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ANIMAL EXPERIMENTATION IN BIOLOGY AND MEDICINE[1]

By Professor A. J. CARLSON

UNIVERSITY OF CHICAGO

THE contributions of experiments on animals to present-day biological and medical knowledge and medical practice is so conspicuous and well known to our profession that my discussion would be out of place in this gathering except for the fact that in a democracy like ours the science and the service of biology and medicine must rest on the broad base of general approval of society and can not be many leagues ahead of the understanding of the average layman. The fact is that there is in our nation still a small body of apparently sane men and women, so poorly informed that they deny the value of animal experimentation for human health and human understanding, men and women so misled that they would, if they could, stop by law the humane use of animals by us in our perpetual labor towards understanding and controlling life and death processes. This is a stern reminder that we should forget that part of the oath of Hippocrates enjoining us to secrecy, that we must ever pass on what we have discovered to all our fellow citizens. This teaching must be done with patience, in true humility and without rancor, as the people in the mart and on the ranch have not traveled our path, hence can not possibly see eye to eye with us, without fair discussion. We, who have had the privilege to delve deepest into the nature of life and the control of disease, would be poor soldiers indeed, did we not strive to shield our fellow men from the consequences of their honest but misguided emotions.

The misguided opponents of modern medical re-

[1] Address in the Symposium on Animal Experimentation, Pacific Division of the American Association for the Advancement of Science, San Diego, Calif., June, 1938.

search and modern medical practice charge that animal experimentation is futile, is without benefit to man. They charge that animal experimentation in biological and medical teaching and research is cruel. Fellow citizens, these are serious charges. What are the facts? To-day man's achievements in medicine and biology are very significant and most cheering to all mankind. Many causes have contributed to this happy progress in understanding of the workings of the human and animal body, and the gradual conquest of human and animal disease. The new discoveries in the basic sciences of chemistry and physics have given the biological and medical investigator new methods of solving old problems, such as kidney disease and the toxemias of pregnancy, new tools for penetrating further and further into the mysteries or the unknowns of life both in health and disease. But without freedom in research; without the confidence in and the moral and financial support of medical and biological investigation by governments, and by individuals our achievements in the understanding of man and the conquest of disease would have been scant, indeed, despite the significant discoveries, the new ideas, the new tools furnished us by our illustrious brethren in chemistry and physics. This is almost self-evident. Modern medical research costs much money, and the investigators must have freedom to work, to experiment, to try again and yet again, under guidance of the moral code of civilization, but unhampered by special philosophies, special superstitions or special prejudice. The moral code of civilized man, as I understand it, reads thus: As between men and the animals, man comes first. This is the law of life. But when man uses or destroys the animal for man's own protection, aid or other interests, such use or destruction must be done without cruelty. I regard kindness to all animals as one of the finest and fairest fruits of human development, especially when the emotion of kindness is tempered and directed by a profound understanding of the complexity, beauty and unity of all life, man, animal and plant.

All science is one, at least in the principle of the scientific method. Physics, chemistry, the technical arts have made the marvelous advances by working with, by experimenting with all forms of matter and energy known to man in the universe, by putting new questions to old "Mother Nature" and seeking newer and better answers by newer and better experiments by means of newer and better tools. If the mineral pitchblende had been taboo to the chemists, the discovery of radium and the subsequent explosive evolution in chemistry and physics could not have taken place as one of the great advances in our knowledge of the world during the present century. In the same way the biological and medical investigator endeavors to use newer and better tools in clearing up the many unknowns in living matter in health and disease, trying newer and better experiments on all forms of life—plant, animal, man.

First, there is an essential unity of all life. Informed laymen are well aware that animals are built on the same plan as man; they have the same organs working by the same nervous and chemical machinery. The animals subsist essentially on the same kind of food and the same kind of air as man, and are subjected to essentially the same kind of disorders as man. The causes and effects of disorders of the heart, the stomach, the lungs, the eyes, the nerves or the brain are essentially the same in animals and man. When the experimental method was introduced in science, including the science of medicine, experiments on animals resulted in rapid progress of our understanding of the nervous and chemical machinery operating in the body in health and disturbances of this machinery that leads to disease. Thus, animal experimentation has played a very great role in the development of our knowledge of infections and their control, of anesthesias and their refinement, of disturbances in nutrition and dietary deficiencies, in growth, in the development of new and valuable drugs and their continued refinement.

One of the great discoveries in medicine of all times is the approximate causes of pernicious anemia and the control of pernicious anemia by the liver and gastric principles. I glory in the fact that this discovery was made in this country, our country, these United States. The first steps were taken by experiments on dogs in the city of San Francisco in the great University of the State of California. Then the ball passed to the Atlantic coast, to fair Harvard. And now the whole world cheers California and Harvard, and Dr. Whipple, and Dr. Minot, and Dr. Murphy. Citizens of California, remember that cheer when you are confronted with proposals to shackle your great universities, proposals which say in effect, that good doctors of this state can not be trusted to treat unclaimed stray dogs humanely!

There were more than thirty years of intensive research on animals—mainly on the dog—before we had the substance insulin in sufficient purity to warrant its trial on people sick with diabetes; and even now every new lot of insulin must be tested on animals before it is safe for the sick man, the sick woman or the sick child. Every informed layman now knows the value of insulin in diabetes in man. You need not take my word for it. Read history and form your own judgment. These facts are obvious. I sincerely believe that if every man and woman in this country knew the inspiring story of the discovery of insulin, all

voices would be raised in approbation of such fruitful animal experimentation.

Second: Free and intelligent experiments on animals during the last three hundred years have been the greatest factor in our present achievements in knowledge of the nature of life and control of disease. It was not till the great William Harvey began to observe and experiment on animals that we started to understand the heart, the blood, the circulation. We began to make real progress in the understanding, if not in the control of cancer, when this malady was discovered in animals and experimentally produced in animals. The lowly mouse, not to mention many other species, has served man well in research on cancer. But we can not say to-day what animal will yield the hoped-for answer to cancer prevention or cure. Animal experimentation has been a great factor also in giving us better knowledge of nutritional anemia, digestive and kidney disorder, glandular disturbances, nervous diseases, the control of tuberculosis, scurvy, hookworm and pellagra.

I wish that all citizens would read the history of biology and medicine of the last three hundred years, and really be informed as to the facts and value of animal experimentation as it is carried on at Berkeley, at Stanford, at Los Angeles, at Harvard, at Yale, at Johns Hopkins, at Chicago, at the Rockefeller Institute and at the Mayo Clinic, in fact, at any first-class university, medical school or hospital here or abroad! Would the commonwealth care to live under the health conditions and be treated for sickness by the empirical and often harmful methods that obtained before animal experimentation laid down the laws for personal and public health and hygiene, which minimized the incidence of epidemics, made the physician a real diagnostician, surgeon and healer? Would the commonwealth care to be deprived for one day of the fruits of animal experimentations in the realm of health and disease of man as well as animals?

I could speak to you for hours on what experiments on animals in veterinary medicine have done for the health and happiness of the dog and the cat, the horse, the heifer, the hog and the lowly hen. We can rid the dog of harmful parasites, including the hookworm, and we are well on the road to prevent dog distemper. As to rabies, we are still in the trenches but making progress. But let the record speak for itself.

Third: Experimentation on animals is essential for the practical application of a great deal of present medical knowledge in the prevention or cure of disease. Animals produce antitoxins for us; they are essential in the discovery and standardizing of new remedies. They are necessary for the diagnosis of some forms of tuberculosis. They are of great service in some aspects of human pregnancy. The modern story of foods, nutrition and the known disorders of nutrition would be largely gaps and guesses, except for the services of the rat, the pigeon and the dog. In brief, we would be greatly hampered in applying the known facts to society were society to stop the doctor and the biologist from the humane use of animals in the scientific service of man. It would have been far better had we used some dozen dogs and guinea pigs in testing the tragic Massengill sulfanilamid elixir. If we had, the killing of nearly a hundred citizens would not now disfigure the fair escutcheon of our country.

Fourth: Animal experimentation seems essential for further progress in biology and medicine. Experimentation has certainly proved its value in the biology and medicine of yesterday and of to-day. But what about to-morrow? Do we know it all now? Or, if not, can't we find the missing answers by intuition, inspiration or logic? I see no hope in that direction. These methods failed in the past. I see no greater value for them in the future. After more than a third of a century's service in biology, it seems clear to me that intelligent and humane use of all species of animals will be necessary on the road to a fuller understanding and control of heredity, growth, cancer, immunity, colds, pneumonia, nervous, glandular, nutritional and mental disorders.

Furthermore, the use of animals is of continuous and increasing importance in the training of the doctor and the biologist of the future. Unfortunately, parents do not transmit their individually acquired knowledge and skill to their children. Each generation must learn for itself, mainly by the old slow and painful method of trial and error. If the society of to-morrow needs the services of doctors and biologists, common sense seems to say that their training is a matter of importance, a training in nature as well as in books. That means, we need animals in the training of doctors and biologists, and animals can be so used, and are so used, without cruelty.

Fifth: Animal experimentation is humane. As to the charge of uselessness and futility of animal experimentation, the answer is given by the history of medicine and biology. As to the charge of cruelty, I have a word to say as a man who has been engaged in animal experimentation for over a third of a century and should know something about it. Cruelty is the wanton or useless infliction of suffering on man or animals. I know the biological and medical research laboratories in this country and abroad, and can state as a fact that in animal experiments involving pain the same anesthetics are used as in surgical operations on man. Neither man nor the animal needs an anesthetic to stand a mosquito bite or the passing of the hypodermic needle through the skin. Moreover, an animal in distress usually can not answer the questions put to him

by the medical investigator. When animals under anesthesia are used in medical teaching, they are not allowed to come out of the anesthesia. Death by anesthesia is probably one of the least uncomfortable deaths. There is inflicted on animals more pain in one hunting, trapping and fishing season than in all the centuries of animal experimentation. The pain inflicted by the hunter, fisherman and trapper is not wanton, to be sure, and yet inevitable.

We use animals, by common consent, for food, for clothing, for labor, for pleasure. How can it be wrong to use animals humanely to increase our understanding of life, our control of disease, both of which contribute to human happiness? We must retain a sense of proportion. Man survives only by destruction of plant and animal life for his food. Man's welfare demands either death control or birth control of the animals, but these must be carried out humanely. When the animal dies as a part of biological and medical investigation, the death is humane. We can not indict or convict of cruelty to animals our universities, medical schools and hospitals on any evidence so far brought forth by the adversaries of modern medicine. And believe me, I have heard it all.

Biological and medical investigation and teaching, guided by the humane behavior of the sane and civilized man, must remain free, must not be restricted, lest we condemn our children to dreary decades of medical stagnation.

Whenever I hear this charge of cruelty to dogs and other animals in biological and medical laboratories, it is difficult for me to follow the precepts of the Bible, and "suffer fools gladly." The attitude and practice of kindness is one of the fairest flowers of human evolution, and we must cherish it. But let us not put the flower of kindness to the dog into the ugly bouquet of unfairness, cruelty, injustice and deception to man. Let us not peddle falsehoods against our fellow men who obey the higher moral imperative of endeavoring to make the world to-morrow a little better than it is to-day. In that group marches the doctor, the biologist, the medical investigator, even though at times our steps falter. At birth, at death and in between at times of pain and strain the doctor is near to guide and succor. Is this doctor, and his teachers in our great medical schools, to be smeared with the charge of cruelty to stray dogs by the enactment of special legislation? In practical life, animals, as well as plants, must be adjusted primarily in the interest of man. We do so necessarily in the case of bacteria, flies, rats, insects and all manner of wild and domestic animals. In my philosophy, man comes first. I will gladly contribute to shelter for stray or uncared-for dogs, when my fellow human beings, and particularly children, are adequately cared for. I am unable to account for the repeated charge of cruelty in animal experimentation and cruelty in the experimenter by apparently sane people who do not take the trouble to visit the university laboratories and the hospitals where such experiments are going on, or to investigate the reputation for cruelty or kindness of the individual investigator in the community. I am not aware that the part of the decalogue reading, "Thou shalt not bear false witness against thy neighbor," has been repealed. I think it should still guide the tongue and pen of honest men. Some of the finest men and women that it has been my privilege to meet in my long life have been investigators in biology and medicine, particularly by the methods of animal experimentation. Such well-known humane citizens as Jane Addams, Dean Gilkey, Clarence Darrow, Archbishop Dougherty, Archbishop Curley, Bishop Lawrence and Rabbi Mann have for years upheld and defended the necessity and utility of animal experimentation in medical research and medical teaching.

Sixth: The tactics of the adversaries to modern biology and medicine. The group that endeavors to cripple the progress of modern biology and medicine by propaganda and restrictive legislation is made up of a small core of peculiar people; the blindest of the blind; people who do not want to see. This small group, through a persistent propaganda of mainly false charges, misled a much larger number of poorly informed but otherwise fine, sane, kind and excellent citizens. The latter usually change their allegiance when they learn the truth about animal experimentation.

The smaller core would stop all animal experimentation if they could. When that attempt fails, they do not hesitate to "bore from within" the larger groups of humane citizens in the promotion of such hampering measures as unclaimed stray dogs not being made available for medical research and medical teaching in our schools. With this smaller fanatical core, these folks of peculiar faiths and philosophies, the end (crippling of modern medicine) justifies the means (a propaganda by falsehood). I have no quarrel with anybody's faiths or philosophies, as long as they are content to use it for their own individual guidance, and do not try to impose it by law on their neighbors. But when it comes to rank falsehoods, such that hurt society, I will not be silent. I will call a spade a spade, no matter who feels hurt. If we did otherwise we would be false to our higher obligation to man: To apply the known, to investigate the unknown, to give that service to society for which our abilities and special experience render us able. The liberal writer, Howard Vincent O'Brien, said recently:

> Life is an endless battle between sense and sentiment. Reason is forever at war with emotion. In a time like

this conditions are especially favorable for the growth of illusion. It is a time when wishful thinking has its chance to dissolve hard facts in a spray of emotion.

Outstanding among those who believe they can snivel their way to sense are the anti-vivisectionists. They will burble ecstatically about their beloved dogs; and wear furs, eat meat and swat the fly. When they are ill they will run for the doctor, but when they are well they do all they can to hamper the doctor in learning how to cure the maladies that afflict them.

If the anti-vivisectionists were content to preach their sentiment, sense would have little to fear from them. Unfortunately for sense, this form of sentiment commands large resources in money and is able to exert pressure on public opinion. People of wealth, whose thinking is dominated by their emotions, are constantly bequeathing large sums to what they consider the worthy cause of stray dogs. It is confidently expected that a certain movie star will do that when he dies. Not knowing either his interest or his intention, millions of people go every day to see his pictures and unwittingly pay tribute to the cause of holding back progress.

In saying that, I expose myself to a deluge of protest from people who do not believe that experiment on living animals has produced any progress. I can only hope that such persons never have to see a child trying to breathe through a diphtheritic throat.

The cry of cruelty to animals does not fire me. For one thing, the pioneers of science take cruel and unusual liberties with their own persons. For another, the cruelty of man to his own kind exceeds anything perpetrated on the lower orders. Those who raise their cry of cruelty to animals seem to center their pathos on the dog. They are silent about the sufferings of the cat, the monkey, the guinea pig and the mouse; and, while they respond quickly to individual instances of human distress, they are fatalistic to the social injustice which causes them. It seems to me that first things should come first and that attacks on cruelty should begin with the sort which keeps humans cold, hungry and idle, and which sacrifices them in the senseless hecatomb of war.

I have no scorn for minorities or for those who see visions. On the contrary, I believe that there is more in heaven and earth than is yet dreamed of in our philosophies. But I believe that truth is more likely to be reached on the hard paths and narrow bridges of experimental science than by the wings of revelation.

The late Clarence Darrow, a friend and champion of the "underdog," species *homo,* wrote me in 1934:

When I was younger I was interested in anti-vivisection but have had no connection with it for a good many years. I have been pretty well convinced that the operation is now performed with care as to anesthetics which really takes away the horror of its contemplation. Then, too, at the very best the death of most animals is a horrible one, if death comes from natural causes. So I am satisfied that vivisection does not add to the pain of animal life. Then, too, I can see no difference between that and killing and eating meat, from which I abstained for a number of years. If the other animals were cared for as humans they would soon drive us off the earth. While I do not place the value of a man far above that of any other animal, still we have a better brain and we will not let the other animals destroy us. Long ago I made up my mind that with strict adherence to anesthetics the terrors and pain of animals is rather diminished than increased by vivisection. So, long ago I stopped advocating it.

In conclusion, may I say a word specifically to the citizens of the State of California? I feel I owe that to you, and I think I can do so without prejudice, for I am a kind of "native son" by adoption: I had the privilege of spending four profitable years in one of your great universities. I do not want to see my Alma Mater shackled. Section 10 of your proposed State Humane Pound Law reads as follows:

It is unlawful for any poundmaster or assistant to use or permit to be used any live animal in his custody for experimental or commercial purposes or to turn over with or without remuneration, directly or by any indirect ways or means any dog, cat or other animal in his custody or over which he has or will have control to any person, school, university, research laboratory or experimental station to be used for educational demonstration, medical, scientific, and/or experimental purposes of any nature, or to any person, school, university, research laboratory or experimental station using animals for educational demonstration, medical, scientific or experimental purposes of any nature.

A vote for this measure is a vote of censure of your universities and medical schools. It is a vote to cripple, hamper and impose an impossible financial burden on medical education and medical research in California. It is a vote of lack of confidence in the medical profession of this state. A vote for this measure says: The leaders in medical education and medical research in the State of California can not be trusted to treat unclaimed stray dogs and cats humanely.

I am a democrat (spelled with a small "d") and believe in the democratic way of life. But the privilege and duty of the voting citizens entails the sober obligation to investigate before we vote. The story of modern biology and medicine, the work in our universities, in our medical laboratories of teaching and research are open books for every citizen to read. Do not take my word on faith, nor the word of our adversaries. Look up the facts for yourself.

This is what happened in my own city and state a few years ago, when opponents of modern medicine tried to shackle medical research and medical teaching. We invited our fellow citizens (including our adversaries) to come to our medical laboratories to see for themselves whether our work was futile and cruel. They came: legislators, aldermen, men of the mart and women of the home and club, men in the store and men

in the street. They saw for themselves and then voted overwhelmingly to give unclaimed stray dogs to reputable laboratories for medical teaching and research, for humane service towards human welfare. This was done by the citizens of Chicago and the State of Illinois. Will the citizens of California do less? In your veins surges the blood of hard-headed pioneers, not yet greatly diluted by the passage of years. I know your magnificent mountains, your fertile valleys, your unique forests, your charming shores. Your institutions of higher learning, of medical education and medical research have flourished like the bay tree. Yours is a happy acre. But has this garden of Eden made you soft in brain and spine? It would be a strange spectacle to see the state of the "forty-niners" as the spear-head of the misguided communities who put the alleged happiness of unclaimed stray dogs and cats above the progressive welfare of our own species; misguided communities, who would rivet restraining shackles on the noblest endeavors of man.

OBITUARY

NATHANIEL GIST GEE

IN the quiet of his home at Greenwood, South Carolina, on December 18 last the long career of usefulness of Nathaniel Gist Gee came to its close. He was born in Union, S. C., on April 20, 1876. He was educated first in the public schools of Union and then in Wofford College, where he graduated in 1896. He was principal of Jordan (S. C.) Academy, 1896–1898, professor of natural sciences in Columbia College, 1898–1901, and he attended at intervals summer sessions at Harvard, Chicago and Columbia Universities. Then he went to China for a long stay at Soochow University, first as professor of natural sciences and later as head of the department of biology, 1901–1915. During this period he trained many of the Chinese investigators of the present day for the studies of the local fauna that they have since carried on with distinction.

After an interval of a few years spent again in teaching in his native state, he returned to China. For a year he was Far-Eastern representative of the Spencer Lens Company. He then joined the China Medical Board of the Rockefeller Foundation as adviser on premedical education, and was assistant resident director in 1926–1928 and adviser for China in 1928–1932. Then he returned to America and was professor of biology at Landon College at the time of his death.

In the Peking Society of Natural History he was successively charter member, organizing secretary, life member and president. He was a member of the Board of Managers of the Fan Memorial Biological Institute. For two years he was president of the East China Educational Association. He was a fellow of the American Association for the Advancement of Science and a corresponding fellow of the American Ornithologists Union.

He was joint author of lists and manuals of the birds of China and interested himself in the fauna and flora of that country generally, but his specialty was fresh-water sponges. He published extensively and became a well-known authority on that group, and amassed a very fine collection from world-wide sources.

He was a good naturalist, a good teacher, an ever helpful, kindly and generous friend of youth and a promoter of good will toward all mankind.

JAMES G. NEEDHAM

RECENT DEATHS AND MEMORIALS

DR. FREDERICK H. FLAHERTY, professor of clinical surgery at Syracuse University, died on September 7, at the age of sixty-five years.

DR. DERRICK NORMAN LEHMER, professor emeritus of mathematics at the University of California, died on September 8 at the age of seventy-one years.

RAYMOND H. TORREY, of Hollis, Long Island, botanist and conservationist, died on July 15 at the age of fifty-eight years.

THE yearbook for 1938 of the U. S. Department of Agriculture, entitled "Soils and Men," the third in the new series dealing with special subjects, is dedicated to the memory of Curtis Fletcher Marbut, for many years chief of the Soil Survey Division. The tribute to Dr. Marbut says in part: "Under his guidance, work in soils became a recognized science in the United States. His own researches in soil classification and geography laid the foundation for our modern concepts of soil."

SCIENTIFIC EVENTS

FORESTS OF THE PACIFIC NORTHWEST

THE Pacific Northwest Regional Planning Commission, in a report published by the National Resources Committee, urges immediate and general adoption of sustained-yield management to conserve the forests of the Pacific Northwest, pointing out that the timber supply is being dangerously depleted. The report lays stress on the importance of sustained-yield management as advocated by the U. S. Forest Service.

It is pointed out that half the remaining timber sup-