal welfare organizations. There has been a softening of attitude and more dialogue is taking place, but there is still much room for improvement (see Comment by J.R. Lindsey).

Tension between those who conduct animal experiments and those who oppose them will always exist, but there are widespread pressures at the present to redraw the lines governing what is and is not acceptable in animal research. In
contrast to Dr. Visscher, I do not believe that the "future of experimental medicine is in jeopardy" as a result of promotion of the "alternatives" concept. Quite the contrary, full acceptance of "alternatives" could lead to valuable and exciting new perspectives for old problems.

Advocacy, Objectivity and the Draize Test

Peter Singer, Editorial Advisory Board

As Michael Fox and Andrew Rowan made clear in the first issue of this journal, a workable blend of scientific objectivity and humane advocacy must be achieved if the journal is to realize its objectives. The current campaign against the Draize eye test challenges scientists to combine objectivity and advocacy, and provides an opportunity of demonstrating how these often contrasted stances can be united.

Now that more than three hundred organizations have joined the coalition against the Draize test led by New York activist Henry Spira, and full-page advertisements have appeared in the New York Times and other major newspapers, most readers of this journal must be aware of the campaign; but for those that are not, the story can be briefly told. The Draize eye test is the routine use of the eyes of conscious, unanesthetized rabbits to test every substance which may be hazardous to human eyes. The chemical is poured in one eye of each rabbit by pulling the lower lid away from the eyeball to form a cup. The eyes are examined for injury at 1, 24, 48 and 72 hours, and sometimes also after one, two and three weeks. The official U.S. government guide describes some of the reactions as "ulceration of the cornea; opacity of the cornea; inflammation of the iris; hemorrhage; gross destruction." The object of the campaign against this test is to persuade the cosmetics industry to put up one hundredth of one percent of its gross income for a cash program to develop an alternative to the Draize test. (For Revlon, one of the industry leaders, this would mean a tax deductible contribution of $150,000.)

That there is cause here for advocacy on behalf of animals, anyone whose ethical principles extend to nonhuman animals will see at once, but that scientific objectivity can in this context be combined with advocacy may take a moment longer to appreciate.

Scientific objectivity comes into this campaign with respect to three different questions: Is the test painful? Is the test reliable? Is the test unavoidable?

Some scientists will balk at the idea that the pain of a test is a matter for scientific observation. Admittedly, we cannot measure the subjective feeling of pain in rabbits—or in humans, for that matter. But that is no reason to take refuge in behavioristic evasions like describing the rabbits' reactions to having chemicals placed in their eyes as 'aversive behavior.' That animals like rabbits feel pain in these circumstances is not only common sense, it is also the simplest hypothesis which explains the behavior we observe; behavior which includes, as the official Draize test guide notes, squealing, jumping and attempts to escape.

The test is painful. Is it reliable? Carrol S. Weil and Robert A. Scala, writing in Toxicology and Applied Pharmacology (19:276-360, 1971) found considerable var-

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iation in the results reported from different laboratories testing the same substance. In a 1974 court case, the Food and Drug Administration was unable to show that the Draize test was appropriate for evaluating safety, or that the results of tests on the eyes of rabbits can be extrapolated to humans (USA vs. Beacon Castille Shampoo No 71-53, Northern District Court, Ohio). In this situation it is the role of scientists to read the relevant reports and evidence, which are not readily accessible to the general public, and to explain their significance.

Finally, is the test unavoidable? The late Dr. D.H. Smyth, a recent chairman of the British Research Defence Society, and therefore anything but an anti-vivisectionist, wrote in his book Alternatives to Animal Experiments (Scolar Press, London, UK, 1978) that it should not be difficult to find nonanimal alternatives to the Draize test since this is a ‘relatively circumscribed problem.’ Eighteen months ago Henry Spira presented Revlon with a scientific paper by Dr. Leonard Rack on possible leads toward an alternative to the Draize test; more recently Andrew Rowan has outlined further possibilities. Here again is an area in which a scientist, making an objective assessment, seems likely to reach conclusions which will contribute toward the elimination of a major form of animal abuse.

Some scientists may believe that standing up and publicly stating their views on these issues could, in the context of the current campaign, damage their reputation for objectivity among their colleagues and with the public at large. They should reconsider. There is nothing in the notion of scientific objectivity which demands silence when speaking the truth will aid ruthlessly exploited creatures who cannot speak for themselves.

**Draize Test Campaign Update:** As of 22 May 1980, the following developments on the Draize eye test had occurred — either as a result of the current campaign or on the initiative of the companies and agencies concerned.

- The Consumer Product Safety Commission, which is responsible for enforcing the regulations of the Federal Hazardous Substances Act (including a Draize eye irritancy test requirement) has declared a 90-day moratorium on all of its eye irritancy testing while investigations are conducted into the possibility of using local anesthetics to reduce the animals’ suffering.

- The Interagency Research Liaison Group has produced a final document setting out guidelines for acute toxicity testing which include a revised eye irritancy procedure. The test is based on the Draize method, but local anesthetics are permitted if they do not interfere with the evaluation of irritancy.

- On April 25, Avon produced an update on animal testing which included the following points: Avon has not used stocks to hold the rabbits since 1965. Since March of 1980, new guidelines have been in force in Avon’s laboratories which require greater use of local anesthetics and the dilution of test substances. Avon is also studying ways to reduce the overall number of Draize eye irritation tests.
Live Animals in Car Crash Studies

On Sunday, 14 January 1980, an article appeared in The (London) Observer describing the use of human corpses and live primates, pigs and bears in simulated car crashes by the French Organisme nationale de la sécurité routière (ONSER). Three photographs accompanied the article: two depicting human cadavers attached to various devices used to mimic the events of a road accident, and a third showing a clothed, anesthetized bear arranged on a car seat in an upright sitting position with its jaws tied together and a safety belt strapped across its chest.

Approximately one month later, French Transportation Minister Joel Le Theule provisionally suspended all experiments at ONSER involving live animals. A decision on whether to lift the ban or keep it permanently in force is expected to be made in a few months when a parliamentary report on the experiments is issued.

To say that one article in the British press was responsible for this action by the French government would be an oversimplification. However, the Observer piece did serve to activate protest and pressure by directing public attention to a topic which has been ripe for investigation on both scientific and ethical grounds. In fact, this was not the first time that the use of live animals in car crash testing captured public interest. In 1978, a great deal of furor arose over experiments which were being conducted by the University of Michigan Highway Safety Research Institute (HSRI). Funded by the U.S. Department of Transportation’s National Highway Traffic Safety Administration (NHTSA), the HSRI project included a phase in which baboons were to be subjected to terminal “impact sled tests” (simulated car crashes) to measure thoracic injury-response. Local press coverage emphasized the “animal cruelty” aspect of the controversial experiments, but more knowledgeable objections from humane organizations centered on the validity of the baboon and other animals as models for human response; the ramifications of continued importation for research of baboons and other primates; the inconsistency of a moral position which damns the use of human cadavers but accepts the infliction of fatal injury on healthy animals; and the necessity of the experiments themselves.

Researchers performed one test with one baboon and then announced that further tests were unnecessary in light of the data already supplied. Although there was no official acknowledgement of the influence of the coalition of citizens and animal welfare groups known as the Committee to Save the Baboon Seven, Fund for Animals representative Carolyn Smith told The Michigan Daily (7 February 1978): “I have a feeling that if there weren’t a Committee to Save the Baboon Seven, there would be six more baboons on the sleds.” Postscript: The remaining six baboons became part of a terminal experiment on hypertension sponsored by the National Academy of Science and the National Institutes of Health.

Are the recent events in France and the earlier cessation of live ani-
mal crash studies at the University of Michigan simply expressions of governmental and professional anxiety over the bad publicity that can be generated by well-meaning but uninformed humanitarians? The answer is clearly no. Real scientific and ethical ponderables surround this type of research. Yet at the same time, people want the assurance that the cars they drive are engineered for maximum safety. These wishes are translated into government mandates and in the ensuing effort to develop safety standards, it is inevitable that some research will be poorly conceived and/or designed. However, when animal life and, indeed, taxpayer money are involved, there must be a scientifically and ethically acceptable rationale for the research concept as well as for the individual experiment tailored to a particular end.

The scientific rationale for using live animals in car crash studies proceeds from the argument that comparative biomedical and biomechanical data are needed to develop an instrumented dummy, or anthropomorphic test device, which will provide reliable, reproducible information for designing safe cars. The animal studies are thus not really ends in themselves, i.e., they do not supply data which can be readily applied to real situations. Instead, they contribute to a pool of information which is supposed to lead to the perfecting of an experimental subject (the instrumented dummy) which will eventually render the further use of live animals unnecessary.

One might ask at this point why human cadavers do not provide the best data for developing an anthropomorphic test device. The considered expert opinion is that a cadaver cannot equal the response of living tissue. A live, morphologically similar animal will more closely resemble the biomechanics, in terms of tissue injury, of a live human response than will the deteriorated, inert and skeletally weak human corpse. There are also practical considerations involved in using cadavers. For example, the Department of Transportation (DOT) has a mandate to sponsor research on safety standards for children. For obvious reasons, child cadavers are extremely difficult to obtain.

Animals, although preferable to cadavers from the point of view of living versus dead tissues, are variable, and the results they yield are often unreproducible. Also, granted that broad morphological similarities exist between humans and certain other animals, e.g., the thoracic regions of a human and a bear, some scientists feel that the differences are basic enough to negate the usefulness of live animal tissue injury data. Dr. Murray Mackay, head of the accident research unit at Birmingham University (UK), told The Observer: “My own view is that [the ONSER animal studies] are of marginal importance. ...there is not a very precise correlation (between humans and animals) because of basic anatomical differences.” Even researchers who are engaged in car crash testing with live animals point out the problem of extrapolating from their subjects to humans because of structural differences. In a paper entitled “Head Impact Response Comparisons of Human Surrogates” which was presented at the 23rd Stapp Car Crash Conference (October 17-19, 1979, San Diego, CA) and published by the Society of Automotive Engineers (Warrendale, PA), researchers from HSRI stated: “Experimental impact testing of animals, in particular primates, provides basic neurophysiological information related to neuropathology. However, although the primate geometry is most similar to man’s, it is significantly different in anatomic soft tissue distribution and skull morphology. This can present severe problems when scaling the test results to human levels. Ultimately these differences lead to complica-
tions in the very complex phenomena of head injury" (p. 500).

That particular research project was funded privately by the Motor Vehicles Manufacturers Association. At present, public funding in the U.S. of car crash experiments using live animals appears to be limited to one contract awarded by DOT to the Southwest Research Institute (San Antonio, TX). The name of the research project is “Crash Injury Susceptibility of Children Compared to Child Surrogates,” and its long range goal is to develop a 15 kg, 3 year old “advanced child test device,” or child crush dummy. The estimated cost of the project is $602,203. The child surrogates mentioned in the title of the experiment are pigs. According to a statement to DOT from Southwest Research Institute Biomechanics dated 21 December 1979, a live animal surrogate was chosen because a) commercially available child dummies are still too crude; b) availability problems aside, child cadavers have limited application to living tissue response; c) insufficient data exists for computer modeling; and d) field accident data is not very useful because preimpact conditions are unknown.

The memo goes on to mention a table prepared by Southwest for an auto industry sponsor which compared anatomical measurements of a pig, baboon, child cadaver and child dummy. DOT officials refused to release this document when a Freedom of Information request was made because of a claim by Southwest that public access to such information would harm their future business relations with industry. One of the nine exemptions permitted under the Freedom of Information Act applies to “trade secrets and commercial or financial information” which a private citizen or corporation gives to the government with the expectation of confidentiality. The courts have interpreted this to mean that information is to be considered “confidential” only if disclosure would impair the government’s ability to gather information in the future, or (as DOT has agreed to maintain in this case) be likely to cause substantial harm to the concerned party’s competitive position. However, in order to stand up to legal scrutiny, DOT would have to prove rather than merely state that disclosure of the data table would “substantially harm” Southwest’s future chances for bids with industry. Legalities aside, Southwest is not improving public relations by making it difficult to obtain information of considerable public value and in the process raising the suspicions of animal welfare and consumer groups.

The DOT study was motivated in large part by the results of another study using live pigs conducted by Southwest under General Motors (GM) sponsorship. The research was interpreted as showing that an out-of-position child could be severely injured by an inflating air bag during a crash and, therefore, air bags themselves presented a danger unless the child was seated normally at the time of impact. As a result, DOT is now funding Southwest to conduct sled tests using pigs so that the government can make an independent assessment of the findings of the GM-sponsored research. No one can dispute the importance of determining whether GM uncovered some definite and serious defects in the air bag, or were merely reluctant to install the devices, which are much more expensive than passive restraints such as seat belts. However, a source within DOT indicated that a soon to be published DOT semiannual report contained the following statement: “It is important to note that none of the child injuries theorized by GM have been observed in the real world crashes of cars with air bags, and that GM does not know the degree to which the animals it used in its tests are accurate surrogates for small children in its tests [sic].” The report also
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states that other auto companies did use child dummies in the develop-
mental testing of air bag systems.

The French government took ac-
tion in response to public protest over a sector of research for which it was providing funds. The DOT, it seems, wants to avert this kind of situation by building into the bureaucracy a body which would function similar to an NIH peer review committee. The Biomechanics Advisory Committee, chaired by neurosurgeon Ayub K. Ommaya, has thus been set up to oversee DOT-funded research in car crash safety. Still, scientific peer review tends to concentrate on re-
search design and may not always in-
clude an examination of the ethics or even the overall utility of a project. One would be hard pressed to find a researcher in the field of biomech-
anics who would deny that the devel-
opment of safety standards for road vehicles is a complex and often inex-
act process. Given the nature of the task, is the use of live animals provid-
ing a significant enough advancement of knowledge to justify their sacri-
fice? If their use is of marginal value, as some have maintained, why con-
tinue to employ them in research which saps the taxpayers’ money and returns no tangible human benefits and absolutely no benefits for the ani-
mal? It can of course be argued that in science there are no guarantees, and that just because the “perfect dummy” may never be invented, that is no reason to stop trying. Yet can it not be argued with equal force that to place the bulk of public faith in the development of a safer (but never fail-safe) machine may be a misappro-
priation of energy needed to solve what is fundamentally a human and not a mechanical problem?

Crash safety testing is meant to be preventive research in the sense that it seeks to gather information on car crash injuries with the ultimate goal of preventing those injuries. There is, however, a more basic prob-
lem to be considered, namely, the causes of road accidents themselves. At the 1979 Stapp Car Crash Confer-
ence (noted above), R.W. Smith pre-

sent ed a paper entitled “The Response of Unembalmed Cadaveric and Living Cerebral Vessels to Graded Injury — A Pilot Study” which described an ex-
periment in which a 10 gram weight was dropped from various heights onto the exposed brain of a dog in order to measure the response of living cerebral vessels. Experiments such as these are of highly doubtful application to the biomechanical responses of humans in car crash situations. As the experimenter admits: “[The] rela-
tionship between trauma caused by a weight falling directly on exposed brain and that resulting from a blow delivered to the surface of the intact skull remains to be demonstrated. It is not even certain that cerebral corti-
tical contusion can be reproducibly caused by an external blow in a dog” (p. 559). Beyond this, they (and better conceived live animal crash tests as well) add nothing to our knowledge of why people speed, drive drunk and refuse to wear seat belts. Obviously it is naive to assert that the psychologi-
cal elements which contribute to the occurrence of road accidents can be completely researched, thoroughly understood and totally controlled. Biomechanical research aimed at in-
jury prevention is as necessary as psy-
chological and sociological research into the human factor in auto crashes. As to whether live animals should be or even have to be used in such research, one New Scientist columnist offered the following sardonic answer (85:544, 1980): “The animals are anesthetized and they don’t know what is happening to them. So that makes it all right. I mean, aren’t human beings the lords of all the Earth? Any treatment of animals is justified if it helps us to dash about in cars and pile them up with less risk of damage to ourselves.”

Nancy Heneson
Legal Rights of Animals in the U.S.A.

The legal rights of animals as expressed in the law of the United States of America are presented together with a discussion of state laws, acts of Congress, and court action resulting therefrom. A list of pending bills is included and controversial areas in which final decisions have not yet crystallized into legal form are summarized. Rights well-defined in law (although not every right applies to every group of animals) begin with: (1) the right of species to exist; endangered species are protected against killing, and the law calls for preservation of critical habitat; (2) the right of individual animals to protection against cruelty, torture, torment and unnecessary killing or mutilation; (3) the right to necessary food, water and shelter which cannot be abrogated by abandoning a dependent animal; (4) the right to a painless death; (5) a qualified right to pain-relieving drugs; (6) the right to safe transport; (7) the right to protection from sadistic exploitation in animal fighting ventures. Failure of the law in the U.S.A. to mandate all basic animal rights is discussed—C. Stevens. (Abstract reprinted from Anim Regul Stud 2:93-101, 1979.)

Pharmacology of Succinylcholine

Succinylcholine (SCh) is a neuromuscular blocking agent whose muscle relaxant action can lead ultimately to death from hypoxia induced by peripheral respiratory paralysis. Succinylcholine chloride, also known as Anectine, Quelicin Chloride, Scholine Chloride, Sucostrin Chloride and U-Tha-Sol, has been used as a method of euthanasia for pets and racehorses suffering on-track breakdowns. Because the action of the drug has virtually no effect on the central nervous system, injected animals remain conscious though paralyzed, and thus they are unable to exhibit signs of pain or distress.

A recent report in JAVMA (176: 646-647, 1980) on the clinical pharmacology of succinylcholine states that the only proper use of the drug is as an assisting muscle relaxer to facilitate surgical manipulations: "Succinylcholine has no sedative, narcotic or analgesic properties. Therefore, it should not be used as an anesthetic agent or as a restraint agent for surgical procedures in nonanesthetized patients. Its use for euthanasia is strongly condemned. Because SCh depresses respiratory muscle function at all clinically useful doses, its use should be restricted to mechanically ventilated patients. Succinylcholine is a useful, safe anesthetic adjunct for inducing muscle relaxation in anesthetized mechanically ventilated patients."

USDA Licenses Vaccine for Canine Parvovirus

A vaccine has been licensed by the U.S. Department of Agriculture (USDA) for the prevention of a canine disease that has recently broken out in New York City and along the Eastern seaboard.

Dellen Laboratories of Omaha, Nebraska, was issued the first license
on February 6, 1980 to produce and distribute a vaccine for canine parvovirus.

According to Pierre Chaloux, Deputy Administrator of the USDA’s Animal and Plant Health Inspection Service (APHIS), parvovirus infections in dogs are usually characterized by severe diarrhea and dehydration, loss of appetite, vomiting, high temperature, and low leukocyte count.

Canine parvovirus is contagious and usually spreads quickly in dog colonies, kennels, and in situations where dog-to-dog contact is prevalent. The virus is often transmitted by ingestion of dog feces and is believed to be a mutant form of the virus responsible for feline panleukopenia.

The infection, which was unknown until the latter part of 1978, has been reported in all areas of the U.S., and also in Australia and the U.K.

LABORATORY ANIMALS

Exercise Cage for Rhesus Monkeys

Monkeys are highly social animals, but standard laboratory cages do not take this into account—usually because of lack of funds and space. In Switzerland, Dr. J. Jaekel at Ciba-Geigy has developed a ‘play’ cage in which groups of monkeys are allowed to exercise for a certain period every day. Recently, an article appeared in Laboratory Primate Newsletter 19(1): 3-5, 1980 describing the development of an exercise cage at Alabama’s Auburn University and the author’s experience with the device.

The cage at Auburn is 2.1 x 2.7 x 2.1 meters in size. A mobile wall is constructed on one side opposite a guillotine door and entrance runway so that recalcitrant animals can be forced to leave if necessary. However, the animals can be trained to exit with only minimal prompting. The exercise cage was used on a daily basis with a group of ten rhesus monkeys, and a majority of the animals were trained to exit without recourse to the mobile wall. (Dr. Jaekel had a similar experience in his facility.) With sufficient assistance, each animal could be allowed at least an hour in the cage, five days a week, and compatible monkeys could be exercised together.

CKC Moves to Ban Laboratory Breeders

A recent decision by the Canadian Kennel Club (CKC) to pass a by-law amendment prohibiting membership to any person, party or company supplying animals for experimental purposes is encountering strong opposition from the biomedical research and teaching community. The Canadian Veterinary Medical Association and the deans of the Canadian veterinary colleges have expressed support for a protest of the amendment, which is awaiting ratification by the Minister of Agriculture. In the United States, the National Society for Medical Research (NSMR) has voiced its fear to Canadian authorities that “if this travesty[the CKC proposal] were allowed to be adopted, it could have a serious and undesirable impact internationally on biomedical research” (NSMR Bulletin 31:3, 1980).

According to an editorial in Dogs in Canada (71:5, 1980), the move to ban breeders and sellers of laboratory dogs from the CKC was motivated by “a deep love and respect for dogs.” The editorial also states that although animal experimentation can be expected to be tolerated and even supported by society in general until suitable alternatives are found, dog breeders, “...whose lives are dedicated to the betterment and protection of those creatures they are responsible for bringing into this life,” cannot condone the involvement of fellow breeders in supplying dogs for research.

The use of pure-bred dogs for biomedical experimentation has tra-
ditionally been defended on the grounds that in contrast to random source animals, animals of standard genotype and known medical history make better research subjects. A major pitfall in animal experimentation is the presence of pathogenic organisms in laboratory animal colonies, which leads to outbreaks of disease and subsequent severe financial losses. However, subclinical diseases, commonly found in random source animals, can be much more insidious, sometimes contributing to incorrect interpretation of experimental results (New Scientist 73:130-131, 1977).

Although dogs bred for the laboratory are initially much more expensive than dogs obtained from pounds, the latter may have lower survival rates after surgical procedures, necessitating the use of more animals. Dr. Michael Festing (Laboratory Animals Centre, UK) has illustrated this problem by referring to an American study in which 93% of laboratory-bred Labradors survived experimental open heart surgery compared to 73% of healthy 'conditioned' pound dogs (New Scientist 73:130-131, 1977).

Researchers appreciate the long-term scientific and economic benefits of using pure-bred animals, but they by no means form a united front against the use of random source animals, particularly in the case of acute nonsurvival studies, where death may occur under less stressful conditions than it would in a pound. Thus, when a measure was passed on 22 April 1980 by the Connecticut State Senate prohibiting the sale, disposition and use of impounded dogs for medical research, it was a decision made in spite of the claims of researchers that their work would suffer if pound animals became unavailable. Public pressure, in the form of letters (one senator received over 600), petitions and telephone calls, exerted a great deal of influence on the legislature. In New York last June, similar action led to the repeal of the Metcalf-Hatch Act, which required taxpayer-supported shelters to supply state laboratories and medical schools with animals for experimental purposes.

FARM ANIMALS

Battery Hen Welfare

According to a report in Feedstuffs (April 7, 1980, p. 19), entomologist R.D. Hall (University of Missouri) presented the following observations at the Midwest Poultry Federation’s annual convention: The Northern fowl mite, Ornithonyssus sylviarum, is a common external parasite infecting cage-housed layer hens and has a significant impact on their productivity and welfare. Dr. Hall emphasized that the battery cage method of husbandry tends to intensify this problem because a) de-beaking reduces preening substantially; b) cage confinement of hens eliminates dustbathing opportunities; and c) although susceptibility to mites varies among individual hens according to breed, birds selected for cage environments are more susceptible than others.

Hall went on to point out that the indiscriminate use of acaricides may result in excessive residues in eggs and meat and health hazards to industry workers.

Intensive Livestock Production: “Costs Exceed Benefits”

A number of arguments to support the thesis that the costs to society of intensive animal production exceed the benefits have been presented by P.G.C. Dunn (Vet Rec 106:6, 1980). Particular concerns include overstocking to increase productivity with market-price fluctuations, greater disease incidence and need for drugs and loss of rural labor and its replacement with energy-consuming machinery. Dunn also states: “By tolerating such practices [of ‘factory’
farming we support a system of animal agriculture which is immoral," and that "Society is paying heavily for it in terms of unemployment, animal welfare, drug abuse, environmental pollution, etc. It is time that we looked at the structure as a whole and stopped applying sticking plasters to the cracks appearing on the surface." He concludes that while one cannot blame the individual farmer or veterinarian for these developments, the system can only be changed by collective action such as the government laying down firm guidelines as to what are acceptable husbandry practices and also providing a "farm labor subsidy" which would allow farmers to utilize human labor and enable them to adjust gradually to more appropriate systems of livestock production.

Abstract: Jewish Attitude Toward Slaughter
The relationship of man to animal in Jewish literature is discussed in this paper. A person may kill an animal for food consumption, but whether such killing is a necessary evil or a good thing in itself remains open. Life is sacred. All the laws of Jewish religion are pushed aside if human life is in danger, with only three exceptions. The taking of an animal's life involves responsibility.

Killing animals for human need is allowed according to Jewish law. This covers the acquisition of other products from the animal, as well as animal experimentation. On the other hand, causing pain to the animal for play or sport, (hunting, etc.) is not permitted.

Many Jewish laws are described which were formulated only to save animals from cruelty. People should behave in as humane a manner toward their animals as possible.

There are many restrictions in the Jewish religion concerning meat consumption. If these restrictions were not intended to prevent man from using the animal for food, then they show man that an animal is a living being, and taking its life in order to feed man should not be done without thinking about it— I.M. Levinger. (Abstract reprinted from Anim Regul Stud 2:103-109, 1979.)

Abstract: Influence of Kosher Slaughter on Blood Supply and Nervous System
Schechita, the Jewish method of slaughtering animals for food, must be carried out on a living and healthy animal. During schechita the soft parts of the neck, including trachea, oesophagus, carotid arteries and jugular veins are severed. The spinal cord and its circulation remain intact.

The main blood supply to the brain comes through the internal maxillary artery. During ligation of the carotids an anastomosis through the occipital artery and the vertebral one permits the blood flow through the vertebrals into the carotids and thus the blood reaches the brain. If both carotids and occipital arteries are ligated the brain receives no arterial blood supply, and the animal dies.

Immediately after shechita blood pressure falls rapidly and no blood flow can be measured in the internal maxillary artery. Therefore no further blood reaches the brain at that time. The pressure in the brain drops even more rapidly than in the maxillary artery, due to the venous outflow which is not replaced by arterial supply. This fact causes an immediate shock in the slaughtered animal.

The functioning of the brain is very rapidly reduced, for immediately after the cut the electroencephalographic recording loses its characteristic form.

The perception of pain is greatly reduced by a clean cut and by the distraction of the animal. It is very difficult to determine exactly the pain perception of animals. One of
the best methods is the registration of electroencephalography. Stimulations which cause pain under normal conditions could not be characterized in the recording if given after shechita. Accordingly it is assumed that the perception of pain stimuli disappears immediately after the cut.

The equilibrium center loses its normal function within 8-10 seconds. The corneal reflex shows individual variation, but generally disappears in cattle later than in small ruminants. Immediately after shechita, there is a motor resting phase followed by strong muscular (reflectoric) activity.

Shechita can be classified as a good slaughter method under the conditions that it is performed by a trained person with suitable sharp and long enough instruments and that there are no difficulties in performing the cut— I.M. Levinger. (Abstract reprinted from Anim Regul Stud 2:111-126, 1979.)

WILDLIFE

Abstract: International Ivory Trade

The international trade in ivory in the nineteen-seventies is described using data published by government statistical offices. Hong Kong and Japan are the main centers of this trade, for both raw and carved ivory. The main exporting countries in 1976 and 1977 were Kenya, Zaire and Uganda, and it is estimated that ivory from over 130,000 elephants entered world trade during 1976 and 1977.

The price of ivory increased dramatically in the early nineteen-seventies, as did the quantity of ivory involved in the trade. This is illustrated by the increases in volume and value of Japan's ivory imports over this period. The high price of ivory led to large-scale poaching and illegal trading. Discrepancies between official export figures for African countries and official import figures for countries in the Far East and Europe indicate the scale of the illegal trade.

Although many countries have introduced legislation concerning the ivory trade, several major consumer countries still exert no controls and thus keep the market open. Work by the IUCN/SSC Elephant Group has shown that the ivory trade has been an important factor in the decline of elephant populations in many parts of Africa. It is suggested that effective control of the trade could provide a valuable source of revenue for many developing African countries— S.M. Wells and J.A. Burton. (Abstract reprinted from Anim Regul Stud 2:75-91, 1979.)

Environmental Hazards Posed by Exotic Fish

"Released by accident, ignorance, or well-meant efforts to solve environmental problems and develop new game fish," exotic fish have become a major source of biological pollution, according to a Department of Interior (DOI) news release dated 7 April 1980. A recent survey contracted by the U.S. Fish and Wildlife Service's National Fishery Research Laboratory (Gainesville, FL) reveals that 84 exotic fish species have been found in U.S. waters. Of these, 39 species have established breeding populations, with eight showing rapid or major expansion over the past six years. Only one species, the European brown trout, is considered by the U.S. Fish and Wildlife Service to represent a beneficial introduction by virtue of its popularity with U.S. game fishermen.

Although the Service acknowledged the survey's warning that "some foreign fishes are cause for serious concern," the agency plans to pursue a policy of "intensive research" on the harmful effects of imports on U.S. water systems rather than stopping further introduction of exotics. Some wildlife biologists view the execution of this policy as a mon-
One example of the long-term problems associated with introducing nonindigenous fish is the case of the common carp, imported in the early 1800's by a Nevada game commissioner and stocked in the state's local streams. The carp, unencumbered by its native predators, acclimatized quickly and began spawning and feeding in the surrounding streams and lakes to the detriment of indigenous fish and vegetation. Compensation was not forthcoming on any level as the carp did not prove popular for eating (it had been touted as a superb tasting fish), or for sport. According to Dr. George Laycock, author of Alien Animals, "...the carp is so entrenched that even today there is little hope of eradicating it, despite continuing research management efforts." Indeed, the U.S. government spends millions annually in attempts to keep the carp under control.

More recently, the grass carp was introduced from the Orient into several states by federal, state and private agencies on an experimental basis for aquatic vegetation control. The grass carp is now present in at least 34 states, and as the DOI notes, "...this effective forager is established in the central Mississippi River area and may have a severe impact on migratory waterfowl and/or the river's commercial fisheries that rely on wetland vegetation." Dr. Laycock reports that as late as 1978, the Ohio Division of Wildlife was experimenting with a new variety of grass carp to see if it could free hatchery ponds of the algae that choke them in the summer months. Nine years earlier, at a Conference on Exotic Fishes and Related Problems held in Washington, DC by the Sport Fisheries Institute and sponsored by the American Society of Ichthyologists and Herpetologists, professionals pleaded for serious research on the grass carp prior to any additional stocking.

Aquarium species are also becoming a priority concern. In 1979 alone, the U.S. imported 130 million fish, primarily aquarium specimens for the pet trade. Among these are piranha, the small carnivores that have been known on occasion to attack livestock and humans. At present, there are no established piranha populations in U.S. waters. However, released "pets" have been found in Michigan, Ohio, Pennsylvania and Florida, where a gravid female red-bellied piranha appeared last spring in a Boca Raton swimming hole. The DOI mentions that it is against most state laws to dump exotic species into open waters, but goes on to say that "...some misguided owners do so rather than destroy their pets."

In 1965 or 1966, the walking catfish, a native of Southeast Asia, escaped from an aquarium fish farm in Florida where it was being held as brood stock. Now, notes the DOI, "...it is considered one of the most harmful introductions in North America. This airbreathing fish 'walks' overland on its pectoral fins to invade new river systems, sometimes stopping traffic as hoards wriggle across highways. It has a voracious appetite and competes with natives like the large-mouth bass and bluegill in freshwater communities."

The Gainesville survey offers a substantial amount of data to support a causal connection between the introduction of foreign fish and critical, sometimes nearly uncontrollable environmental hazards. As Dr. James A. McCann, Director of the National Fishery Research Laboratory, stated: "[New foreign fish species] may prey on native fish, compete for food, hybridize, carry new parasites and disease, and alter the natural environment so that native species cannot thrive. Some species pose a direct danger to humans."
The practice of mulesing sheep to prevent blowfly strike has recently come under fire from the Animal Liberation movement in Australia. Although it is only one of the many issues which Animal Lib has raised in its campaign to reform various sectors of the livestock industry, it is particularly illustrative of the kinds of conflicts in world view which arise when animal rights activists turn the spotlight on the farming establishment. Spokesmen for the livestock industries are quick to stress the emotional and sometimes sensational portrayal by Animal Libbers of time-honored animal management practices, as well as the sinister role of the urban press. Animal Libbers, on the other hand, profess a desire to reach a reasonable compromise with the farming community while at the same time proposing legislation which could have serious economic repercussions for the farmer and the consumer. Both sides offer valid arguments, but the debate is often frustrated by a mutual lack of sensitivity and an incomplete understanding of the context in which the other group is operating. Issues which combine economics, social attitudes, ethics and politics are seldom, if ever, clear-cut. Sheep mulesing as it is presently practiced constitutes an animal welfare problem, but it is a problem which is tightly interwoven with the sturdy threads of rural tradition and economic benefit.

Why is Mulesing Practiced?

Mulesing is an operation in which sections of skin as wide as 164 mm and as deep as 94 mm are cut from the buttocks and tail of unanesthetized lambs, usually at marking (2-10 weeks) or weaning (4-5 months). These areas are stripped to avoid fly and maggot infestation (breechstrike) which can occur in the moist, wool-covered skin folds of the sheep.

John Newman, President of the Sheepmeats Council in Australia, stated in National Farmer (November 29, 1979) that mulesing “if well-done is a rapid operation, but [it] inflicts pain. But it protects sheep from blowfly strike, which is very painful.” Translated into the language of animal welfare, this statement argues that greater cruelty attaches to leaving sheep unprotected from breechstrike than to subjecting them to a painful but relatively short-lived preventive procedure. If this were the whole story, there would probably not be much resistance to Animal Lib’s call for a safe and humane alternative to mulesing. However, as stated by the New South Wales Department of Agriculture (Agr Gazette 83:146-147, 1972), mulesing offers additional economic advantages, such as less stained wool and easier mating, lambing and crutching, which can hardly be overlooked in a nation whose live sheep industry yields in the area of $100 million per year. One begins to see why it is no simple task to gather the resources to develop an alternative and then attempt to introduce it into a farming community which views
mulesing as economically sound and ethically defensible. This situation certainly does not mean that the possibility of reform should be dismissed, but it does demonstrate the need for impartial research into the development of other methods which would eliminate or reduce the animals' pain and satisfy the economic requirements of the producer. One way to start is to look at circumstances in another part of the world where sheep are raised without mulesing.

In the southwestern United States, blowfly strike is not as serious a problem as in Australia, but it is still a source of concern to wool growers. When blowflies do strike, an untreated animal usually dies within a short time. Treatment in both the United States and Australia consists of shearing the infested area and applying any of a wide range of insecticides. However, in contrast to mulesing, which is a one-time procedure with permanent results, preventive measures in the US are confined to crutching (annual shearing of the vaginal area) and shearing in the spring, before the wet season. Dr. Maurice Shelton (Texas A&M University) stated that in addition to these routine measures, a stockman might jet spray his sheep with an insecticide if they habitually walk through tall and dewy grass.

It would thus seem that less radical husbandry practices could serve the same purpose as mulesing. Still, Australia represents a special case. The species of blowfly there is resistant to most organophosphate insecticides. There is also a preference for raising Merino sheep, a breed with high wool yield and loose, wrinkled skin which makes the animal very susceptible to breechstrike.

**Possible Solutions**

Dr. Shelton has pointed out that in the United States, sheep are bred for smoother skin: the less breech wrinkle, the less chance for blowfly infestation. A possible solution to the problem of mulesing is widespread introduction of a breed to Australian producers which combines rapid wool growth with relatively smooth skin. The Rambouillet breed, which is in fact derived from the Merino, already has these characteristics.

Prevention through breeding improvement, without sacrificing either productivity or humane treatment, is an elegant solution in the long term, but the question remains of whether the mulesing operation, which is much more effective than insecticide sprays in Australia, can be modified now to eliminate unnecessary animal suffering and pain.

Traditionally, many livestock operations (castration, dehorning, debeaking, tail docking) have been performed without anesthesia. General or even epidural anesthesia does carry a certain mortality risk which may exceed the risk associated with the operation itself. In livestock production, where economic considerations are constantly influencing standards and practices, anesthetics may represent an additional financial burden to the producer. However, there may be some promise in the idea of developing an inexpensive topical anesthetic which could be incorporated into the mulesing procedure. The Australian Bureau of Animal Health has indicated its willingness to support animal welfare research. Providing the funds for a feasibility study of field anesthesia for mulesing would be one effective way of expressing this support.

Obviously, any attempt to work within the system on mulesing or other animal welfare issues results in compromises which are unacceptable to the
N. Heneson

Comment

philosophical purists, whether their philosophy falls to the left of Animal Liberation or to the right of the hard-core dominionist. However, those who are most directly affected by the changes wrought from the debate between industry and the champions of reform are the farmer, the consumer and the animals themselves. When the needs of more than one group are taken into account, compromise is the most likely outcome.

The farmer may understand his or her animals better than the animal rights philosophers, the animal welfare lobbyist, or the managers of corporate agribusiness. Yet such familiarity with the object of concern does not necessarily imply that other sectors of society should have little or no part in trying to resolve the larger ethical questions of animal exploitation. Animal Lib may not have all the answers, but that does not preclude its ability to serve as a societal watchdog. In order to have maximum impact, however, its efforts must be backed up by data from applied animal welfare science as well as a thorough understanding of the economic arguments of producers and other representatives of the livestock industry. As stated by Wal Shaw, President of the Australian Broiler Growers Council, in an interview with National Farmer (November 29, 1979): “The Animal Lib stir has caused us to look at ourselves — and that’s not a bad thing at all.”

The Ministry of Agriculture’s Involvement With Animal Welfare

Roy Moss

The following is excerpted from a paper presented by Mr. Moss, Regional Veterinary Officer in the British Ministry of Agriculture, Fisheries and Food, at the British Veterinary Association Annual Congress, September 9-14, 1979, Aberdeen, Scotland.

Keeping livestock healthy is primarily the responsibility of owners. Indeed, if they did not do so they would certainly not make a profit. Advice on the prevention, treatment and possible cure of disease is the responsibility of the veterinary surgeon. Prevention of physical damage to animals and their adoption of abnormal behavior caused by confinement which prevents them from exercising their inherited behavioral patterns is the joint responsibility of the ethologist, the technologist who designs the confinement system and ancillary equipment, the livestock husbandry specialist, the veterinary surgeon and the owner. If society also decides that there is a need for enforcement of measures to make such responsibilities compulsory, then it is for governments to make the political decision to do so and to enact legislation on animal protection.
Following consideration of the report of the Brambell Committee, the British government in 1968 took powers under Part I of the Agriculture (Miscellaneous Provisions) Act 1968 to prevent the infliction of unnecessary pain or unnecessary distress to livestock on agricultural land; to make regulations with respect to the welfare of such livestock where such a course was considered appropriate; and to prepare codes of recommendations for the welfare of livestock and to “spend such sums as he (the Minister) thinks fit on the giving of advice, free of charge, to persons concerned with livestock on matters relating to the welfare of livestock.”

Thus it was that the State Veterinary Service (SYS) was given responsibilities for the surveillance of the welfare of livestock kept for farming purposes.

In addition to economic pressures, the virtual eradication of such diseases as tuberculosis and the complete eradication of others, e.g., swine fever, has encouraged livestock owners to invest with greater confidence in larger individual livestock units or complexes of such units. These intensive systems are characterized by more animals per unit, less space per animal and mechanical equipment replacing some of the personnel attending to the animals. One man is thus enabled to look after very many animals. We must never forget the importance of that man, the stockman. His competence with and sympathy for his livestock is crucial for their well being. Paradoxically that very confidence to enlarge has meant that today the size of individual units with high stocking densities under systems of intensive management presents problems of entirely different dimensions than in the past in both the disease and welfare context.

There are aspects of certain husbandry systems which to some observers come very close to the dividing line between necessary pain and distress and that which can be described as unnecessary, if the infliction of pain and distress can ever be described as wholly necessary except in very well defined circumstances. It is in this area that most of the problems for the SYS arise, particularly in the determination of whether or not unnecessary pain or distress is being caused.

The philosophy of the SYS approach to livestock inspection is two-fold. First, we believe that animal welfare is inseparable from the majority, if not all, of our work with domestic farm livestock. Indeed as veterinary surgeons, we take an oath “that my constant endeavor will be to the welfare of animals committed to my care.” Second, we believe that prosecution under the 1968 Act should be used as a last resort when all else has failed. That is why since 1968 there have been few prosecutions. We try first of all to be advisers and in advising we seek the help of the owner’s own veterinary surgeon and other colleagues in the Agricultural Development and Advisory Service (ADAS) such as the environmental specialists, the nutritionists, and the surveyors, all of whom are always willing to cooperate.

The specific welfare content of our efforts to achieve these objectives can be divided into two separate parts:

i. “Police” action which is taken in response to the discovery of adverse welfare conditions found at routine inspections or following the investigation of complaints;

ii. The promotion of positive health which can, I believe, be considered to be the study of the relationship between particular systems of animal husbandry and management standards and the need to improve
(or maintain) productivity. However, before we can hope to satisfactorily discharge these responsibilities to both the animal and the agricultural industry, thereby promoting and maintaining a healthy profitable livestock enterprise on the farm, we need continuously to seek information on the range of normal behavior in all the species of domesticated farm livestock so that we can advise on the design of systems, particularly intensive systems, that will not lead to stress, frustration, or abnormal behavior, for this not only antagonizes certain sections of the general public but also leads to predisposition to disease and to loss in productivity and profitability.

In making these evaluations let us not forget the recommendations of the Brambell Committee which said quite categorically that animals should be provided with a husbandry system appropriate to their health and behavioral needs.

The Brambell Committee also recognized that each system of husbandry has its own hazards which must be evaluated and in that statement they included systems of extensive husbandry. The Committee also believed that if the above principles were applied to intensive husbandry methods the use of such methods should not in themselves be regarded as objectionable and may even often benefit the animals.

Careful observation is a basic and most important tool of our discipline. Knowledge of the range of normal behavior within our domesticated farm livestock species has many gaps. I would like to think that all of us who visit farms on a regular basis or who undertake projects with livestock could record basic aspects of behavior so that the bank of information is increased, thereby improving the quality of the advice that can be given.

More information allows more meaningful advice to be given to Ministers through the Farm Animal Welfare Advisory Committee (FAWAC), which may involve a recommendation to amend parts of the Welfare Codes of Practice. More information allows our colleagues who are daily concerned with this work on the farm to be better briefed. More information allows consideration to be given to setting up and monitoring husbandry systems which can be designed to more closely match the most up-to-date knowledge of the behavioral needs of the animals concerned yet still provide satisfactory returns to the producer.

In the State Veterinary Service, with the cooperation of colleagues in other services of ADAS, we try to monitor all relevant experimental and development projects both inside and outside the Ministry in order to ensure compliance with the welfare codes of practice and any other statutory requirements, and consider if, with minor adjustments to the experiment or development protocol, subsequent results could be improved insofar as welfare content is concerned. The SVS also endeavors to ensure that the results of experimental and development projects which have or could have welfare implications are passed rapidly to all our veterinary and husbandry colleagues, to seek out and support new development projects and to act as a liaison between the FAWAC and research organizations.

We are continuously considering how we can more efficiently retrieve and disseminate information. Currently we are looking at ways and means of obtaining more information on the various husbandry systems for veal production, and have set up a small observational study on the transport of pigs.
It is not just in Great Britain that such interest is being taken in the welfare of livestock and in intensive husbandry systems. Within the Council of Europe, the European Convention for the Protection of Animals kept for Farming Purposes, applies to the keeping, care and housing of all domestic farm animals, and in particular to animals in modern intensive stock farming systems. This Convention has been ratified by a number of member countries including the UK, and a common approach by the European Economic Community countries is expected.

Articles 3 and 4 of the Convention state: “environmental conditions shall conform to the animals’ physiological and ethological needs in accordance with established experience and scientific knowledge.” That must always be our aim.

NSMR: Its Image, Direction and Future

J. Russell Lindsey

The following speech was presented by Dr. Lindsey, Chairman of the University of Alabama Department of Comparative Medicine, at the Annual Board Meeting of the National Society for Medical Research (NSMR), Chicago, Illinois, November 10, 1979.

I would like to begin by stating two fundamental beliefs which have served as guiding principles throughout my professional career:

1. I am absolutely committed to the principle that animal research is in the best interest of both man and animals. (I have had the unusual experience of observing some of the earliest research on the defibrillator done in animals, and later seeing this instrument used to prolong my father’s life by eight years. Similarly, I have seen light years of progress in medical care for animals since I graduated from veterinary school twenty years ago.)

2. I am equally committed to the principle that all animals used in research should be treated humanely throughout the research process. (Some people erroneously believe that a majority of animal research projects involve pain and suffering. I know from personal experience that when trained professionals are willing to invest the time, effort and ingenuity, most legitimate research objectives can be accomplished without pain and suffering.)

Now to the topic at hand, the “image, direction and future” of NSMR. It seems to me that the organization’s present image can be appreciated only as
one sees it in historical perspective. This is necessary because the present image has its roots firmly implanted in the distant past.

For our purposes here I would like to briefly summarize some of the more important events of the past which have contributed to the present posture of NSMR. In doing so, however, I would like to emphasize certain realities usually not accepted by NSMR.

In the late 1860's there appeared in Great Britain an upsurge of public resentment toward a variety of highly questionable animal research practices. This movement began gaining momentum about 1870 and snowballed into passage of the British Cruelty to Animals Act in 1876. Although many blatant acts of animal cruelty in laboratories were exposed, the scientific community persisted in its defensive posture until passage of the British Act became a moral imperative in the public view (Ryan, 1963; Dennis, 1966).

A second, much smaller, snowball of public resentment occurred in the U.S. in the late 1890's when Senator Jacob H. Gallinger attempted for three consecutive years to have Congress enact a similar law. Through a magnificent defensive campaign, reaching from Washington to grass roots America, William Henry Welch almost single-handedly defeated Senator Gallinger and his following (Flexner and Flexner, 1941).

A third and major snowball of public resentment surfaced in the U.S. in the early 1960's, and despite the defensive efforts of NSMR, led to passage of our Animal Welfare Act, its subsequent amendment, and the addition of several new rules through the Animal Welfare Act's built-in mechanism for bureaucratic lawmaking. Fortunately, and again despite NSMR's defensive efforts, the standards promulgated thus far under the Animal Welfare Act have had a very positive effect—beneficial to good science, to animals and to scientists.

The point I wish to emphasize is that NSMR, like all of its predecessors representing the scientific community, has consistently maintained a defensive posture while claiming that all practices of animal use and care within the biomedical community have been "lily white." In my judgment, this has been a major tactical error because abuses of freedoms to use animals in research too frequently have been and continue to be common knowledge (e.g., Science, Editorial, 1976). NSMR's complete unwillingness to face up to these realities and to respond positively to the public's legitimate concerns has led to the inevitable loss of credibility and steady decline in influence.

To compound the problem further, NSMR has rigidly followed the erroneous concept that all who speak out for the humane interests of animals are arch enemies of medical progress. Such persons have been uniformly labeled by NSMR as members of the radical fringe—"antivivisectionists" or "sentimentalists" (Visscher, 1972). This too has been a major tactical error because it means that in reality, NSMR has served as a major force in polarizing the various factions representing antagonists and protagonists of animal research. In the process, many of the most ardent would-be supporters of NSMR have been alienated. The net result has been an organization with a posture generally viewed as counter-productive, and as a consequence, operating in an ever-diminishing sphere of friends and influence.

At this point I would like to speak to the question of the future of NSMR. Although many scientists and other colleagues are beginning to ask whether the
organization has a future at all, I am convinced that because of the enormous pressures facing animal research today, from an avalanche of bureaucratic red tape, from inflation and tightening financial constraints, and from other forces, effective leadership from an organization such as NSMR is needed in the U.S. now as never before. I hasten to add, however, that the organization's future effectiveness will depend on whether or not it is willing to undergo dramatic change. What changes are needed? What should be the elements of NSMR's program for the future?

1. The NSMR should develop an offensive program, a positive rather than a negative posture:
   a) New and imaginative leadership is desperately needed, and may be the key ingredient. That leadership must forget about the old cliches and archaic arguments of the past and begin communicating effectively with all parties concerned.
   b) The positive program would seek to make NSMR a rallying point for all animal research interests, a major center for disseminating information and coordinating efforts of all groups. At the same time, however, NSMR must never assume that it has a role as the only spokesman for medical research.
   c) The positive program must at all costs avoid territorialism, factionalism and criticism of other groups. As an example here, I would suggest that the newly-formed Research Animal Alliance (RAA) should have been received with outstretched arms, and the services of NSMR offered in the interest of close cooperation.
   d) The positive program seeks to identify problems ahead of time and to solve them before they undergo the snowball effect.

2. The NSMR should diligently seek to eliminate the reasons for criticisms of animal research:
   a) The first step is to admit that there are serious problems.
   b) All research institutions should be encouraged to seek AAALAC accreditation, or otherwise subject their facilities and laboratory animal programs to careful scrutiny by professionals competent to judge their quality, using the National Institutes of Health Guide for the Care and Use of Laboratory Animals as a basic standard.
   c) In particular, the NIH should be encouraged to improve its intramural animal care facilities and bring them uniformly up to standards of the Guide. It borders on being a national disgrace that NIH expects AAALAC accreditation of extramural programs but does not take this matter seriously for its in-house operations.
   d) An effort should be made to upgrade substandard facilities throughout the country. Although the Animal Resources Branch of NIH has a program of this type, its funding has always been inadequate. NSMR should wage a campaign to double the appropriation for these purposes at NIH.
   e) A serious effort should be made to increase the number of trained professionals to deliver quality animal care. Again, the appropria-
tion of the Animal Resources Branch of NIH is grossly inadequate in the area of postdoctoral training for veterinarians in laboratory animal medicine. NSMR should campaign to have it doubled as well.

f) Improved training opportunities should be encouraged for research investigators and research technicians. The time has passed when anyone can be permitted to walk into an animal facility and begin doing complicated procedures on animals. NSMR should spearhead a program to improve training opportunities at medical research institutions all over the country.

3. The NSMR must develop mechanisms for effectiveness at the grass roots level:
For many years it has seemed to me that NSMR has cast itself in a very difficult, if not impossible role. The reality of the situation is that a central, office-based organization such as NSMR cannot defend freedoms to use animals in research. It must be done on a day-to-day basis in every institution where animals are used. In the past, too many institutions have been willing to pay their dues to NSMR and forget about any further responsibility for quality animal care. NSMR must actively develop or assist in developing local, positive programs for defending its causes. NSMR should encourage scientists at all levels to become involved in humane societies at the local, state and national level. The truth of the matter is that extremists, like the "2%" in any organization, are a small minority. Many of their well meaning but radical positions are the result of ignorance. NSMR should accept this reality and diligently seek to work with all parties. Above all else, an effort should be made to encourage constructive dialogue rather than polarization of groups.

4. The NSMR must continue and expand its lobbying activities.
The need for these activities at the local, state and national levels continues to proliferate. Therefore, the demands on NSMR in this area will probably increase. Its success in the many new areas under consideration currently, such as transportation guidelines and all kinds of environmental standards, will probably depend increasingly on its ability to use specialists in numerous fields, and to work closely with groups such as the Institute of Laboratory Animal Resources, the Research Animal Alliance and others.

In closing, I would like to quote from the final paragraph which appeared in Dr. Maurice Visscher's article entitled "The Newer Antivivisectionists": "Eternal vigilance is the price, not only of personal liberty, but of progress in biological science..." (Visscher, 1972).

I agree with Dr. Visscher. Vigilance is important. But, I am absolutely convinced that if NSMR is going to be effective in the future, it must do much more than maintain a vigilant, defensive posture. As Dr. Visscher points out in his most recent article on animal rights and alternative methods (Visscher, 1979), "...oppo-
ponents of the use of laboratory animals in research have come to realize that they must change the basis of their argumentation in order to achieve their ends." So too must NSMR change if it is to have any hope of success.

References


Laboratory Animal Care in College Curricula

Michael W. Fox

Most universities and larger undergraduate colleges have a laboratory animal care facility. Animals from such facilities are frequently used in the undergraduate and graduate teaching curricula particularly in biology and psychology. Undergraduate students doing an honors project involving live animals as well as graduate students using live animal subjects for their dissertation rarely receive a basic course in laboratory animal care (including surgical techniques and post operative care, where and when appropriate). The time has surely come for all students who have to work with laboratory animals to receive the basic training in the principles of laboratory animal care: no students in my research experience as a professor of psychology were even familiar with the existence (never mind the content) of the Animal Welfare Act. On campus veterinarians in charge of university laboratory animal facilities and department chairmen whose students use animals should combine their resources and make it mandatory for all students who use laboratory animals as part of their graduate or undergraduate studies to become familiar with the Animal Welfare Act and with the basic principles of laboratory animal care.
Definition of the Concept of “Humane Treatment” in Relation to Food and Laboratory Animals

Bernard E. Rollin*

Abstract

The very title of this talk makes a suggestion which must be forestalled, namely the idea that laboratory and food animals enjoy some exceptional moral status by virtue of the fact that we use them. In fact, it is extremely difficult to find any morally relevant grounds for distinguishing between food and laboratory animals and other animals and, far more dramatically, between animals and humans. The same conditions which require that we apply moral categories to humans rationally require that we apply them to animals as well. While it is obviously pragmatically impossible in our current sociocultural setting to expect that animals should be so treated, this idea should be kept before us as a moral ideal toward which to strive. In this vein, it seems morally necessary that the use of animals in research be constrained by two principles, which ought to be codified as law: the utilitarian principle and the rights principle. It might be thought that such constraints would serve as an intolerable burden to researchers, but such a worry is primarily based upon a faulty understanding of the nature of science which can be refuted by an examination of the history of science.

Imagine going to a conference on human pain and suffering and finding a session entitled: “Morality: Definition of the Term in Relation to Negroes.” This would not perhaps have sounded odd 125 years ago when it was widely taken for granted that blacks were a lower form of life. But today, it would jar and repel us, because it implies that whatever moral categories we have for people in general do not apply to black people.

Similarly, it is clear that the title of this session does not jar most of us. Morally, most of us today are, relative to animals, in the position of most people of years ago relative to the Negro. Let us recall the famous Dred Scott case of

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1856, in which the Supreme Court denied citizenship to blacks on the grounds that they were “a subordinate and inferior class of beings, who had been subjugated by the dominant race.” The court reflected a widespread view. We owned Negroes, we bred them, raised them, took care of them; therefore they were ours, they were property, to do with as we saw fit.

A similar view is held by most of us with regard to animals in general, but most strongly with regard to laboratory and food animals, as the title of this address implies. The view is this: These animals have, after all, been brought into existence by us, their very existence depends on us. We have shaped their bodies and behavior genetically. We give them life and determine the course of their lives. They would have no lives at all were it not for us. Their raison d’être, their very nature, is to serve us. Surely then, we can treat them as we see fit.

Implicit in this way of seeing things are a number of interesting points. One is an assumption that any life is better than none, and that those who give life—the ultimate gift—to something may dispose of it as they see fit. Second is a distorted awareness that animals have natures; the natures of food and laboratory animals being to serve as means to human ends, as tools for humans, as “animal models,” etc. Often, those natures have been developed and shaped by us.

These assumptions must be looked at quite carefully, for implicit in them are a number of profound issues which need much unpacking, if we are to answer the question posed. Let us consider the idea that being responsible for the life of something gives one absolute right over that being. (Interestingly enough, the ancient idea was just the opposite—if a person saved another’s life, he or she was responsible for taking care of that life forever.) Suppose I discover a woman who is about to have an abortion. I pay her a large sum of money to have the child and turn it over to me. I raise the child, house it, feed it, cap its teeth, educate it. When it turns 16, I decide that I am going to cook and eat it, or use it to study the long term effects of asbestos on the lungs. After all, without me it would have had no life at all!

Or consider another scenario. After I buy the child, having decided to eat it, or use it for research, I care for it exclusively according to economic considerations, taking no account of its human nature except to keep it alive and reasonably healthy.

We obviously would not accept this approach to human beings. (In fact, we are directly responsible both for the existence and the traits of our children, yet we do not feel we can dispose of them as we see fit.) We do not accept such an approach regarding blacks even though we bred them for servitude for generations. Why, then, do we accept it vis à vis animals? The obvious answer is, “There is a difference between people and animals?” But the key question then becomes, “What is this difference, and why does it license different treatment?” Obviously, it is not enough to duck the issues by saying it is illegal to treat people that way. The reason that it is illegal is that we consider it absolutely wrong morally.

There are many differences between humans and other animals which are quite obvious. Humans are the only creatures that play golf, fry their food, wear lipstick, etc. Clearly, these differences do not seem to have any moral relevance. What does this mean? Let me illustrate: Suppose I walk up to you throughout my talk and punch you periodically. You ask me why. I say, “Because you have curly hair, that’s why. It’s okay to hit people with curly hair.” Obviously, this is unac-
ceptable. Clearly, curliness is not a morally relevant reason for striking someone. We don’t excuse my hitting you because you are the only person with curly hair. On the other hand, if I hit you because I saw you molesting a child between sessions, that does seem to be morally relevant, i.e., to be a difference that makes a moral difference.

Most of the obvious differences between humans and other animals do not meet the test of moral relevance for justifying our differences in treatment of animals. Is it any more justifiable to subject a being to pain because it has fur than to subject a person to pain because he or she has curly hair? Is it justifiable because we are more powerful than animals? Then it must be permissible to torture children. Is it because animals are less intelligent than we are? Then morality ought to vary with I.Q. Few of us would accept the logical conclusion of this position, namely that if some extra-terrestrial creatures were as superior intellectually as we are to rats, then they would be perfectly entitled to exploit us as they saw fit.

As I have argued in a number of articles, papers, books, lectures, etc., I do not think that there are any morally relevant differences which license us to exclude animals in general from moral consideration in what we do while we include people. Furthermore, it does not seem to me that there are any morally relevant differences between food and laboratory animals and other animals, any more than there are morally relevant differences between slaves and other humans. This sounds very radical because we do not live that way. But as Plato long ago pointed out, just because we all do something does not make it right.

Human beings have developed their moral ideas on the basis of an awareness that certain things are harmful to other human beings while others are helpful and desirable. We have further realized that certain things are more crucial to human beings than others are. Obviously those needs related to survival are essential, as are those related to avoidance of pain. But just as significant are those needs and pursuits which grow out of our uniquely human natures—the ability to speak and reason. It is for this reason that we constitutionally protect freedom of speech and of thought and of assembly and of religion, because it is felt that in these pursuits lies what is essential to being human. We are inconsistent, however, when we fail to apply the same categories and notion to animals. Vertebrate animals feel pain, whatever some scientists may suggest. If these scientists really believe that animals do not feel pain, why do they do pain and analgesic research on animals? Even fish must suffer, since they can be trained using negative reinforcement, though textbooks in wildlife biology do not consider that fish feel pain. All behavioral, neurophysiological and evolutionary evidence militates in favor of this conclusion. Animals have basic needs. And most important for our purposes, animals have natures, have a telos, to use Aristotle’s phrase, in just the same way that humans do.

This brings me back to the point made earlier, our hidden assumption that the nature of laboratory and food animals is to be used by man, since we created them. This is clearly absurd, as I suggested earlier. One can indeed imagine creating chickens who happily pluck, dismember and fry themselves, or rats who are happiest in tiny cages. (But can one imagine developing animals who enjoy the pain of psychological experiments—masochistic mice? If there were such creatures, they could not be used for negative reinforcement studies!) But the
animals that we do use for food production and research purposes do feel pain, do suffer, and do have natures which are almost invariably thwarted and frustrated by our uses. Behavioral studies indicate, for example, that all sorts of animals prefer open space to confinement. And, as indicated, if rats did not suffer pain, stress, and anxiety, they would not be used by psychologists and pain researchers. Despite the fact, then, that we have indeed brought these animals into being, they do have natures of their own, with genetically determined physical and behavioral aspects which we are morally obliged to respect, and which we usually fail to respect when we use these animals. It is the biologist's, ecologist's and ethologist's job to tell us what the nature of a given animal is, so that we may know where our obligations lie.

It may perhaps follow logically from what I have been saying that it is wrong to ever use animals for research or to ever raise animals for food if it is wrong to so use people. (Some philosophers have taken this tack.) I am not interested in pushing this conclusion, because it has no contact with reality. At best, like the idea of turning the other cheek, it is an ideal against which to measure our actual activities rather than a possible program to follow. Note, too, that what we are willing to call "suffering," or "morally relevant suffering," depends on our values; this is true regarding both people and animals. It does, however, seem to me inescapable that one should draw certain conclusions concerning the use of animals in research and food production. (I shall concentrate on research, because I am more familiar with the problems there.) It seems to me morally necessary that the use of animals in research ideally be constrained by two principles, which ought to be codified as law:

1) The Utilitarian Principle — It is usually argued that animal suffering is justified in research on the grounds that research produces great benefits to humans and animals. If this is the case, then we ought to legitimately demand of all uses of animals in research that the benefits (or likely benefits) to humans (or to humans and animals) clearly outweigh the pain and suffering experienced by the experimental animals. It will not do to object to this on the grounds that we never know what benefits will result from a piece of research. We make such predictions about likely benefits every day in all aspects of public policy (including the support of research). In any case, for the argument, let us ignore questionable cases and concentrate only on clear-cut ones.

2) The Rights Principle — In cases where research is deemed justifiable by the Utilitarian Principle it should be conducted in such a way as to maximize the animal's potential for living its life according to its nature or telos, and certain rights should be protected regardless of considerations of cost.

This means that we cannot do as we see fit to a research animal, even if we have determined that the animal's use is justified by the utilitarian principle. We must avoid encroaching as far as possible (consonant with the experiment) on the animal's fundamental interests and nature, and this in turn means that the animal has a right to freedom from pain, to be housed and fed in accordance with its
nature, to exercise, companionship, play, etc.; in short, to be treated as we would treat human beings used for such purposes—as ends in themselves, in Kant's phrase, not merely as means. Both of these principles must be incorporated into a meaningful federal Animal Welfare Act, which covers all animals in all categories (with no exclusion of mice, rats, and domestic animals), which provides meaningful penalties for violation, and which requires that funding agencies apply these principles. Perhaps it should also require local peer review by large committees of scientists and nonscientists, such as is done with all use of animals in research in Uppsala, Sweden. Some scientists will argue that there is no place in peer review for nonscientists—that only scientists can judge the work of other scientists. This is clearly nonsense. The average scientist is a nonscientist outside of his or her own field. In my years in university I have seen this demonstrated on countless occasions. People are well versed in their own niche and are totally ignorant outside of it. The average biological scientist, for example, is totally incompetent to judge a research proposal in evolutionary theory, even though evolutionary theory is at the basis of all modern biology.

Your initial reactions to my proposals are doubtless that they would represent an intolerable constraint on good science. I do not believe this to be the case. In fact, they would actually serve to promote better science. For one thing they would force much closer attention to be paid to experimental design and execution. Sloppy research construction and execution results in wastage of funds, in worthless results, and in animal suffering (witness the recent National Cancer Institute scandals [See Science 204:1287-1292 and 205:746-748, 1979-Ed.]). I'm sure all of you are familiar with examples. One which epitomizes the problem for me occurred a few years ago. A researcher was interested in studying the effects of starvation on the rumen of mule deer, so he proceeded systematically to starve a group of mule deer by withholding food on a regular basis. Like a good researcher, he had a control group of deer which he was feeding for comparison. The two groups were separated only by a wire mesh, so that the deer being starved were subjected to the exquisite torture of watching and smelling the other deer being fed. Not only is this cruel, it is stupid, for the olfactory and visual stimuli could certainly skew the metabolisms of the starving deer, and leave significant changes in the rumen not to be found under natural conditions.

It seems to me that the only sort of research projects dramatically affected by our principles would be those activities which are essentially tinkering—trial and error, devoid of a theoretical base, done by the sort of researchers who really have no idea of why they do what they do or even of what they are doing. Robert Paul Wolff once characterized such researchers as people who throw pieces of dung into a dung heap and fully believe that eventually there will stand a cathedral. The most salient examples of this, of course, arise in the field of behavioral psychology. One of my colleagues in psychology was recently asked why he continues to do underwater maze trials on rats—of what possible value or interest is the resulting knowledge? "This is for future generations to decide," he replied. Period.

Virtually the whole field of behavioral psychology is open to the sort of criticism we are advancing, and it is correlativey no accident that far and away the worst atrocities upon animals occur in this field. As my colleague Richard Kitc hener has ably demonstrated, Skinnerian behavioral psychology is atheoretical,
devoid of a conceptual base. It is characterized by a totally empirical, “Let’s see what happens if...” approach to science. Hence the persistence of “experiments” like the blinding of hamsters to see if territorial aggression is increased, the study of the effect of footshock in rabbits on brain responses to tone stimuli, the inauguration of “learned helplessness” in dogs, etc.

Many lay-people believe that science is simply experimentation — that “Let’s see what happens” is the essence of science. But all good scientists realize that this is not the case. Science is thought and imagination, insight tested by experiment, not arising out of blind induction. Scientific theories do not emerge from random data collection. The importance of data is in the verification of hypotheses, not in their discovery. After all, when one considers any major scientific theory, be it the theory of gravitation, relativity, quantum mechanics, the gene, etc., one makes reference to entities and processes which are unobservable and whose discovery required imaginative leaps. Newton was certainly not the first man to be hit by a falling apple, yet it took Newton’s theoretical vision to postulate gravitation.

The most superficial look at the history of science reveals that no major advances were made simply by gathering data. The great scientists were guided by theory and vision, indeed, sometimes by erroneous vision, as in the case of Kepler, who sought to prove that the orbits of the planets could be related mathematically as the notes of the musical scale, thereby establishing the music of the spheres postulated by the Pythagoreans. Or let us recall Galileo, who is often said to have shown that the acceleration of falling bodies is independent of their mass and is uniform by dropping a heavy and a light object from the Leaning Tower of Pisa. In fact, as seen in his Dialogues Concerning the Two Great Systems of the World, Galileo was a good deal more ingenious than that, and employed reason to establish this point. Take two five-pound weights, said Galileo, and drop them from the same height. Surely they will hit the ground at the same time. Join them by a weightless rod — surely they will still hit the ground at the same time when dropped. Shrink the rod until the two weights are stuck together. Surely they will still hit the ground at the same time. But now we have a ten pound weight, showing that rate of fall is independent of mass.

As another example of where theory precedes data and predominates over it, consider Einstein. His world-shattering critique of Newton was not based on data or experiments unavailable to others, but rather on a conceptual analysis of the concept of simultaneity. Correlatively, when asked what he would have said if some astronomical predictions generated by the general theory of relativity had not been supported by the data gathered by Eddington, Einstein said, in essence, “So much the worse for the data — the theory is correct!”

A similar account can be given about the father of genetics, Gregor Mendel. Every schoolchild knows of Mendel’s famous experiments with the pea plants, which allegedly led him to the discovery of genetics. In fact, statistical analysis of Mendel’s studies indicate that the probability of Mendel actually obtaining the experimental results he claimed was only .00007, or one in 14,000! In short, Mendel knew that the theory was correct, and chose the data which met his expectations.

We know too from the history of science, that in the face of theoretical commitment, recalcitrant data is easily dismissed or explained away and that theory
determines what we see. Consider Galileo’s bishops, who refused to look through the telescope, because they knew the moon was perfect. Suppose they would have been forced to look—would they then have been forced to admit that it was not perfect? Not at all—they simply would have said that Galileo had created an instrument which made the perfect moon look flawed! An even more dramatic example is told of Franz Anton Mesmer, the discoverer of “animal magnetism,” or hypnotism. In order to illustrate the anaesthetic effects of hypnotism to skeptical physicians, Mesmer hypnotized a patient who was to undergo amputation, and the limb was removed with no visible discomfort. “Have I not proved my point?” asked Mesmer triumphantly. “Not at all,” replied the physicians. “The man felt pain; he just failed to show it.”

The point then, is this: Contrary to the way science is often taught and contrary to the way many researchers proceed, science is not merely fact-gathering. To paraphrase the great philosopher, Immanuel Kant, “Theories without data are empty, data without theories are blind.” Certainly we shall make no progress without accumulating data and facts. But these facts must not be gathered at random. They must be gathered in order to test hypotheses and theories arrived at via the creative power of thought, reason and imagination.

The point I am stressing relative to animal research is this: Research which proceeds simply by trial and error is likely to be both useless and cruel. In this sense, placing high value and emphasis on animal life and suffering and putting a certain burden of proof as to the utility and soundness of a piece of research is certain to force us to look more carefully at the logic of the research that we do or contemplate doing, and thus eliminate mere tinkering with no conceptual basis. In the final analysis, animals are not models for anything, except from the perspective of the theoretical mind, which carefully constructs hypotheses and justifies each use of an animal conceptually and morally. Models, like maps, do not exist in nature. Maps are the product of thought and artifice, so too are models. To speak of animal models is to speak of animals being used as models in accordance with a full set of hypotheses which give us reason to believe that the animal does serve to model something, and something worth knowing. Too often, talk of animal models entails that the animal is by nature a model, something simply there for us to tinker with. When the psychologists, for example, cannot answer the following dilemma, they demonstrate that they have no conceptual let alone moral right to use animals as “models”: “A good deal of your research is on mice and rats, studying behavior and learning, utilizing pain to condition the animals. Clearly, you are not interested in the mind of the rat for its own sake. You study these animals because they are relevantly analogous to human beings, because rat behavior is a good model for human behavior. The dilemma is this: Either the rats are relevantly analogous to human beings in terms of their ability to learn by positive and negative reinforcement (i.e., pleasure and pain) in which case it is difficult to see what right you have to do things to rats which you would not do to human beings, or the rats are not relevantly analogous to human beings in these morally relevant ways, in which case it is difficult to see the value in studying them.”

I conclude then, by answering the question I began by attacking. What is humane treatment of food and laboratory animals? First and foremost, it is recognizing their moral status, seeing that they are objects of moral concern and treat-
ing them as you would wish to be treated were you the "model" for some superior race which can dispose of humans as it sees fit. Equally important, we must study the nature of the animals we use for food and research in physiological and ethological terms to determine what needs they have, and how to meet them. Certainly we have bred food animals for food, and lab animals for research, but we have not bred out their ability to feel pain, to suffer under crowding conditions, to enjoy a life without constant stress, etc. If we do not choose to meet these needs, we are morally bound to develop animals which do not have them.

Incidentally, I might add that if everything I have been saying is true, there is another problem with the title of this talk, namely the use of the phrase “humane” treatment. “Humane” is a patronizing term; it implies to most people kindness which we can withhold or give freely (like “charity”). In philosophers' jargon, it is an activity of benevolence, not of duty. But if animals do have genuine moral status, then we are morally obliged to treat them as moral objects; it is not simply a matter of choice and generosity on our part. True, we may choose not to do so since in our society we can get away with it, but then we are in the moral position of a person who chooses to do harm to other people when he is certain that he can "get away with it." We must cease to think (and talk) of our proper treatment of animals as a favor we do them, and start to think of it instead as something we owe them, as something to which they have a right and claim.

**Suggested Readings**

Kitchener, Richard (1972) B.F. Skinner—The butcher, the baker, the behavior shaper. In *Boston Studies in the Philosophy of Science,* Volume XX, D. Reidel, Boston, MA.
Rollin, Bernard (Unpublished) *Animal Rights and Human Morality.*
Mechanical, Electrical and Anesthetic Stunning Methods for Livestock

Temple Grandin*

Abstract

A good stunning method must render an animal unable to experience pain and sensation prior to hoisting and slaughter. The three basic types of stunning methods which are classified as being humane (i.e., painless) in the United States, Europe and other foreign countries are captive bolt (penetrating and nonpenetrating), electrical, and CO₂ (carbon dioxide) gas anesthesia.

The physiological mechanisms of stress are the same before and after the onset of unconsciousness. The release of epinephrine as a result of stress inducers has an effect on the quality of the meat and it is therefore desirable to use a stunning method which produces a minimum of epinephrine secretion.

A literature review indicates the following stunning methods most reliably rendered the animal insensible to pain and minimized detrimental effects to forehead. Cows, steers, heifers, calves — penetrating or nonpenetrating (where brains are being saved) captive bolt or gunshot to the forehead. Shoot behind the poll for heavy Zebu or Brahman cattle only. Market weight pigs (180-250 lb; 80 — 112 kg.) — electric stunning minimum of 1.25 amps. at 300 to 600 volts with 1 to 3 second application time. Sheep — penetrating captive bolt, gunshot, or electric stunning with sharp pin electrodes or electrodes soaked in brine to insure electrical contact through the wool.

Determining Unconsciousness

It is often difficult to determine whether an animal is truly unconscious and insensible to pain without special equipment. The only reliable method for measuring consciousness is the electroencephalogram (EEG), which records electric impulses emitted from the brain. Another useful tool, the electrocardiogram

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(ECG), which records electric impulses emitted from the heart, should not be used as the sole indicator of unconsciousness, since an animal can still be conscious for several seconds after the heart stops beating (Croft, 1976; Nangerone and Kennett, 1963; Roberts, 1954). The ECG may be used to determine an animal's response to pain (Croft, 1952) since the cardiac pain reflex will occur in an animal which, although completely paralyzed and unable to move, is still fully conscious (Croft, 1952; Roberts, 1954; Von Mickwitz and Leach, 1977; Warrington, 1974). When a new stunning method or procedure is being tested, or an old one re-evaluated, it is recommended that the EEG be used, perhaps in conjunction with the ECG.

Reflex testing of a stunned animal is another method which can be readily implemented in the slaughter plant to detect animals which have not been properly stunned. However, reflex testing is not a definite indication that an animal is unconscious and insensible to pain since reflexes may be absent in a conscious animal.

Reflexes of the eye, conjunctiva, cornea and eyelid are the most sensitive simple tests for determining consciousness of animals stunned by penetrating and nonpenetrating captive bolt, CO₂, or gunshot. However, these should not be used to determine the effectiveness of electrical stunning, as electrical stimulation can cause the eyelid muscles to contract, thus masking the reflexive action (Warrington, 1974). The eye pupillary reflex to light may be used as an indicator of unconsciousness because it is not affected by electric stunning. The pupillary reflex is also the first indicator that an animal is returning to consciousness (Croft, 1952).

Indicators of Unconsciousness by Captive Bolt

It is often impossible for the captive bolt operator to test eye reflexes routinely because the animals fall down in the chute and will thus be inaccessible. Certain bodily reactions, which occur when an animal is stunned correctly, can be used instead.

When the animal falls after being shot or stunned with penetrating or nonpenetrating captive bolt, it should collapse instantly. Muscle contractions in the body which result in the curling of the tail and/or tensing of the neck before the head drops should last no longer than 3 to 5 seconds. In some instances, the entire body and neck will quiver just before the head finally rests on the floor. This is a normal reaction and is not a sign that the animal is conscious.

The ears are also a good indicator of the conscious state of the animal. If the ears do not droop and become completely relaxed within 3 to 5 seconds the animal may still be conscious.

Erratic, uncoordinated reflexive movements should not be confused with consciousness since such movements will occur even after the head has been removed. However, when the animal is discharged from the stunning pen or restrainer, the head should be completely relaxed and immobile and the ears should droop. If the ears or head respond to being poked with an electric prod the animal may be conscious.

Indicators of Unconsciousness With Electric Stunning

The only criterion for unconsciousness in electric stunning is the grand mal seizure (Hoenderken, 1978a,b; McGough and Madsen, 1964; Schwerdt, 1939; Warr-
If the seizure takes place the animal will definitely become unconscious. The symptoms of a grand mal epileptic seizure are similar in all mammals (Croft, 1952; Croft and Hume, 1956; Carding, 1971).

Stage 1. (Tonic Phase) The hind legs stretch out violently, the forelegs become stiff and the head bends backwards. Respiration stops. The only definite sign of unconsciousness is full extension of the back legs.

Stage 2. (Clonic Phase) Ten seconds after stunning the animal should gradually relax and make walking movements with its legs. The throat must be cut within 30 seconds to insure that it does not recover consciousness (Hoenderken, 1978a,b).

Stage 3. If the animal is not bled, it will start to regain consciousness in 60 seconds. Consciousness can first be detected by the pupillary reflex to light. After consciousness is regained, the animal will remain paralyzed for another 30 seconds.

Carding (1971) warns that when the electro-coma technique is used (the current is applied for 14 seconds or more), the Stage 1 spasm is masked. In this technique, the current should be tested periodically by stunning several animals for 1 or 2 seconds to check for hind leg extension. In the United States, stunning times greater than 5 seconds are seldom used.

Review of the Mechanical Stunning Methods

There are three types of mechanical stunners: penetrating captive bolt, non-penetrating captive bolt, and gun shot. Either air pressure or a blank cartridge drives a steel bolt into the middle of the animal’s forehead in penetrating captive bolt stunning. The bolt is then automatically retracted and reset for the next animal. The length of the rod which penetrates the animal’s head varies from 2 3/8 in (6 cm) to 3 1/2 in (9 cm) [Von Mickwitz and Leach, 1977]. The nonpenetrating captive bolt stunner works in a similar fashion except the end of the rod has a wide blunt mushroom shaped head, which does not penetrate the skull. Unconsciousness in the animal is produced by impact and concussion. Both types of captive bolt stunners are available in either cartridge fired (Figure 1) or air operated (Figure 2) models. A new hydraulically activated captive bolt stunner has been developed by Hantover, Inc. (Kansas City, MO). Initial tests in a large beef slaughter plant indicate that it stuns cattle more effectively than most air operated stunners.

Many captive bolt stunners are designed so that they can be converted to either penetrating or nonpenetrating by changing rods and housings. Regular pistols and guns may also be used for stunning livestock. Special bullets are available for .22 caliber which disintegrate a short distance after they leave the muzzle of the gun, thus reducing safety hazard.

Tests on sheep and calves indicated that penetrating captive bolt stunning actually kills the animal and unconsciousness is induced instantly (Freeseman, 1975; Gross, 1976; Von Mickwitz and Leach, 1977). Properly applied nonpenetrating captive bolt techniques will render large steers permanently unconscious. Nonpenetrating captive bolt should not be used on sheep (Von Mickwitz and Leach, 1977). The bony ridge and wool on the sheep’s head dissipates the force of the blow (R. Kilgour and C. Steele, personal communication).
The force of the blow is very important to insure unconsciousness. The impact from either a penetrating or nonpenetrating captive bolt must be sufficient to jolt the brain inside the skull (Von Mickwitz and Leach, 1977)—mere penetration is not necessarily sufficient. It is possible to use too much force and to fracture the skull. This reduces the effectiveness of the concussion.

The instructions which accompany the stunner must be carefully followed. Most manufacturers of cartridge-type stunners supply blank cartridges with different sized powder charges to propel the bolt. It is important that the correct cartridge is used for the size and type of animal which is being stunned since the amount of powder in the cartridge determines the force of the blow delivered by the captive bolt. Air operated stunners should be adjusted by increasing or decreasing the air pressure.
Location of Stunner

An animal which fails to go down on the first stunning attempt will become more difficult to stun on each subsequent attempt (author’s observation). Therefore, it is of the utmost importance that the stunner is placed on the correct location on the animal’s head (Figure 3). Incorrect positioning will fail to produce unconsciousness (Von Mickwitz and Leach, 1977). Both penetrating and nonpenetrating captive bolt stunners should be placed against the animal’s head. Pistols or rifles should usually be held a few inches away.

On sheep, the stunner may be placed in the frontal position as shown for cattle (Figure 3) [Blackmore 1975] or directly on the top of the head (Carding, 1971). If Brahman cattle are being stunned, the stunner should be aimed 1/2-1 in (1-2 cm) off the center of the X in the middle of the forehead, as shown in Figure 3 (author’s observation). The skull of the Brahman has a bony ridge in the middle.
Correct stunner application is of the utmost importance to produce unconsciousness in the animal. The arrow points to the location where the apparatus should be positioned. (From: The Schermer mechanical stunning apparatus, Instruction booklet, Alpha International Corp., New York, NY.)

and the bolt is sometimes unable to penetrate it (C. Steele, personal communication).

The LeFieill Co. (San Francisco, CA) is experimenting with a totally new type of stunner, which will enable the slaughterer to save brains. The stunner drives a narrow 3/16 in hollow titanium shaft into the animal’s forehead. Simultaneously the animal is rendered unconscious by high pressure air which passes into the brain through the shaft. Preliminary tests indicate that it may be able to stun beef animals more effectively than a nonpenetrating captive bolt.

Shooting cattle in the poll (i.e., in the hollow behind the horns) should be avoided (Von Mickwitz and Leach, 1977), especially in European cattle breeds. The only time that poll shooting should be applied in European cattle breeds is if the first shot fails to stun the bovine and it has to be shot a second time. Shooting in the poll with penetrating captive bolt is recommended, however, for heavy Zebu and Brahman cattle if the skull is extremely thick (J.C. Walsh, personal communication). The stunner must be aimed so that the brain is penetrated. If the rod merely severs the spinal cord, the animal may be paralyzed and still conscious.

**Captive Bolt Pistol Types**

Cartridge-fired captive bolt stunners come in models which can be held in one hand (Figure 1) or which are mounted on a long handle and held in two hands. Most plants in the United States prefer the hand held types of cartridge stunners. Air operated stunners, also available in one- or two-handed models, are heavier than cartridge fired stunners and are usually suspended from a spring-loaded balancer.

There are two basic types of triggering mechanisms. Type 1 works like a regular gun and the captive bolt fires when the trigger is pulled. Type 2 is trig-
tapped against the animal's head, which causes the bolt to fire. Both types of triggering mechanisms work well on steers, cows and bulls. The type 1 triggering mechanism is recommended for Zebu cattle with heavy skulls because they are shot behind the poll (J.C. Walsh, personal communication), and for sheep. The type 2 tapping mechanism tends to dissipate some of the force of the blow, particularly in smaller animals, because the head is pushed down by the force of the tap. Therefore, type 2 is not recommended for sheep and small calves.

There are two different types of grips on hand-held stunners: The first type has a grip like an ordinary pistol and the second type is cylindrical (Figure 1). In high speed cattle plants slaughtering over 100 animals per hour, either a cylindrical type one-handed stunner or a two-handed stunner with a long handle should be used. The pistol grip types are too awkward to aim at high speeds and tend to encourage shooting in the poll. However, where Zebu cattle have to be shot in the poll this would be an advantage. The pistol type works very well on sheep, when the operator stands on an elevated platform to deliver the shot at the top of the head.

Good Captive Bolt Stunning Practices

The major cause of improper captive bolt stunning is movement of the animal’s head and consequent deflection of the stunner's impact. Leach (1978) has experimented with a head-restraining yoke in a conventional stunning pen. This type of system may work well in a small plant where each bovine could be quietly restrained. In larger plants, attempting to yoke each animal's head in a conventional stunning pen would probably cause more bruises and excitement than simply leaving the animal loose.

A yoke type restrainer is not recommended for pigs. Marple (1977) and Overstreet et al. (1975) reported that pigs restrained in a head yoke for one minute had a low muscle pH, which is an indicator of stress.

In existing conventional stunning pens, the installation of a movable side to crowd the animal snugly against the discharge door would be a better approach. A squeeze side is especially recommended for plants handling various sized cattle. For smaller plants handling less than 20 cattle per hour, Iowa State University developed a pen with a stanchion type head restraint.

A common error is the attempt to chase the animal's head as it moves when aiming the stunner. This is a special problem with cattle. The best technique is to wait until the animal's head is still and then quickly place the stunner on its head and pull the trigger. The greatest accuracy is achieved by a motion which resembles a snake striking. The operator should never stand in front of the animal in a conventional stunning pen since the animal will become agitated and excited because its flight zone has been penetrated (Grandin, 1980a). The operator should stand slightly behind the animal's head (Figure 1), attract its attention with a clicking sound, and then reach over its head to fire the stunner.

When cattle or pigs are being stunned with a captive bolt stunner in a conveyor restrainer, they should be stunned when their heads first emerge from underneath the hold down rack (Figure 4). Otherwise, the animals may attempt to escape because the operator is inside their flight zone.

Even the most skilled stunner operator will miss once in a while. In order to
FIGURE 4—Captive bolt stunning of cattle in a conveyor restrainer system. The stunner should be applied when the animal's head first emerges from under the hold down rack before the animal becomes aware that its flight zone has been penetrated by the operator.

avoid animal suffering, a second stunner should always be kept loaded and ready so that the animal can be immediately shot a second time. Plants which slaughter more than 50 animals per day should definitely have at least two stunners. Plants using an air operated stunner should have a cartridge fired stunner as a back-up.

Captive Bolt Stunner Maintenance

A stunner must be well maintained to ensure that it will deliver a lethal blow to the animal each time it is fired and to ensure that the rod retracts after every firing. For Zebu cattle, where rod sticking can be a problem, ISPA (International Society for the Protection of Animals) developed penetrating captive bolts with a penetrating tip of larger diameter than the rod (J.C. Walsh, personal communication).

Stunners can be damaged by shooting them against the side of a steel or concrete chute, or by banging them against steel or concrete to reset the rod (Von Mickwitz and Leach, 1977). If a surface is needed to push the rod back into the barrel to reset the stunner, a block of wood or piece of plastic meat-cutting board should be used. The stunner can also be damaged by not placing it squarely on the animal's head. Repeated shooting of the stunner on an angle will eventually bend the rod and diminish the hit force.

In cartridge operated stunners, a common cause of misfiring is a weakened firing pin spring resulting in insufficient force to detonate the cartridge. Captive-bolt stunners should not be fired into midair— they are designed to work against resistance.
Stunners are lethal weapons and should be treated with the same respect as regular firearms. Even in high speed slaughter plants slaughtering up to 300 cattle per hour, safety precautions can be easily obeyed. Air-operated stunners are usually less hazardous because the stunner is attached by a cable to a spring-loaded balancer. It is thus impossible to set it down and have it fire accidentally.

**Air- vs. Cartridge-Fired Stunners**

Air-powered stunners are initially more expensive than cartridge-powered stunners. An air-powered stunning system with two guns and a special compressor, or air pressure intensifier unit, costs $5000 to $7000 to install, whereas cartridge-fired stunners cost $150 to $325 each (Koch, Inc., 1980). Cartridge-fired stunners are recommended for small plants which slaughter less than 100 animals per day. An air stunner requires more maintenance than a cartridge-fired stunner but it offers several advantages for large plants. In a high-speed plant, the operator does not have to stop and reload the stunner and the rod is retracted and reset automatically. Also, cartridge costs are eliminated, and there are no empty cartridge casings to clog drains.

**Electric Stunning**

Electric stunning is performed by passing an electric current through the animal’s brain in order to produce instant unconsciousness. If the current fails to pass through the brain the animal will be paralyzed (curarized) but will still be fully conscious and able to feel pain (Croft, 1952; Hoenderken, 1978a; Roberts, 1954). Electric stunning is an excellent method, especially for pigs, when it is used correctly. The method is clean and the application does not require a great amount of skill, although many factors can affect an animal’s sensitivity to electrical stunning. These include breed, wetness, degree of fatness, and the amount of hair or wool. In pigs, for example, the size and age can affect the voltage and amperage required to cause a grand mal seizure (Croft and Hume, 1956; Best & Donovan Co., personal communication; and Pemberton’s Inc., personal communication). Integrated circuits have recently been designed so that a constant amperage can be applied across the animal even if the resistance varies, due to moisture or slippage of the electrodes.

**Voltage, Amperage and Shock Duration Requirements**

**Pigs**—Studies to determine the voltages and amperages required to stun 180-250 lb (80-112 kg) market weight pigs indicate that with application times of 1 to 5 seconds, a minimum of 1.07 amps and 180 volts was required (Hoenderken, 1978a). Use of 1.25 amps at 300 to 600 volts produced more reliable results and unconsciousness could still be achieved even if electrode placement was slightly off. The amperage is the most important factor in producing unconsciousness. The pig must be bled within 30 seconds to insure that it is still unconscious (Hoenderken, 1978b) and in most large slaughter plants the stun to bleed interval is much shorter than 30 seconds.

A survey of European slaughter plants shows that many of the stunners had only 70 to 500 milliamps (0.07 to 0.5 amps) of current (Von Mickwitz and Leach, 1977). The average amperage varied from 70 to 150 milliamps while the voltage
varied from 65 to 280 volts. The duration of application had to last an average of 13 to 26 seconds in order to be effective (Von Mickwitz and Leach, 1977). This method, using the longer application time and lower amperage, is called electrocoma. It is not recommended (Hoenderken, 1978a) because if the stunner fails to produce unconsciousness, a pig would have to withstand the shock for up to 20 seconds instead of only 1 or 3 seconds. If the electro-coma method is used, the current should not fall below 250 milliamps (0.25 amps) at 70 to 90 volts, for 14 seconds (Carding, 1971). Pigs should be watered prior to stunning but not fed for 8 hours prior to slaughter because a fed pig is more resistant to the effect of the electricity (Croft, 1952; Bywater, 1971).

**Sheep and Calves**—Specific data on voltage, amperage and application times for sheep and calves is sparse. Not only was amperage data not cited in a majority of the papers, but the EEG or the grand mal seizure was not used as the criterion for effective stunning. What data is available indicates that sheep could be effectively stunned with a current of 250 milliamps at 90 volts for 3 seconds (Hickman, 1954). Sheep should be bled within 10 seconds because they regain consciousness in 12-15 seconds (Leach, 1978).

It is not impossible to make any specific recommendations concerning voltages and amperages for calves. Carding (1971) recommends 198 watt-seconds for calves. (A watt-second = voltage x amperage x seconds.) However, there are many variations on how 198 watt-seconds can be broken down into amperage, voltage and shock duration, and the papers which were reviewed had insufficient data on amperage and assessment of unconsciousness.

**Type of Electric Current**

Research has been conducted to determine the type of electrical waveform to be utilized for the most effective stunning. Most standard stunners utilize a sinusoidal waveform which cycles 60 times per second.

There have been several studies to determine if changing the frequency of the electrical waveform would improve the effectiveness of stunning (Borzuta, 1971; Croft, 1952; Gorbatov et al., 1976; Hlavinka and Zelinka, 1978; Hoenderken, 1978a; Leach, 1978; Marple, 1977; Van der Wal, 1978; Warrington, 1974). It has been found that unconsciousness is more effectively produced using 50 or 60 cycles AC (standard house current) instead of a high frequency 1800 Hz electric current (Hoenderken, 1978a). Higher frequencies in the range of 2000 to 3000 Hz failed to produce instant unconsciousness and may cause pain (Croft, 1952; Van der Wal, 1978).

Interest in high frequencies has been generated because it reduces the incidence of muscle hemorrhages (blood splash) in the meat (Borzuta, 1971; Marple, 1977; Warrington, 1974). In addition, high frequency stunning of pigs at 1300 Hz to 2400 Hz produces a better quality meat with a lower incidence of pale, watery, soft pork (Gorbatov et al., 1976; Marple, 1977). However, the use of high electrical frequencies is not recommended at this time, since its ability to produce instant unconsciousness has not been verified with the EEG.

Another idea that has been patented is the use of microwaves to heat a portion of the brain to 113°F (41°C) for 1-7 seconds with microwaves of 100-10,000 mega Hz (Schwartz and Wacker, 1976). It is hoped that this method, if it could be perfected, would provide the meat quality benefits of high frequency and pro-
duce painless unconsciousness. Data on the effectiveness of this method is unavailable at this time.

There has also been research to determine if changing the shape of the electrical wave form from sinusoidal to square rather than changing the frequency would have an effect (Weaver et al., 1977). Studies in humans shocked with the square wave machine at a frequency of 150 Hz resulted in reliably induced seizures, with a 50% reduction in energy (Weaver et al., 1977). Additional research is required to develop new stunning technology in the 200-500 Hz range which can provide painless stunning and optimum meat quality.

**Electrode Placement**

Correct placement of the electrodes is essential to ensure that the electricity will pass through the brain and produce unconsciousness. There are many different types of electrodes which are used, although the most common types are the bridge (Figure 5), the two pegs (Figure 6) or the tongs (Figure 7). All three types and variations of them can work well if properly used.

The bridge-type electrode is recommended for high-speed plants slaughtering 300 or more pigs per hour in a conveyor restrainer (Hoenderken, 1978a,b; W. Sybesma, personal communication). Bridge-type electrodes should have one end placed on the pig’s forehead and the other end placed either on the nape of the neck or the back (Figure 5) [W. Sybesma, personal communication]. The bridge electrode may also be effectively placed sideways on the pig: one end midway between the eye and the ear, and the other end at the side of the neck or body. The bridge electrode should never have both ends applied at the same time to the neck or the back, nor should it be applied with one end behind the ears and the other end on the neck or back. This will merely paralyze the pig and not produce unconsciousness.

Peg-type electrodes basically consist of two electrode pegs spaced 3-6 in (7.5-15 cm) apart (Figure 6) which ideally should be placed midway between the eye and the ears on each side of the head in pigs. The wider spaced electrodes are usually recommended to insure that the current passes through the brain. Since it is difficult to apply the peg electrodes in this position while the pigs are moving, most plants apply them in the hollow immediately behind the ears. This position is effective and will elicit a grand mal seizure. If they are placed too far back on the neck, unconsciousness will not be produced (Croft and Hume, 1956).

Tong-type electrodes (Figure 7) are very effective for low speed plants, specifically if no restrainer is available to hold the animal. To ensure that the current passes through the brain, tong electrodes are applied to each side of the head midway between the eye and the ear or just below the ears (Carding, 1971; Croft and Hume, 1952). The tongs must never be placed on each side of the neck, on the top of the head, or on the underside of the neck (Leach, 1978; Von Mickwitz and Leach, 1977). Placement at those locations may not render the animal unconscious. It is also advantageous to soak the electrode pads in brine after every few animals to insure a good electrical contact, especially with calves and sheep due to their thicker hair and the wool (Frazerhurst, 1975).

A pig restrainer with an automatic built-in electric stunner has been developed in Europe. The refinement of automatic stunning systems may improve the accuracy of electrode placement.
The bridge type electrode is recommended for stunning pigs in a high speed plant. The electrode should be placed with one end on the forehead (pictured) and the other end on either the nape of the neck or on the back. The bridge electrode may also be effectively placed with one end midway between the ear and eye and the other end at the side of the neck or body.

**Electric Current Path for Pigs**

Blunt electrodes which do not penetrate the skin are equally as effective as those with sharp pointed ends which penetrate the skin (Hoenderken, 1978b). In addition, wetting pigs results in more reliable stunning (Best & Donovan Co., personal communication; Hoenderken, 1978a, b) and eliminates the need to soak the electrode pads.

Since pigs are usually wetted down for stunning, the entire system must be checked to ensure that the full voltage and amperage from the stunner is passing through the pigs between the ends of the electrodes and not passing through one electrode and grounding out through the restrainer or floor. Electricity flows through the path of least resistance, and if that path is through the restrainer in-
FIGURE 7 — Tong electrodes are effective for low speed plants, especially where no restrainer is available to secure the animal. Tong electrodes are applied to each side of the head midway between the eye and the ear or just below the ear.
stead of through the two electrodes and the brain, the animal will not be rendered unconscious. The restrainer should be insulated to prevent the stunner from grounding out. Current leakage through the restrainer can be checked by connecting one lead from a volt meter to the back of the pig at least 12 in (30 cm) from the electrode and the other lead to the side of the restrainer. The meter should not indicate any current leakage.

**Current Path for Sheep**

The most commonly used electrode for sheep in the United States is the double sharp pin electrode. One pin is placed on the forehead and the other on the neck or body. The electrodes can either be mounted on two separate handles where one handle is held in each hand, or a bridge type electrode can be used.

The practice of using sharp pin electrodes in sheep has been criticized as being cruel. However, only a fraction of a second passes between the prick of the point piercing the flesh and the administration of the current. If the electrode does not make a good electrical contact, the sheep will be paralyzed instead of stunned, resulting in greater pain and stress (Leach, 1978; Kilgour, 1976, 1978). The top of the head is the least painful area to apply the first electrode. The electricity should be turned on as soon as the second electrode is placed into the body.

The pin electrodes for sheep should be hook-shaped for easier application through the wool and to restrict the depth of penetration into the animal. In plants slaughtering 100 or more sheep per hour, a conveyor restrainer should be used to hold the sheep for application of the pin electrodes; in plants slaughtering less than 100 per hour, the shackling pen should be equipped with a crowd gate so the sheep are kept tightly crowded and unable to move or jump away from the electrodes. A new bridge type electrode for sheep has been developed by Thornton Equipment (Auckland, New Zealand). When the electrodes are placed, water flows through them to help make a better contact. They must be used with great care to ensure proper contact to produce unconsciousness. Pin electrodes are more reliable.

**Electric Stunning Economics, Maintenance and Safety**

Electric stunning equipment is very economical to operate and easier to maintain than either captive bolt or CO₂ equipment. A stunner which delivers 1 amp at 300 volts with a 2-second application time uses less than 600 watts. (Watts = amps x volts.) Even if the stunner was never turned off, it would consume less than 30¢ worth of electricity per day, based on a rate of 5¢ per kilowatt hour according to the Arizona Public Service, Phoenix, AZ.

To ensure that the desired voltage and amperage is being delivered to the animal, the stunner should be checked at least once a week with a meter while the animal is being stunned. The amperage can only be measured while the current is passing through the animal. Broken electrodes might easily result in the animals being paralyzed instead of stunned. Cords and electrodes should be checked regularly with an ohm meter. The operator should wear rubber boots and the work station should be insulated.
**CO₂ Stunning**

The first carbon dioxide (CO₂) gas chamber for preslaughter stunning in the United States was installed at the Hormel Packing Company (Austin, MN) in 1950 and patented by L.W. Murphy (1956). It was designed to anesthetize up to 1000 pigs per hour. This method is mainly used on pigs; however, this system is usually not practical for sheep because large quantities of CO₂ are absorbed in the wool and the gas is irritating to the animal (Glen, 1971).

In the original Hormel system the pigs pass through a single file chute through a set of swinging doors and onto a moving conveyor which is compartmentalized. After the animal is enclosed in the compartment, it is conveyed down a 30° slope into the stunner containing the CO₂. It takes about 60 seconds for the pigs to pass through the tunnel before the anesthetized animals are conveyed out of the tunnel to be bled. The Butina Engineering Firm in Denmark has developed CO₂ anesthetizing chambers which require less floor space for smaller plants. The Oval Tunnel unit (Figure 8) has a capacity of 120 to 600 pigs per hour and works on a principle similar to the Hormel system. Butina also makes a Compact Plant which can anesthetize 90 to 300 pigs per hour (Figure 9) and a Dip Lift system which can handle up to 100 Pigs per hour (Figure 10). In the Compact Plant, the pig enters a "V" restrainer trap, the floor of the restrainer drops away, and the restrainer then descends into the chamber containing the
FIGURE 9 — Butina Compact Plant CO₂ system. Each pig enters a "V"-shaped compartment which conforms to the shape of the pig's body. When the compartment is lowered, the floor drops away and the pig is securely held by the "V"-shaped compartment when it descends down into the CO₂ gas. The right-hand illustration shows how pigs move through the system. This is the most humane CO₂ system because struggling and thrashing are reduced.

FIGURE 10 — Butina Dip-Lift CO₂ system. Each pig enters a cage and is lowered like an elevator into the CO₂ gas and then brought back up. The pig is not restrained as in the Figure 9 "Compact" system and it is free to move or struggle.

CO₂ gas. Of the three Butina systems, the Compact Plant is preferred as it may be the least stressful because each pig is securely restrained and unable to jump around (Hoenderken, 1978a).

Most animals will become anesthetized within 22-45 seconds at a CO₂ concentration between 65-70% (Dodman, 1977; Van der Wal, 1971). Exposure to CO₂ at high concentrations (over 80%) or for longer periods of time (over 45 seconds) may cause the animal to become stiff and as a result, reduce bleedout (Dodman, 1977; Ratcliff, 1971). Concentrations below 55% may not render the animal unconscious (Van der Wal, 1971). The balance of atmosphere in the chamber is provided by air which brings the total oxygen content to about 7%.
How Stressful is CO₂ Stunning?

Recent research and observations of animals inside the CO₂ chamber indicate that CO₂ stunning is more stressful than either properly applied electrical or captive bolt stunning. The latter methods produce instant unconsciousness. In the CO₂ chamber there is a period of 20 to 30 seconds between entering the gas and unconsciousness (Hoenderken, 1978a).

It has been reported that entering the dark chamber and riding on the conveyor was stressful to pigs and caused them to balk (Leach, 1978; Sybesma and Groen, 1970). In order to avoid this problem, Hormel Packing Company provides lights in the chamber. Personal observation indicates that, as the pigs passed through the swinging door to the lighted chamber, they were calm and would quietly walk or lie down on the moving floor conveyor. The partitions in between each pig compartment were constructed so that an approaching pig could see another pig disappearing down the tunnel; the next pig would readily follow. Problems associated with the animals being frightened by the mechanical apparatus are discussed in Grandin (1980a, b).

There is evidence that when the animals first enter the CO₂ gas they become excited and stressed prior to the onset of unconsciousness (Dodman, 1977; Leach, 1978; Von Mickwitz and Leach, 1977). Pigs emerging from the CO₂ were completely turned around, contorted and showed signs of gasping. Large white Landrace pigs appeared to react more violently than other breeds which may indicate an important variable in determining the use of CO₂ anesthesia (author’s observation). Lard-type pigs may react less violently to CO₂ than modern, lean meat-type pigs which tend to be stress susceptible. The excitation phase prior to the onset of unconsciousness is approximately 10-20 seconds as determined by EEG studies (Hoenderken, 1978a, b). This phase is characterized by release of epinephrine into the blood (Collins, 1976) and a rise in blood pressure (Mullenax and Dougherty, 1963).

It has been determined that animals are definitely stressed by the period of excitation induced by CO₂, but does this excitation cause pain? Several researchers have attempted an answer, but unfortunately the question is still unresolved (Bloomquist, 1957; Cantieni, 1977; Hoenderken, 1978a,b; Leach, 1978; Mullenax and Dougherty, 1963, 1964; Van der Wal, 1971). Although these studies produced no truly clear-cut evidence of pain, it is known that CO₂ can be irritating to the respiratory tract in both humans and nonhumans (Van der Wal, 1971; Glen, 1971; Glen and Scott, 1973; La Verne, 1973; MacArthur, 1976). Although, while humans can be anesthetized with CO₂ without discomfort (Olson, 1978; Van der Wal, 1971), animals may react differently to CO₂. Humidification of the CO₂ chamber with easy-to-install, inexpensive water foggers and warming of the gas itself could significantly reduce the stress associated with CO₂ inhalation. Another possible method of reducing the stressfulness of CO₂ is to first introduce the pig into 30% CO₂ and 70% air and then increase the mixture to 68-70% CO₂ and 30—32% air (Wernberg, 1978).

Economics and Maintenance of CO₂ Chamber

A CO₂ chamber is the most expensive type of stunning equipment to install initially. A large system such as the Hormel tunnel which can handle over 600 pigs per hour costs $100,000 to $175,000 to install today. Butina Engineering in
Denmark manufactures smaller units which vary from $25,000 to $100,000 including installation costs. Installation of CO₂ equipment in existing plants would require structural modifications and rearrangement of holding pens and chutes. Large pork slaughter plants in the United States calculated that, in 1979, CO₂ cost 5-6¢ per animal for the gas. CO₂ is supplied to the chamber by either cylinders of compressed gas or dry ice (solid CO₂). The Hormel chamber holds a three day supply of dry ice (National Provisioner, 1956). Maintenance of the correct concentration of CO₂ requires at least daily checks. Ideally, a continuously recording CO₂ meter should be installed.

Maintenance costs for a CO₂ chamber are much higher than for either electric or captive bolt systems. Not only do conveyor systems or lift systems have many moving parts which require constant care and replacement, but thrashing pigs may also break the partitions and the conveyors. A CO₂ chamber will remove one or two people from the processing line, but it may add an additional person in the maintenance department to repair the equipment and monitor the CO₂ level.

**Stress, Meat Quality and Stunning Technique**

In order for any stunning method to be painless, it must either induce unconsciousness instantly, or induce unconsciousness with minimum stress prior to the onset of unconsciousness. Any method used to stun or kill an animal will increase the secretion of epinephrine (adrenal in) and other catecholamines (Althen, et al., 1977; Pearson, et al., 1977). The secretion is triggered by the insult to the brain from the concussion, electricity or CO₂ gas.

Due to this fact some researchers have stated that stunning an animal is more stressful than cutting the animal’s throat without stunning. The epinephrine levels are higher after stunning than after cutting the throat without stunning (Althen et al., 1977; Kilgour, personal communication). From a purely physiological standpoint, the stunned animal is more highly stressed. Properly applied stunning, however, reduces pain and discomfort to the animal because it is unconscious either before or simultaneously with the output of epinephrine and other catecholamines. It is of the utmost importance, therefore, that unconsciousness is produced by the stunning method applied.

**Conclusions and Recommendations**

The stunning method used should suit both the type of plant and the type of animal and should produce unconsciousness rapidly and without stress prior to the onset of unconsciousness. Stressful procedures are not only questionable from a humane point of view, but they can also affect the quality of the meat. Table 1 summarizes the various recommended techniques for the different types and grades of animals.

For electric stunning, the minimum power requirements for pigs are 1.25 amps at 180 volts for one to five seconds (Hoenderken, 1978a, b). Amperage readings should be taken during the actual stunning. The shortest application time which produces a grand mal seizure is recommended and the best electrode for high speed plants is the bridge design. The pigs should be wetted prior to stunn-
# TABLE 1—Stunning Recommendations

<table>
<thead>
<tr>
<th>Type of Animal</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulls</td>
<td>Penetrating captive bolt or gun shot to forehead (cartridge-fired stunners require heavy charges).</td>
</tr>
<tr>
<td>Cows, steers, heifers</td>
<td>Penetrating or nonpenetrating captive bolt (where brains are being saved), or gun shot to forehead. Shoot behind the poll only for heavy Zebu or Brahman cattle.</td>
</tr>
<tr>
<td>Calves</td>
<td>Penetrating or nonpenetrating captive bolt, or gun shot to forehead.</td>
</tr>
<tr>
<td>Sows and boars</td>
<td>Penetrating or nonpenetrating captive bolt, or gun shot to forehead, or electric stunning.</td>
</tr>
<tr>
<td>Market-weight pigs</td>
<td>Electrical stunning. (Captive bolt has detrimental effect on meat quality.) Minimum of 1.25 amps at 300-600 volts with 1-3 seconds application time with blunt electrodes.</td>
</tr>
<tr>
<td>Sheep</td>
<td>Penetrating captive bolt or gun shot. Nonpenetrating captive bolt must not be used. In electric stunning, use sharp pin electrodes or electrodes soaked in brine to assure a good electrical contact through the wool. Sheep must be bled within 10 seconds, otherwise they will regain consciousness.</td>
</tr>
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</table>

ing. For sheep, conveyor restrainers should be used with pin electrodes or with the New Zealand bridge electrode with automatic electrode wetting. The pin electrodes are more reliable whereas the New Zealand bridge electrode must be monitored carefully. In small plants where tong electrodes with brine soaked pads are used, the animal may be restrained by hand. To reduce blood splash in both pigs and sheep, and pale, soft, watery meat in pigs, the animal should be bled within ten seconds of stunning.

Unconsciousness may be determined in the slaughter plant by the following methods: For captive bolt apparatuses and CO₂ systems, all eye reflexes should be absent. However, only the pupillary reflexes should be used as a guide in electric stunning.

Meat quality can be affected by the stunning method. Unfortunately, in sheep, the procedure which is most reliable in stunning the animal often affects the quality of the meat adversely.
References


Gross, R. (1976) Elektroencephalographische und elektrokardiographische Verlauf-
sunter suchungen nach Bolzenschuss betaubung und nach Toten durch Entbluten in der Form des rituellen Schlachtens., Tierarztl. Hochschule, Diss., Hannover, FRG.


Hoenderken, R. (1978b) Electrical stunning of pigs for slaughter, 24th Annual Meeting of Meat Research Workers, September 4-8, Kulmbach, Germany.


Koch, Inc. (1980) General Catalogue 198, Kansas City, MO.


Amendment to the U.S. Animal Welfare Act

Representative Pat Schroeder (D-Colo.) has introduced a bill into the U.S. Congress which would amend the Animal Welfare Act "to insure the humane treatment of laboratory animals." The bill (H.R. 6847), which concentrates on research involving pain, contains several features with wide-ranging implications for the conduct of animal experimentation:

1. The definition of "animal" is expanded to include all live or dead vertebrates, excluding horses and farm animals not used in research facilities.

2. A new definition is included for "pain" to cover both "hurtful immediate physical sensations" and "debilitation and significant physical and behavioral distress."

3. Elementary and secondary schools would not be permitted to use animals in procedures causing "pain."

4. The current proviso that the U.S. Department of Agriculture (USDA) cannot promulgate rules, regulations, or standards on the design, outlines, guidelines or performance of actual research or experimentation would be deleted.

5. All research facilities registered with the USDA must establish and maintain an animal care committee of not less than five members (including a veterinarian) who are knowledgeable in and concerned about animal welfare. Projects which could cause "pain" would not be undertaken without the approval of the animal care committee.

6. All animals subjected to painful research must be adequately anesthetized to preclude pain except in the case of procedures resulting in "momentary pain of minor severity," e.g., injections. In addition, the infliction of disease by a registered person would be permitted if the animal care committee deems it necessary.

7. Multiple survival surgery on a single animal would not be permitted unless sequential operations are required for the testing of a single hypothesis.

8. The Secretary of Agriculture would appoint an advisory committee of ten to twenty-five individuals, including professionals, animal welfare representatives and members of the public at large.

9. The Secretary would promulgate rules to permit inspectors to confiscate and/or euthanize animals found to be suffering as a result of failure to comply with any of the provisions of this Act.

The proposed amendment extends the scope of the Animal Welfare Act considerably, but is, in the main, in keeping with accepted voluntary guidelines. For example, the National Institutes of Health Guide for the Care and Use of Laboratory Animals.
(p. 14) discourages multiple survival surgery unless the sequential operations are related components of a research or instructional project (see item 7 above). The Public Health Service policy on animal research includes all live vertebrates in its definition of "animal," and places the responsibility for humane treatment on both investigators and institutions. Animal care committees already function at most institutions which use vertebrate animals, and in many cases, a representative of the committee will review proposed research projects (see item 5 above).

The definition of and concern with pain is a new feature and represents an attempt to codify general exhortations to minimize distress and to use pain-relieving drugs where appropriate. There is a growing move within the establishment to review the whole concept of pain and distress. This provision, therefore, may be simply the overt expression of an implicit concern. The deletion of the proviso exempting actual research from the Animal Welfare Act coverage is a necessary element in the attempt to regulate the use of animals in painful research.

The Schroeder bill has already aroused opposition, demonstrated by the following comments on the pain provision from the Research Animal Alliance (RAA): "...different people will have different understandings of what constitutes pain, particularly since there is tremendous variation from species to species. The definition is too broad and is so vague as to be virtually meaningless" (RAA Regulatory Alert, March 31, 1980).

The National Society for Medical Research (NSMR) refers to the Schroeder bill as a "serious new threat to [the] Animal Welfare Act" (NSMR Bulletin 31(4):1, 1980) and highlights the deletion of the clause preventing rulemaking on the manner in which research is conducted. The NSMR has traditionally been against any extension of the USDA's power to regulate research practices and is even opposed to the establishment of an advisory committee to assist the Secretary of Agriculture: "The imposition of a politically appointed committee, even though the composition specifies certain categories of scientists that would be included, as well as nonscientists, the possibility of this mechanism being a vehicle to impose political pressures on scientific endeavor is unacceptable [sic]."

The RAA is also concerned about the deletion of the sentence which prohibits the Secretary of Agriculture from making rules about the conduct of research: "...elimination of this provision would pave the way for the USDA, at the urging [sic] of animal welfare groups, to interfere with the actual design and management of research activities." This is a contentious issue which will have to be aired and clarified in hearings and debate. However, it is also pertinent to note that research protocols are currently subject to "interference" by peer review groups which can recommend modification of a particular technique if the project is to qualify for funding.

The Schroeder bill is the offspring of a bill which was introduced into the Colorado State Legislature in 1979. Containing most of the provisions listed above, the Colorado bill was endorsed by the deans of both the medical and veterinary schools in Colorado. The bill-drafting group included the Dean and Assistant Dean of the College of Veterinary Medicine, a physician from Colorado Medical School, three attorneys, one philosopher, one veterinarian in private practice, and the head of the Animal Care Facility at Colorado State University. Several members of this group have stated that they are willing to testify in favor of H.R. 6847. The bill is also supported by The Humane Society of the United States and the Animal Welfare Institute.
While it may not be possible to transpose it directly to the federal level, the Colorado bill has had substantial input from research scientists, and this will probably ensure considerable debate on the various issues raised by H.R. 6847. At present, battle lines are still being drawn, but several members of the research community have already indicated that they may support the new bill, either in major part or in its entirety.

**MEETINGS and ANNOUNCEMENTS**

**FORTHCOMING MEETINGS**

**International Association of Fish and Wildlife Agencies:** Worldwide Furbearer Conference, August 3-11, 1980, Frostburg State College, Frostburg, MD. Contact the Worldwide Furbearer Conference Office, Appalachian Environmental Laboratory, Frostburg State College Campus, Frostburg, MD 21532, or telephone 301-689-3115.

**International Society of Animal Hygiene:** Third International Congress of Animal Hygiene, September 10-12, 1980, Vienna, Austria. Contact Secretariat, Third International Congress of Animal Hygiene, c/o INTERCONVENTION, P.O. Box 35, A-1095 Vienna, Austria.

**British Veterinary Association:** 1980 Congress, September 11-14, York University, England. Friday, September 12 session on Welfare—The Role of the Animal. Contact BVA Registration Office, 7 Mansfield St., London W1M OAT, UK.

**American Association for Laboratory Animal Science:** 31st Annual Session, October 5-10, 1980, Indianapolis, Indiana. Contact Mr. Joseph J. Garvey, Exec. Secy., AAALAS, 210 N. Hammes Ave., Suite 205, Joliet, IL 60435 USA.

**Institute for the Study of Animal Problems:** Primate Symposium: Nonhuman Primates in Biomedical Programs: Scientific and Philosophical Issues in Breeding, Husbandry and Experimental Use, October 15, 1980, Golden Gate Holiday Inn, San Francisco, CA. Topics will include the breeding and use of nonhuman primates in the US; nonhuman primate cognitive abilities and social requirements; housing and environmental enrichment; scientific issues and regulation of primate use; ethical concerns in primate husbandry and use; humane concerns and guidelines for caging, breeding and husbandry (panel discussion); and humane concerns in primate use (panel discussion). Contact Heather McGiffin, Institute for the Study of Animal Problems, 2100 L St. NW, Washington, DC 20037, USA.

**Israel Association for Biiatrics:** Eleventh International Congress on Diseases of Cattle, October 20-23, 1980, Tel Aviv, Israel. Contact Dr. E. Mayer, Congress Secretariat, P.O. Box 9610, Haifa, Israel.
Animals in Research

Bates College hosted a conference on March 21-22, 1980 entitled The Ethics of the Use of Animals in Research. The gathering, held in Lewiston, Maine, was made possible through an anonymous gift by a Maine philanthropist. The meeting was divided into two sessions, one on philosophic and one on practical considerations.

After critically reviewing several positions on the ethics of our treatment of animals, philosopher Tom Regan (North Carolina State University) argued his own evolving thesis based on a concept of rights. Launching from Dworkin's Taking Rights Seriously, particularly the notion that "individual rights "trump" the rights of the group," Regan offered several alternative principles describing where that trumping ought to give way. These would provide practical guidelines for the resolution of conflicting claims, instances where an individual's rights would be sacrificed for the sake of the group. An individual, human or nonhuman, possesses rights if he or she is "the subject of a life, for better or for worse." The primacy of individual rights over those of the group, Regan asserts, places the burden of justification on those who would abridge an individual's rights. The researcher must show why the subject of an experiment, if that subject is an individual with rights, must give up those rights for the sake of a group.

In his formal response, Mark Okrent (Philosophy Department, Bates College) charged Regan to further unpack his criterion for possession of "subject." Memory is not yet self-awareness, but it is more than sentience.

In a second formal response to Regan, David Kolb (Philosophy Department, Bates College) suggested that we "stop talking about animal rights and start talking about animal values." Rights are the wrong foundation, in part because they are either possessed or not. Values come in degree and allow us to "move down the hierarchy of animals" in a search for alternative methods of research.

Speaking more directly to the question of practice, Tom Wolfe (National Institutes of Health) offered the weight of a brief history of biomedical breakthroughs to assert the indispensability of animals to research. Given that this role for the animal is critical to contemporary science, Wolfe is concerned with the adequacy of animal care. As a veterinarian and an animal behaviorist, he systematically assesses the animals' species-specific needs. Distinguishing between stress and distress, and holding the former to be a necessary part of life, he attempts to control the animal's distress. Partly based on a reading of Hans Selye, he would achieve this by "providing well-defined controlled stress so that the animal is better equipped to cope with his later life in the laboratory."

In a carefully argued response, Deborah Mayo (Philosophy Department, Virginia Polytechnic Institute) demonstrated the incompatibility of this adaptation training to the laboratory with the concern for the animal's natural needs. Socialization to the stress of the laboratory begs the ethical question of the limits of the conditions to which the animal should be required to adapt. Mayo also offered a number of arguments against the "scientific justification of animal experiments." She held that invalid research arises from the artificiality of laboratory conditions and of laboratory-bred animals, from the presence of "subject."
of interspecific differences, and from the confusion of background with experimental variables.

Providing high contrast to Wolfe, both substantively and stylistically, clinical psychologist Emmanuel Bernstein (Saranac Lake, NY) delivered an evocative and impassioned plea that we lessen the amount of pain to which we subject animals in research. Bernstein’s position is that much research is redundant and inapplicable and, hence, that the pain involved is unjustifiable. Taking the research paradigm of learned helplessness as an example, he tried to show that, while the suffering of the dogs is considerable, the phenomenon induced is not a valid analogue to human depression. Bernstein proposed the formation of groups within research disciplines to act as animal advocates.

An animal requires “a world to be what it is,” offered John Cowgell (North Carolina State University), a doctoral candidate in zoology, with a background both in psychology and the philosophy of biology. The harm that comes from our denial to the animal of its peculiar world is a broader and more morally relevant criterion of abuse than pain. All animals deserve such consideration, independent of any positive prejudice toward those “star species” apparently more like us. Our ethical obligation to them ought not to be founded in human interest and empathy, but in our recognition of their reality, integrity and otherness.

Kenneth J. Shapiro, PhD
Bates College

ANNOUNCEMENTS

Abstract Exchange
The Institute for the Study of Animal Problems (International Journal for the Study of Animal Problems) and Elsevier Scientific Publishing Company (Animal Regulation Studies) have agreed to exchange titles and abstracts of major articles for publication in their respective journals.

Animal Regulation Studies—Volume 2, Number 2, December, 1979:

The international ivory trade—Susan M. Wells and John A. Burton (IUCN/SSC TRAFFIC Group, 1 Marshall St., London W1, Great Britain)

The legal rights of animals in the United States of America—Christine Stevens (Animal Welfare Institute, P.O. Box 3650, Washington, D.C. 20007 U.S.A.)

Jewish attitude toward slaughter—I.M. Levinger (Roonstrasse 50, 5000 Cologne 1, Federal Republic of Germany)

Jewish method of slaughtering animals for food and its influence on blood supply to the brain and on the normal functioning of the nervous system—I.M. Levinger (Roonstrasse 50, 5000 Cologne 1, Federal Republic of Germany)

(For abstracts, see News and Review in this issue.)

New APHIS Administrator

Harry C. Mussman has been appointed administrator of the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service (APHIS), effective July 1980.

The new appointee, currently director of animal production and health at the United Nations Food and Agriculture Organization (FAO) in Rome, Italy, held several management positions at USDA between 1971 and 1977, including the post of associate administrator of APHIS.

Dr. Mussman holds both a doctoral degree in veterinary medicine and a PhD in agricultural bacteriology. He has taught and directed veter-
Mussman succeeds Dr. Francis J. Mulhern, who retired in February to become director of animal health for the Inter-American Institute for Cooperation in Agriculture.

**Newsletter on the Human-Companion Animal Bond**

The Group for the study of the Human Companion Animal Bond, formed in March 1979, has recently published a newsletter which includes abstracts of the papers presented at the British Small Animal Veterinary Association Symposium on the Human-Companion Animal Bond (See *Int J Stud Anim Prob* 1(3): 203-205, 1980). The Group hopes to publish quarterly and welcomes all relevant contributions. Submissions should be addressed to Dr. Peter R. Messent, Newsletter Editor, Animal Studies Centre, Freeby Lane, Waltham-on-the-Wolds, Melton Mowbray, Leicestershire LE 14 4RT, UK.

**Veterinarians for Animal Protection**

The Veterinary Society for the Protection of Animals (SVPA—Société Vétérinaire pour la Protection Animale) is based in Brussels (Avenue Fonsny 41, 1060 Brussels, Belgium). The president of the organization, Dr. Raoul Hens, has a private veterinary practice in Brussels and has held a number of other posts including the presidency of the Scientific Committee of the Belgian National Council for Animal Protection.

The SVPA produces a quarterly Bulletin in French and Flemish, costing 20 Belgian francs. The latest issue (No. 3/4, 1980) contains a report on the twenty-first World Veterinary Congress (1979), where a resolution was passed urging all veterinarians to use their position and influence to call attention to animal suffering in experimentation, farming and slaughter and to promote animal protection in general.

**New Editor for Equine Study Group**

The International Equine Behavior Study Circle announces a change in its North American editorship. Professor Andrew F. Fraser of the Western College of Veterinary Medicine (Saskatoon), resigned as North American editor and coordinator, due to increasing professional commitments. His successor is Sharon E. Cregier, who is located at the University of Prince Edward Island, Charlottetown, P E.I., Canada C1A 4P3.

The Circle, founded in 1978 by Dr. Moyra Williams of Great Britain, collates information on the ethology of horses. It welcomes contributions from members on a wide variety of study topics including equine transport, traffic shyness, grazing behavior, evidence of extrasensory perception in horses, similarities and differences in the behavior of twin foals, and changes of breed characteristics in different habitats.

For further information contact Dr. Cregier and enclose a self-addressed stamped reply envelope.

**Bibliography of Animal Ethology**

A U.S. publisher of scientific books is interested in compiling a bibliography of animal ethology. Monographs, journal supplements, dissertations and articles with English abstracts are to be included as well as addresses of collections and source people. Studies should emphasize the philosophy and history of the animal ethology movement, the self-hood of animals or care of animals from an ethological perspective. Of special interest may be a section on equine ethology. Suggestions and recommended reading lists should be forwarded by December 1980 to Mrs. Sharon E. Cregier (address above).
BOOK REVIEWS

ANIMAL ANESTHESIA (C.G. Green, Laboratory Animals Ltd., Colchester, UK, 1979, $28.00). Animal Anesthesia is a text which covers the subject in a truly comparative manner. It discusses the basic principles of anesthesiology, common tranquilizers, sedatives and anesthetic agents in use today, and the application of this information to all vertebrate species. This makes the volume a very useful resource for any experimental or clinical scientist involved in comparative medicine.

The first eight chapters of the book deal with the basic science of anesthetic agents and management. They are concise and well organized and provide a good review for those familiar with general anesthesiological principles. The book also will be a valuable overview for those less acquainted with the subject and in need of a brief and clear introduction. It will not, however, replace larger standard works or professional training in veterinary anesthesiology.

The summary of recommendations at the end of chapter 1 serves as a basic checklist to follow whenever anesthesia is included in an experimental protocol. The remainder of the book is devoted to a discussion of the application of principles and techniques by taxonomic class. Essentially, this is an extensive literature review of articles pertaining to each group. This material is often widely scattered, and the author has done an admirable job in bringing together related information from varied fields and experiences. The review is followed by a description of recommended techniques based on the author’s experience. All is presented in a standard (and strictly followed) format which, along with many convenient tables and diagrams, makes the information easily accessible.

The last chapter deals with methods of euthanasia, and the appendices contain useful information on proprietary/generic names, suppliers, weights and measures, and a glossary.

For experimental and clinical science to be practiced in an ethical and responsible manner, the researcher and clinician must be aware of the specific needs and idiosyncracies of the animals involved in surgical or diagnostic procedures. Animal Anesthesia provides a good source of this kind of information and would thus be a valuable addition to any veterinary library.

F. Joshua Dein
University of Pennsylvania
School of Veterinary Medicine

COMFORTABLE QUARTERS FOR LABORATORY ANIMALS (7th ed., Animal Welfare Institute, Washington, DC, 1979, $3.00). The purpose of the seventh edition of “Comfortable Quarters for Laboratory Animals,” as stated in the introduction, is “to provide an environment sufficiently natural that the animals can be maintained as normal individuals, upon whom reliable observations can be made.” As in the previous edition, emphasis is placed on alleviating overcrowding and providing adequate room and facilities for exercise and resting. The volume is organized into 13 chapters according to species, with additional chapters on the Animal Welfare Act, environmental en-
enrichment for small animals, and "Substitutes for Laboratory Animals."

The book is simple and readable, presented in a 108-page, 8x10 inch format. There is an introductory comment for each chapter, followed by photo essays (often only captioned photos) of selected animal colonies.

This Animal Welfare Institute (AWI) publication stresses environmental enrichment. It is argued that such enrichment, across all species, allows for the development of normal behavioral repertoires which in turn results in species uniformity and the reliability of test data. While elaborate, spacious facilities are included, the greatest benefit from this work is to be found in the elegantly simple innovations that different colonies have evolved to elicit involvement of the animal with its environment. Such is the case with "grape boards" and artificial termite mounds stocked with finger-licking honey, grapes and raisins for dexterous chimpanzees. Ping pong balls speckled with paint elicit the sustained curiosity of chickens, as do the manipulanda placed in wild carnivore and monkey facilities which provide a means for additional food rewards. Climbing "trees," scratching poles, nest boxes, running wheels and human attention are but some of the additional enrichments being used to simulate natural environments. Many of the concepts presented in the publication are cost effective as well. Modular kennels and dry bedding for laboratory dogs, which provide for greater flexibility at a lower cost, are rapidly gaining popularity with the research community.

While some facilities are well-described, enabling one to obtain considerable "socioengineering" detail (e.g., the Stanford Outdoor Primate Facility), others are poorly presented. The Delta Regional Primate Research Center (p. 38) shows only a small troop of rhesus monkeys sitting on unidentified wire structures. Most of the photographs add much to the clarity of the presentation, but some are of such poor quality as to be distracting. Those chosen to depict roosting behavior in chickens (p.100) are totally unacceptable as representations of laboratory animal housing.

There is also inaccurate referencing (p. 74, reference to pp. 71 and 73 should be pp. 77 and 79, respectively), and the picture legend (p. 63) cites examination table and feed pans which are not evident in the photograph.

The last two pages present the AWI policy on the use of vertebrates as laboratory subjects. The abstract lists and labels nine primary points of the policy. Following this, the expanded text appears to elaborate on the nine points in the abstract. The use of the same typeface style implies a direct referral between the listed points in the abstract and the listed points in the expanded text. However, this is not the case, making the otherwise well-conceived policy statement difficult to follow.

Despite the shortcomings listed above, "Comfortable Quarters for Laboratory Animals" provides many excellent references and innovations in improving the quality of the laboratory animal environment. We recommend it as worthwhile reading for all concerned with laboratory animal care.

Thomas L. Wolfe, DVM
Robert A. Whitney, Jr., DVM
Division of Research Services
National Institutes of Health

BOOKS RECEIVED

ANIMAL TOOL BEHAVIOR: The Use and Manufacture of Tools By Animals, Benjamin B. Beck (Garland STPM Press, New York, NY, 1980, $24.50)

THE INSTITUTE FOR THE STUDY OF ANIMAL PROBLEMS, the scientific research division of The Humane Society of the United States, is seeking a scientist with a biomedical background to research and promote alternatives to the use of live animals in biomedical research and commercial testing and to carry out related duties within the Institute.

Duties: Researching and analyzing existing literature on alternatives to live animal lab use, including toxicity testing, primate use, and drug and cosmetic testing, and preparing original technical articles and position papers on the subject; serving as liaison with universities, private industry, schools, U.S. government agencies, and Congress in promoting alternatives to live animal research and testing and in promoting the refinement of lab research techniques so as to reduce animal use and suffering; overseeing pertinent research projects; supervisory editing of technical journal on animal welfare science; organizing symposia, workshops, and other public events on lab animal issues; serving as liaison with the Institute’s advisory board of scientists.

Minimum Requirements: Doctoral degree in biochemistry, biology, medicine, pathology, or physiology. Published works. One year laboratory research experience using animals via graduate level education or job experience. English language and communication skills commensurate with public advocacy, liaison, and editorial duties. One-two years experience in technical/scientific editing. Humane sympathies.

Salary: $25,000/year.

Working Conditions: Thirty-five (35) hours per week—more as appropriate to the position. Indoor office.

Contact: John A. Hoyt, President, The Humane Society of the United States, 2100 L Street, N.W., Washington, D.C. 20037. Telephone: (202) 452-1100. Send curriculum vitae, one technical and one nontechnical writing sample, and two references.
INSTRUCTIONS TO AUTHOR(S)

Exclusive publication: Articles are accepted with the understanding that they are not being submitted for publication elsewhere. Material accepted for publication implies transfer of copyright to the Journal.

Manuscripts — including footnotes, references, tables and figure legends — must be typewritten, double-spaced on 8 1/2 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.

Organize manuscripts as follows: Title page (pg. 1) containing title of the article (48 characters), author(s), affiliation, present address, address to where proofs should be sent; Abstract (pg. 2); Text (begin pg. 3) which includes introduction, methods/procedures, results, discussion, conclusion, acknowledgements, 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 of 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

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 to allow 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.


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

Original Articles: 5000-8000 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.