Letters

Animal Experimentation

The article "Sleep deprivation, age, and exhaustion time in the rat," by W. B. Webb and H. W. Agnew, Jr. [*Science* **136**, 1122 (1962)], prompts me to bring up a matter only occasionally questioned publicly by scientists. This matter is the professional ethics of animal experimentation.

It is generally accepted that a scientist should act according to the ethical standards of his society—unless he can show that they are false. He has an obligation to do this not only because he personally is a member of society but also because, in his field, he acts as a representative of science and of his fellow professionals. If in his conscience he finds sufficiently important reasons to deviate from those standards, he should give a clear and significant justification for such deviation.

The humane treatment of animals, which includes the avoidance of conditions which would subject animals to acute suffering, does exist as an ethical principle in our culture. However, the avoidance of all conditions which may cause suffering in animals is in apparent conflict with animal experimentation, the necessity of which no person with general perspective or an appreciation of science could reject. Possible controversy is lessened by the fortunate fact that the majority of experiments, provided care of animals and of experiments is in the hands of conscientious persons, do not involve acute suffering. In some cases, more drastic experiments can find justification in an urgent need to find solutions to some medical problems which, in effect, would decrease the total amount of suffering among humans and animals. The great theoretical significance of a particular problem might also justify a drastic experiment, provided no other way for getting necessary evidence was available. However, if a scientist fails to find very clear and important justification for a certain research proposal which would cause experimental animals acute suffering, there seems to be no excuse for deviating from accepted ethical standards, and the experiment should not be undertaken. After all, below the extreme of experiments of the drastic kind there clearly exists a vast area of significant research problems within each field of biological investigation which can supply us with research projects for all our lifetimes!

In the experiments presented by Webb and Agnew, rats were kept in small tanks partially filled with water; they could avoid drowning only by staying on a constantly rotating wheel. The wheel was two-thirds immersed in water so that the rats were prevented from sleeping or resting through being choked with water if they failed to adjust their position on the wheel to keep their heads above the level of the water. This in some cases went on for as long as 28 days, until the animals reached such a pitiful condition of exhaustion that they fell from the wheel and were no longer able to get back on it in order to counteract the sensation of drowning. Clearly, this is a very severe experiment, especially in view of its duration—one that demands a particularly clear and valid statement by the authors concerning their reason for performing it. They failed to give such justification, nor is the justification by any means made apparent by the nature of the problem or the results stated. Other, short-term or more mild methods for studying stress, exhaustion, and sleep deprivation in humans and in animals have been published. In addition, everyday life and medical cases provide us with evidence of the effects of stress and exhaustion in relation to age. And also, most unfortunately, we have some data concerning exhaustion and stress from reports analyzing the condition of prisoners in concentration camps who were subjected, as a means of torture, to sleep deprivation induced by stress treatment.

Furthermore, the experiments described by Webb and Agnew fail to differentiate between the various factors that influenced the condition of the experimental animals—factors such as sleep deprivation, physiological stress (including the specific stress of contact with water), psychological stress, and influence of water temperature. All that the authors report in the way of results is the finding that a certain combination of factors and stresses produced varying values for time of exhaustion in rats of different ages. Thus, they confirm a rather widely known phenomenon that old organisms are less resistant to stress and exhaustion than young ones.

Therefore, unless we are offered a sufficiently valid justification for these experiments, their performance and publication must be considered regrettable.

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I am not sure that I am grateful for the opportunity to reply to Krystyna Ansevin's letter regarding the experiments of Agnew and myself. It is not likely that either her letter or this reply will do much to resolve the emotional, ethical, humanitarian, and scientific issues relating to experiments in which animals are used as subjects. More particularly, I regret that we have been singled out as a target of convenience and that I am forced to reply as an individual to so general and complex an issue, which affects such a large segment of our scientific endeavor.

I cannot agree that this is a question which has received only occasional consideration by scientists. Speaking as psychologist, I can assert that one of our oldest standing committees in the American Psychological Association is the Committee on Precautions in Animal Experimentation, which has promulgated a set of long-standing rules, adopted and carefully monitored by our association. I am sure that similar committees exist in nearly every group of scientists engaged in experimentation with animals.

It is, on the other hand, quite true that this problem is seldom "publicly" raised as an issue by scientists. It is typically, and I believe more fruitfully, being continuously dealt with within the scientific community itself. Rather, this issue chronically has been raised

"publicly" by antivivisectionists and others in our society who either have not known or have not cared about the scientific aspects of the problem. I regret that Ansevin is apparently unaware of the very grave problems that the scientific community is even today facing as a result of several congressional bills regarding animal experimentation. She certainly seems unaware of the concerted efforts of the various scientific societies in response to these bills. For some sense of this problem I refer her to the *A.I.B.S. Bulletin* of February 1961. In my opinion it would have been better not to "publicly" raise this complex problem in this manner at this time.

Regarding the experiment itself, if precedent may be taken as a defense, we find ourselves on solid ground. The bibliography on sleep deprivation experiments runs into the hundreds. Such experiments extend at least from 1891—from an early experiment by Manasseina on the exhaustion of young pups by sleep deprivation—to a recent Russian experiment in 1961, by Feldman, involving prolonged sleep deprivation in cats and dogs. The treadmill apparatus used in our experiment with rats was described in 1946 by Bunch and Licklider, in the *Journal of Comparative and Physiological Psychology*, and an "improved" version for mice was described by Kavanau in March 1962 in the *Journal of Applied Physiology*. Certainly these precedents should place our experiment at least within the general professional ethic.

As for the animals themselves, considerable care was taken in dealing with them. Evidence of this is the fact that only one animal died in the 28-day experiments, and that this death resulted from a pulmonary condition which could have occurred under circumstances independent of the experiment. The remaining animals were carefully watched, often at the cost of considerable discomfort and occasional "exhaustion" on the part of the experimeters. Finally, the animals were carefully tested for several months after their experience on the wheel, and no evidence of permanent damage was found by comparison with the control group. I do not, of course, have measures to indicate whether "pitiful states of exhaustion" occurred, or whether the animals were forced to counteract a "sensation of drowning."

However, Ansevin's letter poses two more general propositions that cannot be so specifically dealt with. It is suggested (i) that we refrain from performing "extreme" experiments, and (ii) that when animals *are* used in experiments that involve "acute suffering" "clear and important justification" be provided. Clearly, the words *extreme, acute suffering*, and *clear and important justification* are highly judgmental and value-laden terms. *Extreme* may be defined as any condition exceeding that occurring to an "average" animal at an "average" time; *acute suffering*, as any condition in which it might be inferred that the subject would not freely volunteer for the condition; *clear and important justification*, as the prospect of completely modifying a theory or saving x number of lives in y time. Clearly, on the basis of such criteria or variations thereof, to provide controls would be impossible and the range of our experiments would be pedestrian; the use of subjects would be governed by whimsy or short-term emotional outbursts. Perhaps even more important, the requirement of "justification" would obliterate basic research. I hope that we may rather continue to be guided in our choice of conditions and use of subjects by the desire to seek systematic relationships in the world about us and integration of these relationships with the theories and accumulated knowledge of our various disciplines. Let us hope that the "ethic" that we are to be governed and judged by in our choice of such conditions or subjects will be that of our peers in the scientific community rather than one derived in the absence of an awareness of the overall issues involved.

Finally, I cannot forbear noting that the "inconsequential" findings which Agnew and I reported have been of such interest to at least a portion of our scientific community as to exhaust our supply of reprints within 6 weeks.

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Wrong Subtitle

Since political scientists have not yet invented a new and more accurate language for their discipline, I think they have an obligation to be as precise and objective as they can in writing plain English. For this reason I trust you will let me note for the record that