Preliminary Verdict for Electro-Immobilization

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

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

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

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

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

With regard to the manner of electrical contact between device and subject, earlier investigators thought it was essential to deliver electrical current directly into body fluids, thereby providing a low-resistance path for the current, avoiding electrical burns of the skin and delivering an adequate amount of electrical energy to the subject. In development of the Vet-Master, which makes electrical contact with the animal in the relatively contaminated regions of mouth and anus, we were concerned that penetration of the skin with any type of needle to reach the body fluids would create risk of infection, as well as cause pain upon application of the contacts. We therefore developed nontraumatic rectal probes and lip contacts, which deliver current to the body fluids by way of the moist rectal surface, and saliva within the mouth, respectively. These contacts have proved to be excellent low-resistance routes through which electric current can be delivered. No tissue trauma has been observed at these sites in any animal we have immobilized with the Vet-Master. Absence of pain upon attachment reduces the need for initial physical restraint as well.
The second issue, relating to properties of the electrical current suitable for the purpose of the device, has been extensively examined by a number of investigators. In general, it appears that alternating currents or repetitive pulses of current are more useful than direct current, and further, that higher frequencies of alternation or repetition tend to be more satisfactory than the lower frequencies. Certain investigators who have tried these types of devices on themselves have reported that lower frequencies (less than 100 cycles per second) can create considerable discomfort. We have examined a range of different frequencies in working with the Vet-Master, and find the most satisfactory immobilization occurs with frequencies at or near 100 cycles per second, provided that the duration of cyclic application of current (length of pulse) is properly selected. Preliminary evaluation of enzyme profiles from calves subjected to electronic immobilization in our lab would suggest that higher frequencies may result in milder metabolic disturbances in tissue than do lower frequencies.

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

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

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

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

### Enforcement Powers for Humane Societies

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

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

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

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

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

With this aim in view, a pig park was set up at the Edinburgh School of Agriculture farm, Eastern Howgate, in which the animals are allowed as much freedom as possible. The park consists of an enclosure of 1.3 ha containing a small pine copse, gorse bushes, a stream, and a swampy wallow. A small population has been kept there for about 3 years. At present, this population consists of a boar, four adult females, a subadult male and a subadult female, together with any young from the females that
have not yet been removed. Normally, young have been removed when ready to be fattened, or at 12-13 weeks when they wean themselves.

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

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

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

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

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

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

Egg Producers Issue Guidelines for Destroying Baby Chicks

As Walter Jaksch related in an earlier issue of the Journal (214:2-3-213, 1981), the male chicks of laying hens are considered an unwanted and useless byproduct to the egg industry. Since laying hens have been specifically bred to channel all of their available energy into producing eggs, layers gain weight poorly. So the males of these strains cannot be used for meat production, and they are usually destroyed when only a day old. However, since these male chicks are not...
considered as food animals, there have been few regulations, in any country, on how they should be killed and disposed of.

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

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

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

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

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

Then, instructions for use of CO\textsubscript{2} and some of its advantages are explained. For disposing of large numbers of chicks, it is advised that

A constant trickle of CO\textsubscript{2} be introduced into a large plastic-lined container...The container is then slowly filled with chicks. Each layer of chicks will be unconscious or dead before the next layer is added.

Parenthetically, the guidelines note that "development of CO\textsubscript{2} chamber utilization is also encouraged."

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

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

**Establishing Baselines for Domestic Animal Behavior**

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

The first step in deriving an ethogram is a pilot study, in which the most prominent behaviors observed are recorded and assigned to one of several categories: gross motor patterns, vocalizations, and odors. This is done for both individual and social behaviors. Animals should be studied in different housing systems, as well as in unconfined, natural situations. Concerning odors in particular, the author notes that "we are just beginning to appreciate the rich odor vocabulary used in various social contexts of domestic animals." Then, the behaviors listed in
the pilot study are subdivided into iden-
tifiable units, termed "modal action pat-
terns"; these units must be defined in
objective terms and then characterized
in a quantitative sense by measures like
frequency, duration, amplitude (intensity),
and latency (the interval between presenta-
tion of a stimulus and the initiation of a
response).

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

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

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

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

But a farmer in Nehoosa, WI, Mrs.
Tom Martinson, has written to the jour-
nal about the insensitivity that she sees in
the way that both industry and govern-
ment are thinking and talking about the
downer cow problem. It is her firm be-
lief that all of the verbiage about the
economics of dealing with downers is ir-
relevant at best, and coldly callous at
worst, because so little money is made
from the sale of these animals, irrespec-
tive of how they are eventually graded.
She writes:

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

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

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

Attitudes Toward Dogs and Cats

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

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

Deaths in Primate Trade

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

Reseaching Research Methods

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

It is well known that some substances may cause discomfort or pain after injection and that this reaction may be indicated by the animal’s lack of appetite,
restlessness, or reluctance to move. In
the small rodents, these symptoms are
not obvious, and sensitive methods are
needed to detect them. Recently, John
Herbert (Dundee University, U.K.), using
a sensitive device to measure mouse ac-
tivity, has found that injection of as lit-
tle as 0.1 ml of a harmless substance
(such as a 0.9 percent solution of sodium
chloride) caused an increase in explora-
tory activity. By contrast, an injection of
1.0 ml of an irritant (10 percent peptone
water) resulted in inactivity that lasted
for 4 hours. This work is now being extend-
ed under a grant from the Universities
Federation for Animal Welfare
(Annual Report, UFAW).

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

Cat Population Dynamics

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

Dart Gun Modifications

It is well known that the use of anes-
thetic darts for the capture of wild ani-
mals carries a significant risk of injury
and even death. Part of the problem is re-
lated to the weight of the dart. Recogni-
tion of this fact prompted the develop-
ment of lightweight dart (Nord Vet Med
34:39-43, 1982). The dart has only a limit-
ed volume capacity, and thus concentra-
ed drugs must be used, but it is very ac-
curate up to 60 m, with a range of approxi-
ately 120 m.

Alternatives at NIH

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

ORR [Division of Research Resources]
has taken the lead in planning the
development of a new activity in
1983 entitled Biomedical Research
Model Development. This activity
will ascertain whether there are al-
teratives to the use of laboratory
animals which can result in more
reliable, economical, and efficient mod-
els to be used in biomedical research.
In 1983, this activity will consist of
initiating planning efforts through
workshops and conferences aimed at
understanding the problems, and
identifying areas of research most
likely to benefit from the develop-
ment of models and the areas of
technology most likely to yield usa-
able research models. The Committee
welcomes this effort to find alterna-
tives to the use of laboratory ani-
mal for research. A report on the re-
sults of this effort should be made
to the Committee at next year’s
hearings. If a program design is pro-
posed, it should include estimates of
total funding required, how such
funds would be administered, the
criteria for allocating funds, and the
amounts recommended for fiscal
year 1984.

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

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**Laboratory Animal Numbers**

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

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

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

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

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


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