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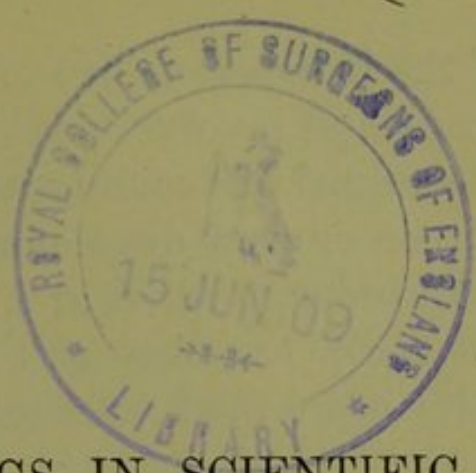
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ON THE USE OF DOGS IN SCIENTIFIC EXPERIMENTS

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FOR some thousands of years the dog has been bred and trained to help man in his avocations as hunter and herdsman, and has acquired, in the course of ages, a dependence on his master, and a consequent devotion to his interest, that well merit the affection with which the dog is regarded by the great majority of civilised men.

It is not surprising, therefore, that the ghastly accounts, which are sown broadcast throughout the country by the various Anti-vivisectionist Societies, of the cruelties alleged to be constantly perpetrated on dogs in the interests of Science, should excite opposition to the continued use of this animal for experiment, at any rate in the minds of those who give credence to such reports. Even those members of the community who realise that the knowledge and control of our bodily functions required for the successful treatment of disease can only be gained on living animals, are tempted to enquire whether results cannot be equally or at any rate sufficiently well attained by experiments on animals lower in grade of intelligence or less endeared to man by tractability and service.

The justification for the use of the dog must arise out

of the indispensability of this animal for scientific purposes, and involves at the same time a responsibility to the animal of avoiding, so far as possible, the infliction of pain or even discomfort.

In order to arrive at a conclusion on these two points we must examine the conditions under which these animals are used for scientific purposes in this country. In the first place, the choice of animals which can be used in experimental research is for the most part strictly limited. The larger questions of Physiology and Pathology, those the solution of which must affect practice throughout the whole of its ramifications, are of necessity the subject of investigation chiefly in academic laboratories. Here only do we find the men the main object of whose life is the advance of Science. Here only is the investigator stimulated in his researches by the necessity of continually teaching the large truths of his science. Here only is it possible to obtain the brightest spirits among the students as co-workers, and train them as future leaders of Science. If, therefore, the investigations carried out in these scientific institutions involve the use of experiments on animals, the animals must be such as can be kept in a healthy and normal condition either in the laboratory itself or in buildings in close proximity to the laboratory, limited in their area and the nature of their surroundings by the fact that in most cases they have to be placed in the middle of populous centres.

Except, therefore, for isolated experiments, the ordinary animals of a farm, such as bullocks, sheep, pigs, and goats, are not available for our purposes. It is true that at the present time experiments are carried out on these animals, but these experiments take place only at agricultural stations, and have for their object the decision of practical questions bearing on the nutrition

and diseases of these animals. Only incidentally are the results of such experiments of wide-reaching importance on the science of life as a whole, or in the treatment of disease in man.

Let me here emphasise the point that the distinction commonly drawn between utilitarian and purely scientific experiments is entirely artificial. The whole aim of Science is the acquisition of control, either over the forces of Nature, or over the functions of our bodies, or over those of organisms in relation to man, and this control can only be obtained through knowledge. In the purely scientific laboratories it is the fundamental questions which are the chief objects of research. But an advance in such questions implies a far-reaching change in the relation of man to the science in question and every advance opens up at once a whole series of subsidiary questions relating to the immediate application of the science to man or man's pursuit. The purely academic investigations on animal electricity by Galvani, of the movements of a magnet when hung in the neighbourhood of an electric current by Oersted, of the relation of one current to another by Faraday, rendered possible the whole of the electrical industries at the present time. And it is not by purely utilitarian investigations, comparable with those into the most economical method of constructing some detail of a dynamo, that a similar revolution will be rendered possible in the relations of man to his environment.

All researches are utilitarian, *i.e.*, are for the benefit of man. We are, however, accustomed to restrict this term to those in which we can see the immediate benefit and in which, therefore, the advance can only be a small one of detail. The larger advances in Medicine must come from the Physiological and Pathological laboratories, and if animals are required for the advance of

these sciences they must be such as can be kept in health and comfort within the limits of the laboratory.

The following animals come within this category : the frog, mouse, rat, guinea-pig, rabbit, dog, cat, and monkey.

Of these the frog owes its value to the fact that, being a cold-blooded animal, its isolated tissues survive a considerable time after removal from the body, and can therefore be used for the study of fundamental phenomena common to all animals, such as muscular contraction, the function of nerves, etc.

The guinea-pig, rat, and mouse are of chief value for inoculation experiments, such as those of diphtheria and tubercle, where large numbers of experiments have to be made, and the operation in each case is relatively simple, the answer required being generally given by the survival or the death of the animal.

The rabbit takes an intermediate place between this class and that including the dog and cat. It can be used for certain more complicated experiments, but for many its organs are too small or too delicate. Moreover, the great differences between its diet and digestive system and those of man, and the low organisation of its nervous system, and, indeed, the greater simplicity of its organisation, limit its capabilities as a means of physiological analysis of higher functions, and, in particular, render it impossible to apply results obtained on it directly to the elucidation of the functions of man.

The only animals left, therefore, are the cat, dog, and monkey. The latter animal is useful especially for experiments on the brain and central nervous system. In a sense, it has the most highly developed nervous system, and is in this respect nearest to man. For this very reason we should be loath to use it for experiments where animals lower in the scale would suffice. Moreover, the

limited supplies of these animals, and the difficulties of keeping them in a healthy condition in confinement, will always prevent their use for any experiments which can be equally well carried out on other animals.

The cat and the dog are both carnivorous, and both have digestive systems presenting marked analogies to that of man. The dog, moreover, can thrive on a diet as omnivorous as that of man himself. Which of these two animals can be utilised depends in most cases on the size of the organs which it is desired to investigate. A number of experiments can only be performed on dogs, because the corresponding organs in the cat, though larger than those of the rabbit, are still too small to permit of experimental interference.

Though it is impossible to give a full list of such experiments, which must vary with the progress of Science, the following examples may serve to show the indispensability of the dog for a large number of important researches.

(1) Practically the whole of our knowledge of the production of lymph in the body is derived from experiments on dogs. This is owing to the fact that the main lymphatic ducts are too small and delicate in the rabbit and cat to permit of a tube being placed in them so as to measure the lymph produced under any given circumstances. The choice of this animal, therefore, has not been simply a matter of convenience, but is necessitated by the nature of the problems involved.

(2) Although some of the earliest experiments on the heart, *e.g.*, the causation of the heart sounds, and the interpretation of these sounds, which are utilised by every medical man when he listens to the chest of a patient, were made on a calf, the further analysis of these sounds and of their changes with different conditions of the heart was carried out in physiological laboratories, where

the only animal of sufficient size to be obtained was the dog. In the same manner the investigation of the pulse, of the work of the heart, and of the relations between the blood pressures in the heart and the blood vessels respectively, has been carried out on the dog, and further extension of our knowledge of these matters can only be looked for by continuing the experiments on dogs.

(3) The laws governing intestinal movements have been studied in many different kinds of animals. The clue to their interpretation was, however, obtained in the dog, and it would have been impossible to have arrived at these laws from experiments on the cat or rabbit, although, when once ascertained on the dog, it was possible, by altering the conditions of experiments, to show their applicability also to other animals. Observations on the dog furnished the key to the interpretation of the extremely complex movements observed in the intestines of other animals.

(4) In a series of important experiments made lately by Professor Schäfer, on the best methods of carrying on artificial respiration for the resuscitation of partly drowned persons, it was only possible to make use of the dog, since this was the only one of the laboratory animals in which the bony cage of the chest can be compared in any way to that of a man.

(5) The recent researches by Professor Pawlow, of St. Petersburg, on the physiology of digestion, have revolutionised our conceptions of this process, and must determine the whole of our treatment of disorders of digestion. These investigations involve the establishment of artificial openings into different parts of the alimentary canal (*fistulae*, as they are called). Through these openings the different digestive juices can be collected at different stages in digestion, without

interfering in any way with the comfort or well-being of the animal. The cat would have been much too small, and would have yielded too minute quantities of juice to permit of their proper investigation. In this case the farm animals would have given results of far less service, owing to the wide divergence between the anatomy of their alimentary canal and that of man, whereas the results obtained on the dog can be transferred almost without alteration to the phenomena presented by digestion in man.

It would be possible to extend considerably this list, but the examples I have adduced may be sufficient to show that our present knowledge has been obtained by certain classes of experiments, involving some of the most important functions of the animal body, and of the utmost interest to the physician in the treatment of disease, which were made on dogs, and could only have been made on dogs. We may conclude that the use of these animals would still be necessary even if it were possible to utilise largely the herbivorous farm animals for the purposes of research.

It is probable, however, that many of these subjects would remain uninvestigated, and the advance of our knowledge would not have taken place, if the experiments that I have detailed involved the infliction of pain, or at least of pain at all severe. Fortunately for Science, this is not the case. The introduction of anæsthetics and new narcotics and of the aseptic method of operation into Physiology has well-nigh abolished pain from our Physiological laboratories, as it has from the surgical wards of our hospitals, and has advanced the science of physiology no less than the practice of surgery. I do not think that the absolutely painless character of the vast majority of physiological experiments is sufficiently appreciated. Records of classical experiments, performed before anæsthetics were invented or had come into

general use in laboratories, are too apt to be taken as typical of those of the present day, when the use of anæsthetics is invariable in all experiments more extensive than a simple inoculation.

Though I have been engaged in the experimental pursuit of physiology for the last seventeen years, I can say that on no occasion have I ever seen pain inflicted on a dog or cat in a Physiological Laboratory in this country, and my testimony would be borne out by anyone engaged in experimental work in this country.

Moreover, it is not merely the normal humanity of the operator that should deter the infliction of useless pain in a physiological experiment. It is the object of the experimenter to limit the field of his experiment so far as possible, so that when he is, so to speak, putting a question to any function of the body, this function shall be unaffected by any factor other than that which is being controlled by the experimenter. Of all possible disturbing factors in the body, none can be greater than that of pain. It is a common experience that a slight toothache will upset the processes of digestion, and a storm of pain playing on the different functions of the body might make it impossible to judge how far any result obtained was due to our experimental interference, how much to the irregular actions of the pain inflicted. It is true that the anæsthetised condition may be regarded as more or less abnormal. We are able, however, by using different anæsthetics, to vary this abnormality from one experiment to another, and thus to allow for it in interpreting the results of our experiments. We should not be able to allow for the effects of such an indeterminate factor as pain, and a physiological experiment which is painful is thereby a bad experiment.

The very small total amount of pain inflicted in physiological experiments will be rendered clearer if we

consider the conditions under which experiments are carried out. Since from the character of the lines of research pursued, more dogs are probably used in my laboratory than in any other laboratory in this country, we may take one year's record of experiments as an example. In the year 1902, 155 experiments were performed on dogs in the Physiological Laboratory at University College. Of these, 151 were performed under license alone. What does this mean? In experiments performed under license alone, the animal must during the whole of the experiment "be under the influence of some anæsthetic of sufficient power to prevent the animal feeling pain, and the animal must, if the pain is likely to continue after the effect of the anæsthetic has ceased, or if any serious injury has been inflicted on the animal, be killed before it recovers from the influence of the anæsthetic which has been administered." In all these experiments, therefore, the dog was first chloroformed; the experiment was then performed while it was fully anæsthetised, and at the conclusion of the experiment the animal was killed without ever recovering consciousness. With common care it is easy to keep animals for hours under the influence either of chloroform or ether, or of a mixture of these two drugs, in a state of complete insensibility, and the same result may be attained by the use of large doses of narcotics, such as morphia or urethane. In none of these experiments could the animal have felt anything at all of the operations.

No one has yet been denied our moral right to take animal life in the interests of man. Millions of animals are slaughtered every year for food. Nor are the lives of dogs in any way regarded as sacred. At the Battersea Dogs' Home over 20,000 dogs are suffocated annually in the lethal chamber in order to diminish the danger of stray dogs in the London streets. This

institution is mainly kept up by funds contributed by the charitable. In the vast majority of our physiological experiments euthanasia is attained even more completely than is the case in the Dogs' Home, but in the laboratory the death of the animal is utilised for increasing our knowledge of the animal body, and therefore in the service of man.

In 1902, four experiments were performed in my laboratory, under Certificates B. and E.E. Such certificates would be necessary for an operation such as the establishment of a gastric fistula. The animal being fully chloroformed, an opening into the stomach is made, with exactly the same precautions as are used when the operation is carried out on man in cases of irremediable stricture of the gullet. The wound is dressed with all aseptic precautions, and the animal is then allowed to recover from the anæsthetic. Experience on man shows that the healing of a wound made in healthy tissues is practically painless, and we have no reason to suppose that dogs are more sensitive to pain than man himself. In a week's time the wound is healed, and we have a dog normal in every respect, except that there is a direct opening between the exterior of the body and the interior of the stomach.

The earliest case of gastric fistula, which was the subject of detailed observation, was that of Alexis St. Martin, a Canadian, in whom a gastric fistula had been established as the result of a gunshot wound. Dr. Beaumont took St. Martin into his employ, and for many years carried out careful observations on the secretion of gastric juices, and on the movements of the stomach walls. His experiences are sufficient to show that observations on a gastric fistula, which has first been established in an animal, are perfectly devoid of pain or even discomfort.

The painless condition of a wound depends on its

healing aseptically. Experience on man shows us that infection of a wound may be followed or attended by pain. By the terms of the certificates under which these experiments are made, if the antiseptic precautions fail and suppuration occurs, the animal is required to be killed under an anæsthetic. It is generally essential for the success of these experiments that the wound should heal cleanly, and that the surrounding parts remain in a healthy condition. We may conclude, therefore, that in the majority of physiological experiments no pain is inflicted.

In a certain small proportion of cases, although we cannot speak of actual pain, the effect of our operative measures may be to cause sickness followed by the death of the animal. In all such cases the animal must feel ill and miserable, as it does in distemper, but it is just these experiments which have the most immediate bearing on the causation and treatment of disease in man. A disease such as diabetes is produced in the animal in order that we may study the conditions on which it depends, and so learn to control them. Such experiments do not, however, form one per cent. of the total number of experiments on dogs.

Since, as I have shown, the use of the dog is indispensable for the furtherance of our knowledge on many functions of the body, any legal prohibition of the use of dogs for experimental purposes would deal an irremediable blow to the advance of Physiology and Medical Science in this country; while the only practical result to the dog would be that a few hundreds more would be killed in the lethal chamber at the Battersea Dogs' Home, instead of obtaining euthanasia at the hands of the physiologist.

