1983

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with itself. "The suffering intrinsic in animal existence is thus primarily not that of pain...but that of want and fear" (p. 105) as his or her purposes may be frustrated or threatened.

This ontology of animality implies an obligation on the part of scientists to study particular animal species in their natural habitats. Only in this way can we begin to grasp just what it is we deprive them of when we place them in a lab and make them the subjects of our experimentation. A less exploitative and more sensitive ethic must be built on such considerations.

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Introduction

Beilharz (1982) has pointed out that it may be possible to adapt animals genetically to existing husbandry systems, rather than adapt the systems to the animals, in order to improve animal welfare. While I am in fundamental agreement with Beilharz' way of thinking (Van Rooijen, 1982a), I am afraid that his statements may easily be misunderstood.

Beilharz says: "The evolutionary processes, if they are not obstructed or misdirected, must lead to such a degree of adaptation that welfare will have to be taken for granted, just as we can do no better than to take for granted the welfare of any wild animal in its natural habitat." From this statement, one might conclude all we have to do is wait, and the animals will eventually adapt to intensive systems. Concerning animals put into new kinds of environments, he states that, if individuals do *not* have the capacity to adjust phenotypically, "adaptation of the population will require a rapid genetic response to prevent dying out of the population." This comment may suggest that one does not have to wait very long for the animals to adapt successfully to intensive systems. He also notes that it is likely that a rapid genetic response is accompanied by much "suffering." From this, one might conclude that suffering during such a process is only "natural," and is therefore justified.

Beilharz writes further that the procedure of adaptation "may have to be approached in stages, if the environmental conditions aimed at are radically different from those to which the animals are now adapted." Because he fails to

tell us whether intensive husbandry systems belong in this last category of environmental conditions, one might conclude that it is not necessary to adapt animals in stages if they are to be kept under intensive conditions.

Therefore, because these statements of Beilharz could be misused to defend the practice of keeping animals under the stress of intensive conditions, under the rationalization that this is part of a long-term rational plan, I want to discuss each of these statements in the following comment.

Are Wild Animals in Nature Happy All the Time?

Beilharz feels that we can take for granted the welfare of any wild animal living in its natural habitat. He writes: "I believe that we can do no better than to assume that the welfare of any adapted form of life is guaranteed, *i.e.*, that it does not suffer in its particular environment." This assertion might give rise to the idea that wild animals are happy all the time. However, I do not believe that this idea (which seems to be inspired by Rousseau) is correct. In fact, wild animals are sometimes compelled to fight with rivals for food, sexual partner, nest site, *etc.*; they may return to find their nests empty because their young have been killed by a predator; they may break a leg in an accident; they may have to endure lengthy periods of bad weather; and so on.

Among some species of fish, each female lays, during her lifetime, millions of eggs. In steady-state populations, only two individuals out of all of her offspring (on average) will have the opportunity to reproduce again. We can assume that many of the other individuals that do survive to reproduce will be likely to suffer for shorter or longer periods of time. Lorz (1973, cited in Van Putten, 1981) has defined the welfare of an animal as: "Living in harmony with the environment and with itself, both physically and psychologically." I agree with Beilharz that, if animals are living in an environment into which they fit, and with which they are in harmony, we may assume that they experience a certain degree of welfare. But even adapted forms are not always in *harmony* with the environment to which they are *adapted*; harmony and adaptation must be construed as two separate parameters.

Is Reproduction the Same as Welfare?

Beilharz cites Tschanz, who has written that the best measurement of adaptation to an environment is reproduction. Beilharz writes: "There is no doubt that, on basis of this criterion, there are poultry and pigs that are quite well adapted to intensive farming."

Indeed, reproduction offers a good index for comparing the adaptedness of individuals within a population but, at the same time, one must recall that this is a quite different concept from the idea of harmony. The term "adapted animals," when used in this sense, does not mean animals that are in harmony with their environment and themselves but, rather, that animals simply show a high degree of fitness. Fitness and welfare often coincide, but a one-for-one overlap is not necessarily the case (Dawkins, 1979; Van Rooijen, 1982). An example will serve to make this clearer. One may compare two bulls, one ranging free on an island with some cows, and one kept under very adverse circumstances — but from the latter, each sperm is used for artificial insemination. The reproduction rate of the second bull is obviously much better than that of the first one, but, with respect to their welfare, the reverse is true.

Beilharz writes: "In fact, if we could free ourselves of our human prejudices and take a broad perspective, we would find that in evolution, the interaction of domestic animals with humans has been a very successful form of symbiosis, be-

cause neither human beings nor domestic animals would be present in the same huge numbers without the others." This sentence suggests that, if we permit ourselves to take a very *narrow* perspective instead, and do *not* free ourselves from our human prejudices, we would find that the human-domestic animal symbiosis had been very unsuccessful, because so many animals are suffering.

In actuality, there is merely an apparent contradiction in Beilharz' thinking. The fact that, biologically, domestic animals have been very successful does not exclude the possibility that this success may go hand in hand with suffering in many animals.

Is Suffering During the Process of Adaptation "Natural"?

Beilharz states: "The evolutionary processes, if they are not obstructed or misdirected, must lead to such a degree of adaptation that welfare must be taken for granted. But he also writes that it is very likely that these processes of adaptation are accompanied by much suffering. These assertions may give the impression that suffering during the process of adaptation is "natural."

Rapid changes in forms of life after a rapid change in the environment have actually been rare during evolution. Rather, rapid changes in the environment of a species have most often resulted in an extinction of that species. Only a few species have survived rapid changes, not because they also managed to change rapidly, but largely because they already possessed certain traits that allowed them to remain unaffected by the new change in the environment. Also, most of the changes in the various forms of life have occurred only very slowly. They are often the result of a continuous interaction between two species, for instance, a predator and a prey species, or a parasite and a host. During such an interaction, both species continuously adapt themselves to each other over long periods of time. Further, changes in the abiotic environment, that have occurred gradually (for instance, alterations in climate), may explain the evolution of some species.

We must realize, too, that adaptation processes are still at work in wild animals that are living in their natural habitats, animals whose welfare Beilharz assumes is guaranteed. This situation has existed for long periods during the evolutionary history of each species. Therefore, I doubt whether, in the greater portion of the history of life on earth, animals have suffered more during adaptation than do present-day animals in natural habitats.

Is Suffering During the Process of Adaptation Ethically Justified If It Turns Out to Be "Natural"?

Some predators kill their prey in a way that would give rise to considerable opposition if this method were to be practiced by humans: What we find acceptable in nature is not always held to be equally acceptable in relation to the animals that are placed under our care. Therefore, because nature can never be held up as our ultimate ethical standard, it does not really matter whether suffering during adaptation occurs in nature or not.

Does a New Environment Induce a Rapid, Genetic Change?

Beilharz states that if we put animals into a new environment, this change will necessitate a rapid genetic response to prevent a dying out of the entire population. This statement is teleological: it implies that putting animals under intensive husbandry conditions will of necessity induce rapid genetic adaption. Therefore, since the period of suffering that occurs during this adaptation is of brief duration, it could be asserted that this treatment is ethically acceptable. However, this view of things is Lamarc-

kian. In contrast, the neo-Darwinistic view holds that if populations enter a new environment, the speed of their adaptation will differ solely according to random chance; only those populations that serendipitously attain a high degree of fitness to the new environment will survive.

In nature, as a rule, the fitness of those individuals that are more in harmony with their environment than others will be greater than the fitness of individuals that are less in harmony with their environment. In artificial situations, however, it is possible that animals will continue to survive, even though they have not yet truly adapted in the sense of living in harmony with their environment. This last point is important in regard to the question of suffering. We simply do not know beforehand how long it will take for domestic animals to become sufficiently adapted to intensive systems such that they not only survive, but are also in harmony with these environments.

Is a Conventional Husbandry System the Natural Environment of a Domestic Animal?

To determine to what kinds of environments domestic animals have become adapted, I will list some characteristics of one selected species: the pig. Because pigs easily become feral (Hanson and Karstad, 1959; Pullar, 1953), I will also mention some of the characteristics of wild swine.

That pigs are adapted to environments that provide much more space and variety than most conventional systems have to offer is indicated by some data furnished by Wood (1865, cited in Reiher, 1969). One person rode 4½ miles in 1 hour on a boar, and another person drove 4 miles with a four-in-hand of sows. A wild boar jumped over a wall of 9 feet, and a domestic pig scaled one of 4½ feet. Their desire for variety is also indicated by the fact that pigs prefer some substrate over a bare concrete floor, and that their preference for different substrates may show a diurnal rhythm (Van Rooijen, 1981b and 1983). Meynhardt (1980) related how pigs are kept by the fishermen of the Donaudelta. After a training period of 2 months, in which they are taught to listen to a call or whistle, these pigs are left free to range over the Donaudelta. They soon become completely feral and are very difficult to approach. Yet in December, the pigs are piloted home by use of the call or whistle. During the last 1 to 2 miles, these pigs swim behind the boats and then enter their pens without coercion. Pigs also easily learn to open a gate by pressing on a plate with their nose (Van Rooijen, 1983). But conventional systems make little use of the actual capacities of pigs.

Although some authors have supposed that pigs have poor sight (Ackerknecht, 1950; Mellen, 1950), more recent research has shown, on the basis of morphological (Beauchemin, 1974) and behavioral (Klopfer, 1966) data, that the pig eye is very much like the human eye. Olfaction, however, is even better developed than in humans: domestic pigs are able to follow human tracks (Reiher, 1969). For wild pigs, this is said to be true even if the tracks are several hours old (Snethlage, 1957). And most people know that domestic pigs are used to locate truffles (Rebière, 1967). Also, the sense of hearing is better developed in pigs than in humans. Meynhardt (1980) describes how wild swine were able to localize acorns in the dark without searching, solely on the basis of the sound generated when the acorns hit the ground. He further described how these swine, in the dark, removed the shells of the acorns.

In conventional systems, pigs are often given only pellets to eat. But in nature, wild swine eat a wide variety of food (roots, the green parts of plants, fruits, and small animals) and are described as connoisseurs: swine prefer

certain types of potatoes over other types, and they like acorns most of all, but will eat American acorns only when there are no European acorns left (Meynhardt, 1980).

Hunters ascribe to wild swine an "almost humanlike logical ability" (Snethlage, 1957) or at least an intellectual capacity equal to that of the red deer (Kiessling, 1925). Yerkes and Coburn (1975) stated that domestic pigs had "an approach to free ideas" that these research workers had not in any way expected. The intelligence of domestic pigs is often said to be comparable to that of dogs (Ackerkenecht, 1950; Mellen, 1950). The capabilities of pigs are also demonstrated by the fact that wild boars are used as bloodhounds (Guman Singh, 1956) and domestic pigs as gundogs (Zeuner, 1963). Many more facts about pigs could be mentioned, but my aim here has been to indicate that there exists a considerable gap between the nature of the niche to which pigs are actually adapted and the environment found in conventional husbandry systems.

One may argue that most of these data are derived from wild swine or uncommon breeds, and are therefore of less value with respect to pigs kept in conventional systems. Of course, I have noted some extraordinary cases, and I do not doubt that domestication has influenced pigs (Van Rooijen, 1982a). But the thousands of years of domestication are negligible when compared with the great span of time over which evolutionary changes have occurred. Even those changes that, on the evolutionary scale, are considered rapid took more time than did domestication. Therefore, I do not believe that we may consider conventional husbandry systems as natural environments of the domestic pig.

Is the Attempt to Adapt Pigs to Intensive Husbandry Systems, in the Same Degree as Pigs Are Adapted to Conventional Systems, Realistic?

At this point, the descendants of the first intensively kept pigs have lived at most, for some 10 years under intensive conditions. Such a span of time amounts to nothing compared with the number of years that pigs have had the potential to adapt to conventional systems. However, selection of these pigs, with respect to the characteristic of harmony with the environment, has been unconscious. Perhaps we can reach our goal sooner by conscious selection. But at the same time we must keep several points in mind.

1. We must be careful not to select only against particular symptom traits. For instance, if we try to select against tail-biting, it may turn out that we have selected for blindness which, in this case, amounts to a somewhat perverse way of turning out the light. This sort of danger is also present in our attempts to adapt husbandry systems to the animals but, because it is common in behavioral genetics to select on the basis of just one clearly defined parameter, the threat is far greater in selection experiments. Therefore, we should combine selection experiments with intensive ethological and physiological investigations of the animals under selection.

2. In genetics, selection is done mostly on the basis of only a small number of isolated parameters. Selection on this principle involves the danger that the selected animals may no longer be in harmony with themselves. For instance, if we select for large eggs, we do not simultaneously select (consciously) for a larger cloaca width. This practice may therefore cause a lot of suffering. To keep animals in harmony with themselves, we have to select for many traits at the same time. However, this procedure may interfere with production charac-

teristics. A parallel example is that of many companion animal species: selected traits often interfere with the normal functioning of the animals.

3. Our goal may be too ambitious. One may be impressed by the diversity in form and behavior of, for example, domestic dogs. However, closer investigation shows that all of the behavioral elements of these domestic species were already present in their wild ancestor, but that varying aspects are differentially emphasized in the various breeds. As discussed above, there is a wide gap between the natural environments of pigs and conventional rearing systems. And the gap between conventional and intensive systems seems to me to be much larger. Pigs are rooting specialists, but when kept under intensive conditions, no substrate is provided for them to root in. It is not surprising, then, that under these intensive conditions many pigs exhibit behavior patterns that closely resemble those of psychiatric patients. On the basis of extrapolation from our own feelings, we can assume that the suffering of such animals is intense (Van Rooijen, 1981a). Our attempt to select pigs that are adapted to intensive husbandry systems, to the same degree that pigs are adapted to conventional systems, may be more like an attempt to select a duck out of a pigeon than selecting a collie out of a wolf.

My conclusion is that we must first perform small-scale experiments and gather sufficient information to see whether our goal is realistic.

What Do Pigs That Are Adapted to Intensive Husbandry Systems Look Like?

Pigs kept intensively must prefer pellets over acorns and, for the entire day, they must prefer a bare, slatted floor over one of straw. Of all species, the niche of an intensively kept pig is therefore perhaps most comparable to that of the storage ants of Myrmecocystus. The bodies of these insects are enormously distended from fluid food reserves that are stored in their crops, and they are permamently confined to the nest. Other members of the colony tap them for food, by inducing them to regurgitate (Eisner and Wilson, 1975). In many respects, humans keep the environment of the intensive-husbandry pig constant in the same way. Therefore, we can consider the situation of these pigs similar to that of those parasites that have lost many of their capacities, because they can rely on the homeostatic mechanisms of their hosts. We may expect that, when pigs have become totally adapted to life in intensive husbandry systems, they will show many traits in common with internal parasites. Although it is theoretically possible to adapt pigs to such an extreme extent, it is clear that this endeavor is more unrealistic than the attempt to adapt them to a degree similar to that of pigs adapted to conventional systems.

Final Remarks

One has to keep in mind that we *are* successfully preventing the whosesale demise of the domestic animals living under intensive conditions. And we may assume that, never before in evolution, have there been animals so disturbed that they perform behavior patterns, comparable to those of psychiatric patients, that were nevertheless able to stay alive and breed successfully. In our intensive systems, this is made possible only because we are assisted by various techniques (e.g., regular food distribution, artificial insemination, flat decks, etc.). This means that, in this situation, it is not likely that fitness and welfare coincide. I do not understand what Beilharz meant when he wrote about "obstructed and misdirected evolutionary processes" because, from the viewpoint of evolution, *all* directions are neutral. But if one wants to use these terms, the care and

protection we give to animals may be considered as a form of evolution that is "obstructed and misdirected," inasmuch as their final consequence is that fitness and welfare do not coincide.

References

Ackerknecht, E. (1950) Anatomische Underschiede zwischen Wild—und Hausschwein. *Zeith Tieruch Zuchtingsbiol 58*:465-472.

Beauchermin, M.L. (1974) The fine structure of the pig retina. *Albrecht von Grafes Arch Ophthalmol 20*:27-45.

Beilharz, R.G. (1982) Genetic adaptation in relation to animal welfare. *Int J Stud Anim Prob 3*:177-124.

Dawkins, M. (1979) Interpreting ethological data. *Appl Anim Ethol 5*:189-192.

Eisner, T. and Wilson, E.O. (1975) *Animal Behavior.* Freeman and Company, San Francisco, CA, p. 259.

Guman Singh, K. (1956) Wild boars being used as blood hounds. *J Bombay Nat Hist Soc 53*:258-259.

Hanson, R.P. and Karstad, G. (1968) Feral swine in the southeastern United States. *J Wildl Manage 23*:64-74.

Kiessling, W. (1925) *Das Schwarzwild und Seine Jagd.* Neudamm, Melsungen, B.R.D., pp. 115-127.

Klopfer, F.D. (1966) Visual learning in swine (L. Bustad, ed.), In: *Swine in Biomedical Research,* pp. 559-575.

Larz, A. (1973) *Tierschutzgesetz. Kommentar.* Verlag-C.H. Beck, Munchen, B.R.D.

Mellen, J.M. (1950) *The Natural History of the Pig.* Exposition Press, New York, NY.

Meynhardt, H. (1980) *Schwarzwild-Report. 2. Auflage Verlag.* J. Neumann-Neudamm. Melsungen, B.R.D., p. 17-18, 57-67.

Pullar, E.M. (1953) The wild (feral) pigs of Australia: their origin, distribution and economic importance. *Memoir Nat Mus Melbourne 8*:7-23.

Putten, G. Van (1981) Het meten van welzijn bij landboushuisdieren. *Tijdsschrift Diergeneeskunde 106*:106-118.

Rebiere, J. (1967) *La Truffe du Perigord.* Piere Fanlac, Perigeux, France.

Reiher, E.G. (1969) Sinnesphysiologische und lernpsychologische Unterschungen bei Schweinen. *Form Funct 1*:353-404.

Rooijen, J. Van (1981a) Are feelings adaptations? The basis of modern applied animal ethology. *Appl Anim Ethol 7:* 187-189.

Rooijen, J. Van (1981b) Wahlverschen: Eine ethologische Methode zum Sammeln von Messwerten um Haltungseinflusse zu erfassen und zu beurteilen. *KTBL-Schrift 264*:165-185.

Rooijen, J. Van (1982a) Die Anpassungsfahigkeit von Schweinen an einstreulose Butchten. *KTBL-Schrift 281*: 174-185.

Rooijen, J. Van (1983) Operant preference tests with pigs. *Appl Anim Ethol 9*:87-88.

Snethlage, K. (1957) *Das Schwarzbild.* Parey, Hamburg, B.R.D., pp. 38-39.

Wood, J.G. (1865) *An Illustrated Natural History.* London, U.K.

Yerkes, R.M. and Coburn, C.A. (1915) A study of the behavior of the pig by the multiple choice method. *J Anim Behav 5*:185-225.

Zeuner, F.E. (1963) *A History of Domesticated Animals.* Hutchinson, London, U.K.