

# News & Analysis

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## **"Surplus Population" and the Hunter**

When an anti-hunter confronts a hunter with questions about how he (or she) is able to kill innocent animals, the hunter will often counter by affirming that the deer he kills are simply surplus population that would otherwise face a cruel death from winter starvation. The debate usually ends at this point, since the two protagonists are speaking about two different issues. The anti-hunter is talking in terms of moral issues, while the hunter believes he is talking science. A recent report argues that the term "surplus population" is a misnomer, and is based on a lack of understanding about the dynamics of ecosystems and the natural factors that control animal populations. D.S. Favre and G. Olsen contend that the current situation is as follows. (The full report is available from Society for Animal Rights, Clarks Summit, PA.)

Wildlife populations can be increased dramatically by many kinds of factors, such as availability of food and the length of a species' yearly gestation period. In the end, though, it is the carrying capacity of a given area that sets the actual limit to animal numbers, despite short-term increases and decreases in numbers that result from other causes.

Hunting, however, represents an anomaly, since it is one of the few factors that can destroy the natural balance and bring entire populations to extinction. Hunting also represents an intrusion into the natural balance whose long-term effects on, for example, the gene pool of the species and the populations of other species who share the habitat have not yet been studied scientifically.

At present, many State government agencies are committed to a program whose chief goal is maximizing deer populations. These efforts are self-funded, and therefore independent of regulation from other State agencies. So any change

in the current mentality toward hunting will require a concerted educational effort on the part of those who oppose hunting. This effort must be directed toward untangling the moral and ecological consequences of hunting and understanding the slippery basis of the pseudoscience that rationalizes it.

## **Animal Rights and Poultry: A Framework for Discussion**

An excellent paper on animal rights and its implications has recently been published by a poultry scientist. The author discusses the topic in relation to man's evolutionary history as a predator and exploiter of other species. It is suggested that, providing man attempts to eliminate suffering from the animals with which he is dealing, there is no reason why he should not exploit them. However, decisions on the degree to which, and the manner in which, we exploit animals are ethical decisions that should be made by society in general, but only when it has a knowledge of the facts.

Some definitions of animal welfare are given, and the need for objectivity in debates on welfare is emphasized. Although it may be possible in the future to gain some insight into the subjective feelings of domestic fowl, including whether or not they are suffering mentally, at the present time the scientist is restricted to producing factual evidence on their health, production, physiology, biochemistry, and behavior.

Three methods for assessing the welfare of poultry using behavior are described and discussed. One method is to look for unusual or inappropriate behavioral changes and show independently that they are indicative of reduced welfare. A second method is to allow the bird to choose its own environment and assume that it will choose in the best interests of its welfare. A third method is

to subject birds experimentally to stressful situations such as deprivation, frustration, or fright, observe their behavior, and compare it to that which occurs under commercial conditions. To date this method has been the most successful in helping to assess the welfare of poultry. (Abstracted from I.J.H. Duncan, *Poult Sci* 60:489-499, 1981.)

### **The French Stand Firm on Right to Hunt**

In recent issues, the *Journal* has reported research which identifies how historical and local cultural factors can become dominant influences in a particular country's attitudes toward wildlife, in spite of a common western cultural heritage. A prime example is that of Italy, where hunting is becoming increasingly popular, in part because of national values related to *machismo* and social conformity (*Int J Stud Anim Prob* 2(3):114, 1981). Now it seems that similar kinds of cultural values, based on a sense of pride about hard-won rights for the lower classes, are at work to support the survival of the fox hunt in France.

By contrast, in Britain the days of the fox hunt seem to be numbered. Rising costs, the increasing success of anti-blood sport groups, and a change in public opinion are commonly cited as reasons for the decline. For example, a poll indicated that 66 percent of the public opposed the idea of fox hunting by members of the royal family.

But in France, fox hunting is considered one of the basic rights that was wrested from the aristocracy at the siege of the Bastille in 1789. Any attack on fox hunting is therefore viewed by the Left and Communists as an assault on the lower classes. There are 1,700,000 licensed hunters in France, as compared with 300,000 in Britain.

Recent times have seen some decline in the numbers of French hunters, largely stemming from the same pressures noted in England, such as rising costs and effective anti-hunting campaigns by ecologists. Ecologists assert

that over-hunting is threatening many species with extinction. But the basic principle of the right to hunt is still being staunchly defended. As Communist leader George Marchais remarked: "The right to hunt is a conquest of the French Revolution. It must be defended."

### **Good Marks for Calves**

In Britain, calves that are too weak or sickly to be of interest to those who rear calves or the more reputable dealers end up being passed from one market to another, until they are finally sold for raising or slaughter. Often, they die during transit. And these are the weakest animals, least able to withstand the repeated stress of loading and unloading involved in the constant movement from one sale lot to another. The calves are legally permitted to be as young as 7 days old; often, they are even younger, since there is no reliable way of telling how old a calf actually is. A further complication is that disease spreads quickly among these weakened animals, especially antibiotic-resistant salmonellosis. At a symposium on the topic, John Bell commented that "a visitor from another planet might deduce that the salmonellae had devised this system in order to ensure their own survival and prosperity" (quoted in *Vet Rec* 109:523, 1981).

Along with many other groups, the British Veterinary Association is pressing for regulation of this kind of transit: a Movement of Calves Order, which would make it an offense for a calf of less than 2 months to be brought to sale at more than one market within a period of 4 weeks.

The difficulty comes in figuring out how to ensure that an individual calf has not been recently presented for sale. To solve this problem, the BVA has suggested that each calf be marked when it first comes to market. Current BVA thinking holds that the best place for such a mark might be on the calf's thorax, where the hair could be clipped or dyed. Then, when a marked calf appeared at a sale,

staff could check the owner's records, to ensure that it had not been at market within the last 28 days.

### **Captive Bolt Shooting**

Captive bolt stunning performed frontally, occipitally, and on the nape of the neck was studied in 30 veal calves. The state of consciousness was estimated by results on electroencephalograms recorded via surgically pre-implanted electrodes placed frontally, on the right side of the head. Frontal stunning on the left side of the head, as well as occipital stunning, almost certainly ensured immediate unconsciousness, because delta and theta waves (tending to an iso-electric line) appeared on the EEG directly after stunning. Additionally, the corneal reflex was absent. However, occipital placing did not result in macroscopical damage to the cortex, as did frontal stunning. Shooting with a captive bolt in the nape of the neck caused unconsciousness after a mean of 21 seconds. Until then, the calves were fully conscious, according to the EEG, and also showed a positive corneal reflex. It is therefore suggested that for the sake of animal welfare, captive bolt shooting at the nape of the neck should be abandoned. (Abstracted from E. Lambooy and W. Spanjarrd, *Vet Rec* 109:359-361, 1981.)

### **Jewish Ritual Slaughter May Ignore Animals' Welfare**

The question of ritual slaughter has aroused much debate over the past months. A recent meeting of the Veterinary Public Health Association (U.K.) discussed Jewish ritual slaughter (shechita) and why it is practiced. The authors report some of the points made at that meeting and review arguments that have been advanced in support of shechita, and also explain the British Veterinary Association view on this method of slaughter. In the opinion of the BVA, shechita, which involves killing the

animals by a single slash, with a 40-cm blade, to the carotid artery leaves vertebral arteries intact, resulting in an active, although reduced, blood supply to the brain. The animals therefore suffer reflex convulsions about 5 to 10 seconds after the ritual cutting, although it is hard to discern whether any pain is perceived by the animals. Nevertheless, the BVA feels that a minimally stressful slaughter procedure should entail some concern about handling of the animals before killing and pre-stunning, procedures that are not a part of traditional shechita. (Editorial, *Vet Rec*, September 26, 1981).

### **Tissue Culture Course Funded**

For a number of years in the 1970's, Dr. Sergey Federoff at the University of Saskatchewan ran a tissue culture course for anyone interested in learning the techniques for working with cells in culture. However, he was forced to stop offering the course due to lack of funds. Various animal welfare groups lobbied on his behalf with the Canadian government and, as a result, he will now receive \$10,000 per annum for the course via the Canadian Council on Animal Care. In addition, Dr. Gilles Julien, Executive Director of the Natural Sciences and Engineering Research Council (NSERC) of Canada has stated that grant selection committees have been explicitly encouraged by NSERC to promote alternative methods to animal research when conducting site visits.

### **Follow-up: Pulmonary Hemorrhage in Racehorses**

In the last issue of the *Journal* (3(1): 17, 1981), it was mentioned that R.W. Cook, Professor of Equine Medicine and Surgery at the University of Illinois, has estimated that only 0.8 to 2.5 percent of all racehorses actually experience hemorrhage (epitaxis) after a race, although approximately 25 to 80 percent of all horses are given the drug Lasix, a purported cure for bleeding, before a race.

However, more recent work by J.R. Pascoe *et al.* (*J Am Vet Res* 42:703, 1981), who examined horses within 2 hours after racing with a flexible fiberoptic endoscope, found dramatically higher percentages of true "bleeders." Of the 235 thoroughbreds examined, 103 (43.8 percent) showed varying degrees of hemorrhage in the tracheal lumen, although only 2 horses (0.8 percent) had subsequent blood flow from the nostrils.

Statistical analysis of the data, however, did support previous findings that the frequency of hemorrhage tends to increase with the age of the horse. This trend is considered to reflect the long-term effect of chronic pulmonary lesions: an inability to repair damaged areas of tissue in the face of continued stress of training and racing. Also, treatment of bleeding with Lasix still appears to be of little value: 30 of 56 Lasix-treated horses had evidence of pulmonary hemorrhage.

### **Sheep Become Latest Victims of Intensive Farming Conditions**

A proposed solution to some of the problems of sheep-raising has recently been introduced in Australia: sheep are being kept, for the duration of their lives, in large, windowless sheds. The sheds are on average 60 by 300 feet; they are ventilated by louvres and a roof opening along the edge. Each pen in the shed measures roughly 12 by 15 feet, and usually contains about 20 sheep. This translates to one sheep for every 9 square feet. To keep the sheep's fleece clean, floors are constructed of wooden slats, so that urine and feces can fall through. Feed, in the form of soybean, grain, and vitamin pellets, is limited to 600 grams a day; feeding is kept to 3 days a week. The sheep would normally eat twice this amount, and more often, but it has been found that no extra wool yield would accrue from the increase in feed allotment.

Other practices include the taking of skin samples (about 5 mm in diameter) without the use of anesthetic. The only apparent advantage to the sheep from

this intensive method of husbandry is the virtual absence of blowfly strike. In the absence of the blowfly problem, the need for the painful mulesing operation is obviated (see *Int J Anim Prob* 1(4):224-226, 1980 for a complete discussion of the complexities of this problem).

### **Wild and Exotic Pets: Better Off in the Wild**

As more and more people are attempting to keep wild and exotic animals as pets, bites and other injuries from these animals are becoming increasingly common. In particular, the number of reported rabies cases is on the rise, with pet skunks and raccoons the most common sources of infection. About 3,000 cases of confirmed rabies in skunks were reported in 1979, compared with 3,600 in 1980. Furthermore, recent research has shown that the rabies virus can be transmitted vertically in skunks and bats (*i.e.*, to offspring), even when the animals have been raised on ranches for many generations. Also, since there is no licensed rabies vaccine for use in wild or exotic animals, and the precise incubation period required for the clinical signs of rabies to appear is unknown, nondomestic animal bites to humans usually mean that the animal involved must be destroyed.

In addition to rabies, wild animals have been implicated in other kinds of severe attacks. Typical cases include:

- In Michigan, a 4-month-old girl was severely mauled by a pet raccoon; the child died on the next day.
- In Texas, a 5-year-old boy survived a pet raccoon attack which occurred while he slept. The animal tore off the end of his nose, tore his lips, and scratched him.
- In Colorado, a 5-week-old girl was attacked by a ferret; nearly half of each ear was chewed off, and there were multiple puncture wounds on her face.
- In California, a 27-year-old man was bitten and killed by a pet Indian cobra snake, part of a collection of 89

snakes and other reptiles.

Among other considerations, the behavior of wild animals is often a problem. Wild animals respond in ways that are unpredictable to owners who are not prepared, through adequate education, to handle them properly; only rarely does a wild animal become a fully domesticated pet. Such an animal will retain its natural reactions and therefore perceive many kinds of movements as attacks or aggressive threats.

Proper nutrition of these kinds of animals presents another problem, since most prepared diets, intended for common domesticated animals, are simply not adequate. Reptiles and amphibians in particular have highly specialized dietary requirements, which are not often easily available.

Perhaps the best solution to the problem of wild and exotic animals kept as pets is a total ban. Organizations such as the Center for Disease Control and the American Veterinary Medical Association strongly recommend that those States that have not already prohibited the keeping of these animals immediately enact legislation to do so. The AVMA also recommends that the U.S. Public Health Service, USDA, and Department of Interior cooperate to draft laws that would halt the interstate shipment of wild animals for pets.

But, given the determination of some people to own and display exotic animals, any attempt at a total ban will probably end in failure. An alternative solution is a State permit system, patterned on that already in place for falcon owners, under which those who want to keep falcons must meet certain federally established requirements that include a written exam on basic biology, care, handling, and laws pertinent to raptors; building of proper facilities for the bird; and banding and registration with the U.S. Fish and Wildlife Service.

For raptors, at least, this program seems to work. Because of the stringency of these requirements, few cases of injuries to humans from domesticated raptors have been reported. (Abstracted

from S.L. Diesch, *Cal Vet* 35(12):13-17, 1981.)

## The Draize Campaign — A Summary

In 1979, Henry Spira, an English teacher in New York and an animal activist, started to lay the groundwork for a campaign against the Draize Eye Irritancy test on rabbits. (See *Cosmetics Technology* 3(7):32-37, 1981 for background on the test). Spira spoke to representatives from animal welfare groups and cosmetic companies. At the end of 1979, he put together a coalition of over 400 humane societies to campaign for the abolition of the test with a specific focus on the cosmetic industry.

The first step in the campaign consisted of an approach to a major cosmetic company (Revlon) to ask for their assistance. They requested a formal proposal and the coalition accordingly drafted one requesting the following action:

1. Revlon should approach the Cosmetic, Toiletry and Fragrance Association (CTFA) with a proposal that the CTFA coordinate a collaborative effort by industry to seek an alternative to the Draize; and
2. Revlon should commit \$170,000 (0.01 percent of their gross income) to the project.

Revlon responded on February 13, 1980 and stated that the proposal had been turned over to the relevant CTFA committee and that "neither Revlon, nor any other single company, can give any assurances as to what action, if any, this committee, or any other committee of the CTFA, may take on this matter, except to say that it will receive consideration." Needless to say, this response did not find much favor, and the next phase of the coalition's campaign got under way.

This phase consisted of an exhortation to all groups to mobilize their forces to write and protest to (a) the major cosmetic companies; (b) the relevant U.S. regulatory bodies — (The Consumer Product Safety Commission (CPSC), the Environ-

mental Protection Agency (EPA), the Food and Drug Administration (FDA) and the Interagency Research Liaison Group; (c) their representatives in Congress; and (d) the media. The Millenium Guild in New York City chose Revlon as its sole target and took out a full-page advertisement ("How many rabbits does Revlon blind for beauty's sake?") in the New York Times on April 15.

The advertisement itself became news and focused the campaign spotlight on Revlon in particular. It also galvanized other companies into action: the CTFA were soon organizing a closed workshop to discuss the prospects of developing an alternative to the Draize. However, the joint initiatives did not help Revlon. Donald Davis, editor of *Drug and Cosmetic Industry*, noted in the June (1980) issue of the magazine that the attack on Revlon "probably has engendered more sympathy in the industry over the company's 'plight' than any other single happening since the founding of the company...but...there has been a distinct lack of 'volunteers' among industry leaders to help take the heat off Revlon."

At the end of the year, Revlon grew tired of being the target and announced that it was making a 3-year grant of \$750,000 to Rockefeller University to research possible alternatives. Revlon also invited other cosmetic companies to join it in supporting such research. Now that the dust has more or less settled, one can point to the following results of the campaign. These indicate that earlier protestations that "all that can be done to ameliorate the test and seek alternatives is being done" were very misleading. Many constructive actions were possible.

### Industry Actions

The first major result of the coalition's campaign was the organization by the CTFA of a workshop on the Draize test. This was an important event because it stimulated a reassessment of attitudes (at least two participants commented that they had begun to reappraise their approach) and because it identified research avenues that could have poten-

tial. Anthony Johnson of Unilever (U.K.) was one of the main innovative forces: he presented promising data on the use of *in vitro* eye preparations as irritant screens, on the use of smaller volumes of the test sample, and on the use of local anesthetics.



Following up on Revlon's grant of \$750,000 to support research into the Draize test alternatives, the CTFA announced the formation of an Ad Hoc Fund for Alternatives to Animal Testing, with a goal set at 1 million dollars. Avon immediately pledged \$750,000, followed by Estee Lauder with \$350,000. Other companies, including Bristol-Myers, Chanel, Mary Kay and Max Factor, have also contributed to the fund. The CTFA has now awarded 1 million dollars to Johns Hopkins University to establish a Center for Alternatives to Animal Testing. The Center will be directed by Dr. Alan Goldberg, a toxicologist and cell biologist in The Johns Hopkins School of Hygiene and Public Health. The Center will focus on basic research with the aim of identifying test methods that will diminish and replace the use of animals. Some of the research will be based at Johns Hopkins, but it has also been proposed that promising projects at other institutions be funded. A symposium on the topic of alternatives in ophthalmic and dermal testing is set for the middle of May.

## Federal Agencies

The CPSC, which was the only agency with a formal regulatory requirement for irritancy testing, led the way on the Draize test when it announced a moratorium on all in-house Draize testing on May 8, 1980, pending the results of an investigation into the use of local anesthetics. The study took a lot longer than the 3 months scheduled for it, but eventually the CPSC research identified a satisfactory local anesthetic. They found that a double dose of tetracaine abolished the pain response but did not significantly affect irritancy scores (*The Rose Sheet 2* (17), April 27, 1981). In addition, the CPSC has modified its requirements for Draize testing. For example, if a product contains a known irritant or has been found to be an irritant in the skin test, CPSC will ask the manufacturer to label it as an irritant. Only if the manufacturer refuses will CPSC resort to an actual test. According to Richard Gross, CPSC Executive Director, the agency would probably reduce its annual quota of Draize testing by about 90 percent.

The EPA joined the CPSC in establishing an in-house moratorium on October 1, 1980. In addition, the Office of Pesticides and Toxic Substances proposed to "establish the search for alternative test methods to the Draize as a priority for the coming year."

The FDA did not initiate anything on the Draize test until mid-1981. They then announced that they still considered the Draize test to be the best available technique for assessing irritancy, but that they are "committing funds to allow one of our senior scientists to study a new *in vitro* technique" (*Congressional Record*, E 2953, June 15, 1981).

Perhaps the most significant initiative was that taken by the Interagency Research Liaison Group, which has been responsible for standardizing test protocols among five different Federal agencies. Their new guidelines for the Draize test now include the following elements:

1. The guide states that "for humane reasons, substances known to be corrosive may be assumed to be eye irri-

tants and should not be tested in the eye. Furthermore, substances shown to be severe irritants in dermal toxicity tests may be assumed to be eye irritants and need not be tested in the eye."

2. The guide recommends that only 3 rabbits (instead of 6 or 9) be used initially and that only if the results are equivocal should more animals be used.

3. The guide notes that anesthetics should not be used in most instances. "However, if the test substance is likely to cause extreme pain, local anesthetics may be used prior to installation of the test substance for humane reasons."

## Research Initiatives

As a direct result of the Draize campaign a number of research proposals and ideas have been put forward, and some data have been made available that might otherwise have never been published. For example, the research experience of the Unilever laboratories in the U.K. was communicated at the CTFA workshop. Also, Johnson and Johnson's experience with the use of serotonin release as an index of response to an irritant was announced at the recent NIH symposium on trends in bioassay methodology (McCormick, 1981).

The first funded project specifically identified as a search for a Draize alternative was the Revlon grant of \$750,000 to Dr. Dennis Stark of Rockefeller University. However, it has taken some time for the research to get underway. According to Dr. Stark, his group will be looking at the release of chemotactic factors *in vitro* in response to an irritant, in an effort to identify specific factors that could be used as reliable indicators of irritant potential.

The second project to be initiated was supported by a grant of \$100,000 from the New England Antivivisection Society. The project leader, Dr. William Douglas of Tufts Medical School, is attempting to establish an assay system consisting of human corneal cell cultures. He plans to use primary cultures generated from surplus eye bank material (of which there is, apparently, a considerable quantity) and, after character-

izing the cultures thoroughly, will investigate a series of end points with known irritants. The end points include dye exclusion and vital dye assays,  $^{51}\text{Cr}$  release, morphometric analysis, lymphocyte activation, and cytosolic enzyme release.

The third project was also funded by the humane movement, in this case by a consortium of groups led by the American Fund for Alternatives to Animal Research. They gave \$176,000 to Professor Joseph Leighton (Medical College of Pennsylvania) for a 3-year study of the potential of the chick chorioallantoic membrane (CAM) for assessing inflammatory response. The CAM is well supplied with blood vessels, and it has been known since 1911 that irritating materials placed on the CAM will evoke a distinct inflammatory response. On the other hand, there are no pain-detecting nerve fibers in the CAM, according to Professor Leighton.

### General Outlook

The success of the Draize test campaign has definitely had an effect on attitudes toward animal testing. There is more willingness on the part of officials in regulatory agencies to listen to arguments based on humane issues and more scientists are addressing the issue. For example, Professor Frederick Sperling (Howard University) has stated that he holds "no brief for this [Draize] test, which is not a good one scientifically.... It is deplorable that better testing for primary skin and eye irritation has not been developed in the approximately 40 years of its use" (*Bioscience* 31:480-481, 1981).

### Friendliness and Pigs

Hemsworth *et al.* (1980) have shown that the reproductive performance of sows is enhanced when the animals are treated with "tender loving care," as reflected by their lack of fear toward strangers (observers).

Stockmen who spend little time with the animals, so that they are not well socialized to people, will have sows that are easily disturbed and even fearful of human proximity which, as these researchers have shown, adversely affects productivity (16.5 live piglets per sow per year, versus 21 on farms where there was a good sow-farmer relationship).

In a second study with two groups of pigs, stockmen either deliberately socialized growing pigs by stroking and talking to them or repulsed them and handled them roughly. "Good" and "bad" treatments were given for 2 minutes three times per week from 11 to 22 weeks of age. The "loved" pigs grew 5 percent faster than the "unloved" ones. (Abstracted from *Livestock Prod Sci* 8:67-74.)

### New Electric Stunning Methods

Since I wrote my review article on stunning 2 years ago, many important new research studies on stunning have been published. In order to ensure that market pigs do not regain sensibility during bleedout, they must be bled within 30 seconds after electric stunning (Hoenderken, 1978). Blackmore (1981) found that approximately 25 seconds is required for a pig to lose sensibility during bleeding. Therefore, he recommends a stunning-to-bleeding interval of 15 seconds, to ensure that even poorly stunned pigs will not regain sensibility. After electric stunning, the period of insensibility, as measured by brain waves (electroencephalogram), has an average duration of 60 seconds and a minimum duration of 32 seconds (Hoenderken, 1978). Thirty seconds would be the absolute maximum allowable interval, and new facilities should be designed for an interval of 15 seconds or less.

Shortening the interval between electrical stunning and bleeding is economically advantageous to the slaughter plant. A stunning-to-bleeding interval of 30 seconds or less will help reduce pale, soft, exudative (PSE) meat and blood splashing in the meat (Grandin, 1980a, 1980b,



1980c). In most large slaughter plants, bleeding begins within 30 seconds after electrical stunning, but there are still some plants with intervals of 60 seconds or more. Reducing the stunning-to-bleed interval will help improve meat quality, especially in items such as canned hams.

Problems with animals regaining sensibility during bleeding can be nearly eliminated by using an electric stunner that stops the heart. Meat inspection regulations in the United States and some other countries should be changed to permit the use of stunners that cause cardiac arrest. This type of stunner is usually applied to the head and the forelegs or to the head and the back (Gilbert, 1980; Grandin, 1981); the current must pass through the brain.

Cardiac arrest does not adversely affect bleedout or meat quality. In pigs, "Cardiac arrest did not affect the weight of the blood lost, the rate at which it was lost, or the amount apparently retained in the carcass" (Warris and Wotton, 1981). In sheep bled while prone, bleedout was slower and less blood was collected during the first 2 minutes; however, there were *no significant differences* in the pH value of the meat, tenderness, hemoglobin concentration, myoglobin concentration, or growth rates of spoilage bacteria from sheep stunned with a conventional electric stunner as compared with sheep that had been stunned with a stunner that stopped the heart (Kirton *et al.*, 1981; Chrystall *et al.*, 1981). Observed differences in bleedout between the two groups could probably have been minimized if the sheep had been bled while hanging. Lambooy (1981) also reports that cardiac arrest in electrically stunned calves did not affect the hematin value in the meat as compared with controls with beating hearts.

In Holland most of the pigs are stunned with electric stunners that cause cardiac arrest. The same method is also used on sheep in New Zealand. I have observed electric stunning in both Holland and New Zealand, and I was impressed with the humaneness and efficiency of their methods. Another advantage of an electric stunner that stops the

heart is that the animal does not kick the shackler and sticker, and blood splash in the meat is reduced (Kirton *et al.*, 1981).

Research by Blackmore (1981b) indicates that young calves sometimes remain sensible for more than 60 seconds after their throats are cut for bleeding. For electrical stunning to be humane for calves, stopping the heart is essential. In my opinion, the only humane methods for stunning calves are use of a captive bolt or an electric stunner that stops the heart.

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### **Coyote Control Action Attempted by Interior and EPA**

Three States — Wyoming, South Dakota, and Montana — in addition to the U.S. Department of the Interior have recently submitted applications to the Environmental Protection Agency to resume use of the poison Compound 1080 (sodium monofluoroacetate), previously banned in 1972, to kill canid predators, principally coyotes. The Interior Department is also recommending that the practice of denning be reintroduced. "Denning" involves the killing of entire litters of coyote cubs in their dens. This procedure was stopped in 1979, under the order of Interior Secretary Cecil Andrus. The currently available alternatives recognized by Interior are trapping, aerial and ground shooting, snaring, use of dogs, and the M-44, a spring-loaded device that propels sodium cyanide into a coyote's mouth. Interior would also like EPA to relax 10 of the 26 existing restrictions on the use of the M-44. These changes are requested on behalf of privately held lands.

Meanwhile, in a January 29, 1982 press release, the Fish and Wildlife Service announced the cancellation of a 1972 Executive Order that restricted the use of chemical toxicants on Federal lands and in Federal programs to control livestock losses. Use of poisons like 1080, on these lands, however, is still

subject to EPA control; what's been lost is the back-up regulatory mechanism that has been provided by the 1972 Executive Order.



### *The Rationale Behind the 1972 Decision*

Compound 1080 was banned in 1972 by the EPA Administrator because of a formidable body of evidence about the complex array of toxic effects that the agent could create throughout an environment. The accumulated data had demonstrated that 1080 was highly toxic to all species, including humans: at least 13 people (and possibly as many as 18) died from 1080 poisoning. Many nontarget animals were killed, including endangered species like the California condor.

In summary, the EPA statement asserted that there were "no reliable data on the amount of predator control achieved by use of these poisons," and that there were effective alternatives to the use of 1080 and other predicides.

A 1979 statement by Interior Secretary Andrus reaffirmed these conclusions and set objectives for the department's Animal Damage Control Program that included a long-term phase-out of lethal control measures, a corresponding switch to nonlethal, noncapture methods of control, and an emphasis on "preventing predator damage rather than controlling predators."

### *EPA's Role in the Reintroduction of 1080*

However, the Interior Department now believes that these alternative methods are simply not sufficiently powerful tools to counter predation

losses and that use of 1080 and denning must be resumed.

While the Interior Department can resume denning without further clearance, reintroduction of 1080 requires an adjudicatory hearing before an EPA Administrative Law Judge because EPA is specifically responsible for ascertaining that all types of pesticides marketed in the United States do not cause unreasonable adverse effects to humans or the environment. (Chemicals intended for control of predators are considered pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act.)

At the initiative of the EPA, therefore, the Agency held informal preliminary hearings in Denver and Washington in July 1981. On the basis of the findings from those hearings, EPA decided to convene formal hearings in early 1982. In a press release issued on December 1, 1981, Administrator Gorsuch asserted that "substantial new information" had been gleaned at the Denver-Washington meetings and noted two particular points (quoted in full):

1. The finding in the 1972 cancellation that 1080 posed significant hazard to humans may have been in error. Compound 1080 has been widely used in the United States since 1972 to control rodents without any reported human fatality.
2. Further, pharmacological research suggests 1080 may metabolize rapidly to a less harmful substance, casting doubt on the conclusion in the 1972 order that the chemical is a primary and secondary poisoning hazard to nontarget species.

She also stated that spokesmen at the July hearings had stressed the differences between the old pre-1972 delivery mechanism for 1080—the large-bait station (usually a poisoned carcass of a sheep or lamb)—and two more recently developed mechanisms, the toxic collar and the single lethal dose (SLD) bait. The 1080 collar is a rubber and plastic apparatus that is strapped onto the neck of a sheep or goat. It contains two 1080-filled compartments, which break and release the poison when a predator attempts to bite the throat of its prey. The SLD baits,

made of fat or meat containing sufficient 1080 to kill a coyote, are placed around a "draw station" such as a dead sheep or calf or at sites frequented by the target species.

In 1977, EPA began issuing experimental use permits to the Department of the Interior to allow use of the 1080 collar in limited field testing; these permits have been renewed every year. EPA bases its reissuance of these permits on a report by Terrill (cited in the EPA report, *Notice of Hearings on Application to Use Sodium Monofluoroacetate (Compound 1080) to Control Predators*, 1981) on trends in predation losses: Losses of lambs were 35 percent higher for the years 1972-1978 as compared with 1958-1972. Cattle losses (from all sources) increased during 1972-1980 by 11.2 percent over losses for 1950-1972. Ranchers also claimed that alternative methods such as aerial gunning of predators are both costly and ineffective. While conservationists strongly disagree with these numbers and claims, EPA has nonetheless decided to proceed.

Finally, EPA has made use of new research by Kun (*Notice of Hearings on Application to Use Sodium Monofluoroacetate (Compound 1080) to Control Predators*, 1981) which the Agency has utilized to formulate a completely new pattern for the cellular metabolism of 1080 than has been previously assumed. It is claimed that 1080 itself is nonpoisonous; it must first be converted to fluorocitrate by cell enzyme systems to exert its effect. It is also asserted that there is little risk of secondary poisoning from the carcass of a 1080-killed animal, because a scavenger that consumes fluorocitrate from a primary victim would detoxify the fluorocitrate residues before they had a chance to exert any toxic effect. Any secondary poisoning effect, therefore, must come from unmetabolized fluoroacetate remaining in the primary victim. But it is also claimed that ingested 1080 breaks down rapidly (in 5-10 hours) into nontoxic metabolites under any circumstances.

However, in a recent letter to Administrator Gorsuch (February 8, 1982),

Joseph Cowan, Assistant Chancellor of the University of California, San Francisco, speaks of Kun's consternation on finding that the EPA had distorted, and in some cases contradicted, his actual data. For example, on the issue of the breakdown of 1080, Kun had actually stated that "the trace amount of fluorocitrate formed from 1080 is biochemically unstable. "The letter asserts that "There is a vast amount of difference between a research finding of 'nontoxicity,' as claimed by your [Press] Release, and one of 'instability.'"

### *The Mechanics of the Formal Hearing Procedure*

As announced in the December 7, 1981 *Federal Register*, all parties interested in the use of 1080 were given until January 26, 1982 to file a Statement of Position on all the issues involved and to also file a preliminary list of witnesses with a "brief narrative summary of their expected testimony." Actual testimony before the Administrative Law Judge began in March and is expected to last about 60 days. At the conclusion of the hearing, the judge will make a recommendation to Administrator Gorsuch on whether to resume use of 1080. The judge's recommendation is not, however, binding on the Administrator.

### *Animal Welfare Groups Against 1080*

A coalition of animal rights advocate groups that includes The Humane Society of the U.S. (HSUS), Defenders of Wildlife, the National Audubon Society, and the Sierra Club, among others, is being represented at the hearing by a Washington-based law firm. These groups believe that the logic behind the decision to hold a formal hearing procedure is invalid since the vast compendium of evidence that led to the 1972 and 1979 decisions on 1080 and denning is still unshakably sound, that none of the new data obtained since then has changed the essential facts about the broad-spectrum toxicity of 1080 to the environment. They point to the thousands of pages of testimony compiled by the Fish and Wildlife Service in public hearings held in 1978 and 1979, prior to the 1979

statement by Secretary Andrus. The coalition now believes that "any major significant departure from these decisions must now either be shown to be consistent with the existing record or plainly supported by a new record compiled with similar attention to the National Environmental Policy Act" and other appropriate legislation such as the Endangered Species Act (1973), the Wilderness Act (1976), and the Administrative Procedures Act (1976) (letter to Secretary Watt, November 19, 1981).

In contradistinction to the findings of Kun cited above, the coalition points to several well-established facts about the primary pharmacology of 1080 and its subsequent distribution in the environment, as set forth in a 1972 EPA decision paper on the banning of 1080. Chemically, sodium monofluoroacetate can be described as a white powder that is soluble in water and also highly stable. It is therefore very persistent in ground water, once it has been introduced into an ecosystem. Further, 1080 is readily taken up by the root and leaf systems of plants. The possible effects of this on grazing animals, both domestic and wild, are still unknown.

Monofluoroacetate is highly toxic for all species: a dose as low as 0.5 to 2 mg/kg of body weight acts rapidly on the central nervous system and heart, causing arrhythmias and convulsions. Since these effects come on too quickly to permit any effective treatment, antidotes are relatively valueless. Death, however, may not arrive until many hours after the initial poisoning. However, as noted by Natasha Atkins (wildlife biologist, then working for The HSUS), in her statement before the informal EPA hearings in July 1981:

*The lethal dose for a canid is between 1-2 mg, while it would take 100-200 mg to kill a human. Because canids are so susceptible to 1080 poisoning, foxes, wolves, and domestic dogs are potential victims. Some of these, notably the San Joachim Kit Fox, the Northern Kit Fox, and some sub-species of the Gray Wolf are endanger-*

ed species. The endangered black-footed ferret and protected hawks and eagles could be easily attracted to the bait. These latter species are not as sensitive as canids, but it would take only marginally larger doses of 1080 to kill them. Since the guidelines for bait preparation recommend a minimum dose of 5 mg per single bait for coyotes, the consumption of one bait—little more than an ounce of bait material—could kill many of the less sensitive species.

Atkins also points out that there is a "serious gap in our knowledge about the cumulative effects of sublethal doses" of 1080. A government study in New Zealand (C.G. Rammell and P.A. Fleming, *Compound 1080: Properties and Use of Sodium Monofluoroacetate in New Zealand*, 1978) asserted that "repeated sublethal doses are reported to have a cumulative effect" in certain species, and that there is a possibility of chronic poisoning in humans who are exposed to 1080. And we are all too aware of the tragic consequences on wildlife that resulted from continual sublethal doses of some toxicants, such as DDT.

It is also argued that the burden of evidence seems to indicate that the effects of 1080 as a secondary toxicant when other animals feed on the carcass of a 1080 victim are widespread. In a first-person narrative on his work with 1080 as a Federal predator control supervisor, Dick Randall (*Defenders*, October 1981) tells of his own experience with 1080 as a secondary poison.

In 1969, tracer chemicals (cadmium and zinc oxide) were added to 1080 to differentiate between animals killed by Government poison and those killed by "do-it-yourself" poisons, since the Government was being repeatedly sued by people who claimed to have lost pets through poisoning on public lands. Between 1970 and 1972, Randall checked the digestive tracts of wildlife carcasses found near the large-bait 1080 stations for signs of the tracer. He discovered that 50 percent of the dead birds (includ-

ing six golden eagles) and 40 percent of the dead mammals contained tracer. Randall has also observed that canines can travel long distances after ingesting 1080. In the process, they often regurgitate bait material as they travel, thereby ensuring distribution of the poison throughout a wide area.

Randall argues that the 1080 collar is a particularly poor mechanism for selective killing, since its use has been found to involve dangerous problems such as "sheep chewing on the collar and poisoning themselves, dribble from the collar poisoning the wearer, punctures from thorns and barbed wire, and lost collars."

On the issue of denning, the animal welfare coalition has also stated that it is "wasteful and scientifically absurd" (letter to Secretary Watt, November 19, 1981) because "it is axiomatic that in order to stop a coyote from killing sheep, it is necessary to target the coyote that is doing the damage. It is, therefore, equally axiomatic that killing 6- to 9-week-old pups is wasteful and counterproductive since they could not possibly kill sheep." The letter also points out that, contrary to Interior's assertions (i.e., denning is accomplished by fumigating or shooting), flares, barbed wire, burning, and trebel hooks are used routinely in killing new cubs in their dens.

### *Poisons, Dennings, and Total Populations*

For both ranchers and environmentalists, an especially critical aspect of any predator control program must be a careful consideration of the effects of a given method of control on the total population of predators—factors like numbers and stability of numbers, social organization, territorial imperatives, and hunting patterns.

Most observers have found that under natural conditions, where elements like social group hierarchy and social organization are not continually disrupted by predator control programs, the coyote is primarily a scavenger, limiting its predation to small rodents. However, when an established coyote pack is

killed off, new, transient animals will move in to occupy newly vacant territory. During the period required for the new residents to establish patterns of hierarchy and social bonds, some animals are driven away from the usual food sources — mice and squirrels — and are forced to prey on any available domestic livestock (*Defenders*, October 1981). Coyotes also exhibit density-dependent natality. This means that a decrease in population tends to cause a corresponding increase in numbers of new births. In this way, coyote populations can increase by as much as fourfold. In her 1981 statement before the EPA, Natasha Atkins noted: "Reductions of predator populations also have been shown to upset certain interspecific balances. In New Zealand, where 1080 reduced populations of dingos, another canid species, significant increases in other species were detected. The Fish and Wildlife Service also reports [*Predator Damage in the West: A Study of Coyote Management Alternatives*, 1978] that increases in other predatory species coincided with 1080 reductions of coyote populations in the early 1950's."

### *Possible Alternatives*

The 1972 (EPA) and 1979 (Interior) statements on 1080 and predator control policy both stressed the development and testing of alternatives. It appears that little actual work in this area has been done. Further, some of the obvious methods for keeping predators from sheep, many of which date back to prehistory, are not being used. *Defenders* (October 1981) quantifies the extent of this deficiency, based on data from the Department of the Interior's publication, *Predator Damage in the West: A Study of Coyote Management Alternatives* (1978):

*In the mountain states, herders are employed by only 16 percent of the ranchers running sheep on public lands. In the Great Basin states, only 24 percent hire shepherds to protect their livestock. Of sheep enterprises with more than 5,000 head operating*

*on public lands, only 8 percent have constructed lambing sheds to shelter newborn animals. Fewer still use guard dogs...*

Ranchers also seem unwilling to make use of available nonlethal chemical coyote repellents, despite their proven effectiveness.

Other promising alternatives to wholesale predator destruction include taste aversion chemicals, reproduction inhibitors, and anti-coyote electric fencing (evaluated as highly successful in terms of both cost and effectiveness in *The Journal of Range Management* 33(5): 385-387, 1980). The mere presence of burros or llamas also works to keep coyotes at bay.

### *The Larger Picture*

It is difficult to piece together exactly which political, economic, and fundamental philosophical attitudes have motivated the current initiatives on Compound 1080 and denning by the administration. The earlier decisions were endorsed by a multitude of expert witnesses and several consecutive changes of government. The present proposal does not even find universal approval among the "sagebrush rebellion." As Jim Barron III of the National Cattlemen's Association said, "The coyote has nothing to fear" from the new provisions (quoted in *Feedstuffs*, December 13, 1981, p. 13).

In fact, the decisions on predator control measures like 1080 and denning seem to arise more from a philosophic bedrock that goes deeper than economic concerns or simple political expediency. Consider this quotation from a recent briefing statement by Robert Jantzen, Director of the Fish and Wildlife Service:

*If we in the Service seek to maintain wildlife habitats, I feel we must be prepared to act when wildlife, a product of that habitat, adversely affects man's other interests.*

First, use of the word "product" implies that animals can be considered as consumer goods, like television sets and

pantyhose. Second, the phrase, "man's other interests," also implies that, to many in the present administration, animals are simply another inert resource to be used as we wish, when we wish.

### **A Look at the LD50, 55 Years Later**

For scientific, economic, and ethical reasons it is necessary to periodically reassess all toxicological test procedures, including the LD50 test. Tests that are not optimal or that have become obsolete because of new scientific knowledge must be changed or eliminated.

A review of the LD50 test shows that the precision of the procedure is dependent on the number of animals used. But even with large numbers of animals, there are considerable variations of the test results, because the numerical value of the LD50 is influenced by many factors, such as animal species and strain, age and sex, diet, food deprivation prior to dosing, temperature, caging, season, experimental procedures, etc. Thus, the LD50 value cannot be regarded as a biological constant. Through standardization of the test animals and the experimental conditions the variability of the LD50 determinations can be reduced, but never fully eliminated. There are several tests with which an approximate LD50 can be determined. These methods use fewer animals than the classical LD50 test, but their precision and reproducibility are sufficient for most purposes of acute toxicity testing. Through incorporation of physiological, hematological, biochemical, pathological, and histopathological investigations in the simplified test procedures with small numbers of animals, it is possible to markedly increase the informational content of the results with regard to the toxicological spectrum and the target organs of toxicity. Such studies have already replaced the LD50 test in large animals, such as dogs and monkeys. It is also desirable to replace the LD50 in rodents with such a procedure.

For the prediction of the human lethal dose and for the prediction of the symptomatology of poisoning after acute overdosing in man the LD50 test is of limited usefulness. An acute toxicity test with small numbers of animals combined with comprehensive studies of physiological functions and biochemical and histopathological examinations often provides more important information for emergency physicians and poison control centers. For the selection of doses to be used in subacute and chronic toxicity experiments the LD50 test does not provide consistent and reliable results. A simple pilot experiment with few animals but repeated dosing gives more useful information. For the evaluation of special risks for the human newborn and infant the LD50 test is poorly suited. For the appraisal of pharmacokinetic behavior and bioavailability, the LD50 test gives only semi-quantitative, often ambiguous information. (Abstracted from G. Zbinden and M. Flury-Roversi, *Arch Toxicol* 47:77-79, 1981.)

### **Placenta a Practical Medium for Microsurgical Training**

According to surgeon John C. McGregor (Department of Plastic Surgery, Bangour General Hospital, Broxburn, Scotland), the human placenta offers a satisfactory, economical, and readily available source of tissue for microsurgical training. The multiplicity of vessels of varying size gives ample opportunity for practice not possible by other experimental approaches in the United Kingdom. However, the placental preparations cannot provide experience of the continued patency of practice operations, such as microvascular anastomoses, but laboratory animals and Home Office licences are not required. This model offers a possible answer to the problem of a shortage of biological materials and will enable a significant improvement in the training of microvascular surgeons in all interested specialities. (Abstracted from J.C. McGregor, *J Roy Coll Surgeons* (Edinburgh) 25:233-236, 1981.)

## And a Quarter for the Dryer

Mario Altissimo of Turin recently filed a European patent application for a dog-washing machine that looks suspiciously like an iron lung. The grubby dog is pushed into a cylindrical cabin, and his head is clamped down firmly by a collar. Once in place, the dog is treated to high-pressure jets of water

(with a little soap added) and then dried with a blast of hot air pumped in through the cabin. Purportedly, the dog is not only thoroughly cleansed by the procedure but, the inventor claims, receives an "efficient hydro massage" as an added bonus. However, note dubious expression on face of dog.

