EXPERIMENTS ON ANIMALS, AND THEIR
INFLUENCE ON MORTALITY *

J. H. LANDIS, M.D.

Health Officer

CINCINNATI

The mental attitude of those opposing vivisection furnishes a rich field for the psychologist.

Sporadic outbreaks against vivisection may be expected to occur, just as do sporadic outbreaks of smallpox or other acute infections. They occasion a flurry of excitement, temporarily obstruct progress, and are then brushed aside.

To the antivivisectionist, the experimenter looms large as a monster of cruelty, running amuck among animals with a red hot poker in one hand and red hot pincers in the other, gouging out eyes or twisting out livers, kidneys, hearts, lungs and other anatomic parts for the pure joy of maiming and killing.

This delirium tremens attitude toward vivisection seems to be a source of so much real comfort to those who oppose experiments on the lower animals that it is almost an act of cruelty to try to enlighten them; their delusions are so fixed that attempts to dissipate them are almost as hopeless as to convince a maniac behind crossed bars that he is an exceedingly humble member of the Smith family instead of King Solomon.

Medicine and surgery have reached their present state through a long line of experiments on man and the lower animals. Ideas which have resulted in lengthening the average duration of life over twenty years, during the past century, had their inception in the laboratory and were confirmed at the bedside.

When the Almighty gave man "dominion over them," the lower animals, He named no restrictions and, when He placed Adam in a deep sleep and extracted a rib, He qualified as the first and greatest vivisectionist of all time.

The prevention of suffering, disease and death, and the prolongation of life can be said to be the objects sought by those experimenting on the lower animals.

Not idle curiosity nor a Jesse Pomeroy capacity for cruelty, but a desire to make this world a better place to live in, for both animals and man, is the motive inspiring the experimenter.

Man is not the sole beneficiary. The lower animals also have their lives prolonged, and are saved from needless suffering as a direct result of these experiments.

A few years ago, anthrax killed millions of dollars' worth of stock. In England alone, pleuropneumonia caused a loss of \$450,000,000 in the first quarter of the nineteenth century through the death of cattle due to this cause. Introduced into the United States, it threatened to ruin the cattle industry of the country. Experiments carried on in France demonstrated its infectious character; the application of this knowledge entirely eliminated it in the United States, and was accomplished in six years at a cost of \$1,500,000, an infinitesimal outlay for the results obtained.

In the old days, glanders claimed thousands of horses; Texas fever, thousands of cattle; hog cholera, hundreds of thousands of hogs; and bovine tuberculosis, untold thousands of domestic animals.

These diseases are now understood and their prevention is being brought about, thereby not only adding to the comfort of the animals but also saving millions of dollars' worth of food from destruction.

During the late eighties, von Behring conceived the splendid idea that diphtheria might be robbed of many of its terrors. The carrying out of this idea meant the use of animals for experimental purposes, and a number of horses and a considerable number of guinea-pigs were used.

It may be of interest to compare two five-year periods in Cincinnati's death rate from diphtheria and croup, one before, the other after antitoxin had been discovered. From 1876 to 1880 inclusive, with a population of 245,000, 872 children died of diphtheria and croup. From 1909 to 1913 inclusive, with a population of 380,000, 227 children died from the same causes. During the first five-year period the average annual death rate per hundred thousand of population was 71 and during the second five-year period, 12.

In 1912, the Bureau of the Census based its vital statistics on a population of 95,545,336. Assuming that similar results in the treatment of diphtheria and croup were obtained throughout the country, this one series of vivisection experiments saved the lives of 56,345 children last year, as many children, almost, as are attending the public and parochial schools of this city. According to the Committee of One Hundred on Conservation, this represents an economic saving for the whole country of \$227,750,000 in one year from one disease alone.

To those who place a higher value on the life of a rabbit than they do on that of a child, these figures will mean nothing. To those parents, however, who have had a child rescued from death by slow suffocation or from blood poisoning, it means a foretaste of heaven.

To the old-time doctor it means the difference between a losing fight in 40 per cent. of his cases and a practically uninterrupted series of victorious conflicts with one of the greatest scourges of childhood.

The prevention of lockjaw and hydrophobia has been perfected through experiments made on animals. The cure of these diseases can be discovered only by a continuance of these experiments. The Pasteur treatment has reduced the number of cases of hydrophobia in persons bitten by rabid dogs from between 6 and 12 per cent. to less than 1 per cent. To those who always base their conclusions on the exception to the rule, this will mean nothing; but to one who has seen some poor unfortunate racked by the convulsions of hydrophobia, it means more than words can convey.

The prevention of lockjaw was entirely due to experiments on animals. Before this great discovery was made, the annual celebration of the Fourth of July ushered in a series of dreadful tragedies. Young America paid dearly for its patriotism. In hospitals and private homes throughout the land, the victims of lockjaw passed through the agonies of recurrent convulsions until outraged Nature closed the scene with the death of the victim.

Vivisection has changed the course of events, and a death from lockjaw now is almost sufficient ground on which to base a suit for malpractice. A few animals were used to bring about this change. Their use for that purpose has been challenged by the antivivi-

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sectionist; but to one who has stood by the bedside of some child and witnessed his last few agonizing hours, the change wrought in the prevention of this disease is like a beautiful morning after a night of frightful dreams.

During 1912, an average of 398 funerals due to tuberculosis and 190 due to cancer were held in this country every day. A large proportion of the deaths due to tuberculosis occur at a time when the victim is at the most productive period of his life. According to the estimate of the Committee of One Hundred, the deaths due to tuberculosis represent an annual economic loss of over \$727,000,000. Physicians are familiar with the methods which have proved efficacious in the cure of some cases, but a specific cure, one which shall be to tuberculosis what quinin is to malaria, remains to be discovered. This cure can come only through experiments on animals, and the final crucial experiment must be on man. Is the end desired worth while? Are investigators to have their activities paralyzed, and is Western medicine to enter on a sleeping contest with that of China? The tragedies represented by those 145,000 deaths leave the imagination staggering and impotent. Are the necessities of helpless women and children to have no weight in the balance? Is the life of a guinea-pig to stand between young men and women and bar them from a fair chance in life? Shall we continue to stand by the bedside of those dying from this cause and merely dream of a cure, or shall we continue experiments the results of which, experience leads us to believe, will be as great a blessing to the human race as are those now enjoyed through diphtheria antitoxin?

To the antivivisectionist, the convulsions incident to tuberculous meningitis mean nothing; the days and nights of torture incident to hip joint or spinal disease mean nothing; the weeks, months and years of cough, fever and slow starvation due to consumption of the lungs mean nothing; but to the physician scientist they are goads that sting and lacerate, urging, always urging, him to solve the problem of dying thousands.

Cancer comes later in life, as a rule, and its drain economically is not so great as that of tuberculosis. Its capacity for torture, however, is limitless and ends only with the death of the victim. The 69,000 deaths reported in 1912 represent untold agonies to those afflicted and to their families. In some it meant death by starvation, in others a slowly advancing ulcerative process that consumed the face, the eyes, the nose, until the victim was transformed into a horrible caricature of a human being. Woman was its favorite victim; her organs of reproduction and the infants' source of food supply its favorite choice of location. Thousands of women who were indispensable to growing children, and who had reached a period when fortune seemed ready to dispense its choicest favors, saw the grim reaper beckon them into the dark shadows from which they never returned.

There is an element of mercy in the deaths caused by the acute infections, for the end comes quickly. In cancer there is no mercy shown, for the disease counts its victim's life blood drop by drop and rots his tissues until he becomes a loathsome decomposing mass. The cause of cancer is unknown; its cure can be brought about only through the continuance of experiments. In the meantime, for reasons not clearly understood,

the problem is becoming progressively greater, for each year records a higher mortality from this cause. The discovery of a cure will add almost a decade to the average duration of life, and reduce the total mortality about 6 per cent. Are these objects worth working for, and, if so, are the lives of a few animals to stand in the way? Permit the question to be answered by those who would be benefited. If the records of the Cincinnati Health Department can be taken as an index to conditions over the entire country, one out of every eighteen people now living in this country face a lingering death from this cause. Do the other seventeen care to take the chance that they will not be the one to solve the great mystery this way?

The great advances in surgery were brought about through experiments made on animals. The buried suture cost the life of one horse; the catgut ligature the life of one calf!

Had Lister's discoveries been given to the world before our Civil War, they might have saved the lives of 1,142 who died of gangrene, 2,747 who died of blood poisoning, over 90 per cent. of those who died of wounds implicating joints, and practically all of the 1,497 who died of secondary hemorrhage. Lister's experiments, making modern surgery possible, involved the use of so few animals that one stands appalled at the idea that similar beneficent results in other diseases may be halted through the pernicious activity of a few individuals in whom two ideas simultaneously entertained would produce symptoms of compression of the brain.

But for Lister and his followers, appendicitis, gall-bladder disease, the various conditions in the digestive tract amenable to surgical treatment, and those peculiar to women would be claiming their thousands. In fact, modern surgery with its wonderful life-saving devices would be unknown. If the time ever comes when it becomes necessary to settle this question of vivisection, let those who live today because of past experiments be heard and marshal the spirits of the thousands sacrificed because of lack of knowledge during the Civil and Spanish-American wars. The living and the dead testify to the beneficent results!

Cholera, the plague, smallpox, malaria, yellow fever and epidemic cerebrospinal meningitis have been conquered through knowledge gained experimentally.

Control over the plague cost the lives of a large number of rats and a still larger number of fleas. Control over smallpox costs the lives of a considerable number of calves each year. It is said on good authority that control over malaria has cost the lives of a vast number of perfectly innocent mosquitoes, and the same can be said of yellow fever.

The discovery of the Flexner treatment for epidemic cerebrospinal meningitis was secured by a series of experiments on twenty-five monkeys and 100 guinea-pigs. Before this was done, seventy-five out of every hundred attacked by the disease died, and many of those who escaped with their lives were left helpless dependents, some blind, some deaf, some idiotic, some paralyzed. Since the perfection of Flexner's plan of treatment, the figures are exactly reversed, 75 per cent. being quickly cured, practically none left dependent.

When the court decides whether or not experiments shall continue, introduce the testimony of those who

have been saved, marshal the living from the blind and insane asylums who might have been saved from a fate worse than death, and the records of those dead from this cause.

Flexner's fame will stand with that of Jenner, Pasteur, von Behring and Lister, and, throughout the coming centuries, will grow greater, while the bodies of his detractors rot in forgotten graves.

Keen is authority for the statement that maternity hospitals at times lost as high as 75 per cent. of their inmates from child-bed fever, and that a mortality of 3 per cent. in general practice was considered about normal. To Pasteur and Lister belongs the great credit of practically eliminating this disease so that the mortality has fallen to less than 1 per cent. Without the knowledge gained through their experiments, Cincinnati's loss from this cause in 1912 would have been about 223 instead of twenty.

When the question of vivisection comes up for final settlement, let 389 mothers with babies in their arms march before the jury and then show by statistics that, but for experimentation, eleven of these mothers would be in their graves.

In the olden days, the majority of operations for cesarean section resulted fatally, and one successful operation was enough to establish a surgeon's reputation. Now practically all cases are successfully performed, and a failure raises the question of the surgeon's efficiency. A few years ago, ruptured tubal pregnancy was almost necessarily fatal; now it has come to be one of the safest operations in surgery, and annually saves the lives of thousands of women.

The successful removal of ovarian tumors is of so frequent occurrence that the reporting of a case in a medical society is usually prefaced with an apology for consuming the members' time. In the good old days, before experimentation made this result possible, the victim "passed out" through weary years of suffering.

When the evidence is submitted to the court, present pictures of advanced cases or, preferably, the living case, and then pass before the judge those who have been rescued from untimely graves. The years of usefulness added to the life of woman through this one operation would aggregate hundreds of thousands. While this operation antedates the experiments making modern surgery possible, the almost uninterrupted series of recoveries are entirely due to facts established by these experiments.

Anesthesia, local and general, owes its development and perfection to experiments. Many heads, supposedly wise ones too, wagged solemnly when ether was introduced as an aid to surgery, but the experiments were continued and different technic and materials tried out until, at present, postoperative pain, nausea and discomfort are practically eliminated from the clinical history.

In the olden days (when, according to some people, all of the good things happened), the patient was roped and thrown like a steer at a round-up. His body was strapped to a table, and whatever was necessary to do was done despite his struggles. If it was an amputation, the bleeding stump was thrust into boiling pitch to check hemorrhage. A little later, the actual cautery was used for this purpose; a little later, torsion, and finally, the ligature. These advances constituted steps

in the series of experiments necessary to save life and, doubtless, were bitterly condemned at the time.

I have heard the description of an amputation of the breast done nearly a hundred years ago by Dr. Hancock of Milleville, Butler County, Ohio. The woman went through the operation with but one evidence of pain and that was a sharp, hissing intake of the breath when the first incision was made. This operation, like all others done before anesthesia was discovered, was probably delayed so long that permanent recovery was not to be expected.

Fifty years ago, many parts of the body were considered beyond the reach of the surgeon. Experiments on the lower animals have brought them, one after another, into his field. Even the heart itself is laid bare, and lives saved by closing stab wounds heretofore considered necessarily fatal. The brain is no longer forbidden territory and, through the knowledge gained by experiments, tumors are located and removed and abscesses drained, thereby saving many valuable lives.

In the past seven years, more has been learned concerning the cause and accurate diagnosis of syphilis than was learned during the preceding four centuries. With the cause isolated, past experience leads us to hope that a quickly acting cure will be perfected. What was learned during the past seven years was wholly due to experiments on animals. The working out of a cure must come through a continuance of these experiments.

When vivisection is arraigned before the court, call the roll of the innocent victims of man's immorality. Millions will answer who died before they were born, and countless thousands of women whose husbands were damaged goods at the time of marriage. Take the court to the nearest asylum and show those hopelessly insane from this cause, and then let the court know that vivisection aims to replace a stillbirth with a healthy living child, childless women with happy mothers, the hopelessly insane with normal men and women.

Some advances have been made toward perfecting a specific cure for gonorrhea; further advances can come only through a continuance of these experiments. When the testimony is introduced in this court scene, gather the blind from the asylums and let the court look into their sightless eyes.

Smallpox, a little over a century ago, was one of the greatest causes of infant mortality. An adult without a pitted face was a curiosity. In the century antedating Jenner's discovery of vaccination, fifty million lives were lost in Europe from this cause alone. There has never been an epidemic since vaccination was discovered that has not illustrated its protective value, and yet people exist who are color blind to facts and who believe, or profess to believe, that doctors advocate vaccination for the fee that is in it. Slander's venomous tongue never fashioned a more malicious falsehood. In all the annals of the race, there is nothing surpassing the unselfish attitude of the physician whose whole life is dedicated to an effort to bring about conditions that actually threaten his livelihood. Treating one case of smallpox is worth more, in fees, than is received for vaccination in the course of several years.

Trying out vaccination meant experimenting on human beings. The beneficent results obtained are

seen on every hand in the faces of the people and in a study of mortality records. In the old days about 90 per cent. of the people had the disease, and from 25 to 40 per cent. of these died. At present the immunity enjoyed through vaccination is so universal that the disease hardly figures in mortality records and, when it does, nearly 100 per cent. of the deaths are in unvaccinated individuals. All advances in therapy, whether due to specific serums, vaccines, antitoxins or drugs, are the direct result of experiment.

The first doctor to administer quinin for malaria was experimenting with his patient. Has the result justified the experiment? The first one to give thymol in hookworm disease was experimenting. Ask the millions of cured anemics from this cause if the results have justified the experiment. The first one to give mercury and potassium iodid for syphilis experimented with the patients, and so the list might be continued indefinitely with practically an unbroken series of affirmative answers to the question.

Life is an experiment. When Fulton saw the first steamboat advancing against wind and tide, it was the result of an experiment. When Morse flashed messages over wires between widely separated points, that was the result of an experiment. When Marconi harnessed the ether waves and talked across the ocean, that was the result of an experiment. When Edison reproduced the sound of the human voice, that was the result of an experiment. When the Wright brothers, in the face of incredulity and almost insurmountable obstacles, conquered the air, that was the result of an experiment. Bessemer, Burbank, Bell and the thousands of others who have unlocked Nature's storehouse and given her secrets to be the servants of man have all been experimenters. What they are in their chosen fields, Lister, Pasteur, Ehrlich, Wassermann, Flexner, Jenner, von Behring, Reed, Carroll, Lazear and thousands of others are in the field of medicine.

Research work in preventive medicine requires genius, imagination and industry. When the goal is attained, the reward, while not a material one, is "enough to overpay lifetime toil and sacrifice." It is like that which "comes when some patient watchman of the universe at last beholds the light we call discovery, or when the chance rock in some derided student's pathway tells the secret we know as science."

Shall we gradually retrograde to a stone age period of living, or shall we continue to experiment along lines that will ultimately make man absolute master of his environment?

The discovery of methods of immunization against disease has been made possible wholly through experiments. In the Civil War, typhoid fever and dysentery killed more men than did the bullets of the enemy. If the men rendered unfit for duty during that period in either of the armies could have been kept well and fit while those diseases ran riot in the other, the end of the war would have come much sooner; and, had the South possessed the advantage, the result would probably have been reversed.

Typhoid vaccination has eliminated that fever from our army and navy and has saved many lives in civil life. Dysentery is not the scourge to troops in the tropics that it was twenty years ago. These changes have been brought about by experiments on animals.

The relationship between infant mortality, due to intestinal diseases, and a polluted milk supply has been established by experiments. The application of the knowledge gained has gradually reduced the mortality from this cause in Cincinnati from 103 per hundred thousand of population in 1910 to 57 in 1914. The animals used in assembling the proof have been few in number compared to the lives saved, and it is a conservative statement to say that for each guinea-pig used, a thousand babies have been saved from death.

To the antivivisectionist, the experimenter is the last word in selfishness, his own body the one thing in the world too sacred for experimental purposes.

History records no more convincing evidence of devotion to an idea than appears on almost every page of the history of medicine. Our literature is rich in material calculated to inspire the heart and brain of poets and writers of romantic fiction.

The work of Carroll and Lazear furnished an example of heroic self-sacrifice that is hard to duplicate in the annals of the race. Carroll deliberately subjected himself to the bite of a mosquito thought to be infected with yellow fever. The disease resulting therefrom placed his life in jeopardy for days, and left him with a damaged heart that ultimately caused his death. Lazear deliberately permitted a mosquito to feed on his hand, and a week later was a martyr to science. The names of those other heroes who took similar chances in establishing the method of transmission of this disease should be inscribed on the same tablet with those of Carroll and Lazear. In making this great sacrifice, these men saved the lives of thousands of others and removed the tropics' most pitiless scourge. But for their work, the Panama Canal would be a dream instead of a reality, and the southern portion of this country would be devastated periodically by the yellow plague. If experiment had only this one great achievement to its credit, the continuance of others along similar lines would be a thousand times justified.

Several years ago Mrs. Carroll sent me a copy of a portion of a paper in Dr. Carroll's handwriting. Two paragraphs from this will indicate the sublime heroism inspiring this series of experiments:

Before the mosquito experiments were finally agreed upon, Dr. Carroll suggested twice to Drs. Reed and Lazear that they themselves submit to the inoculation as the best atonement they could offer for subjecting others to the risks entailed thereby.

As an earnest of our appreciation of the absolute necessity for using human beings and of our sincerity and willingness to assume the same risk that we were compelled to impose on others, it was agreed among the three American members of the board that they would submit themselves to the same risk and mode of attempted inoculation.

These three American members of the commission are in their graves. It would be an interesting fact to relate at this time that a grateful country had provided generously for those left dependent. One would assume, without investigation, that Southern boards of trade had voluntarily made it their business to place the families of these benefactors beyond the reach of want. As neither of these conditions has been brought about, however, it must be stated with humiliation and shame that the proverbial ingratitude of republics is still in evidence.

Reed, Carroll and Lazear freed a large portion of the Western hemisphere from the danger of yellow

fever, and made the new South and the new tropics possible. Modest pensions have been given their families, but, from reliable information, it appears that the children of Dr. Carroll are being denied opportunities for a liberal education because of lack of funds.

In a paper of this character, it may be permissible to refer to the men of the Public Health Service who have risked their health and lives while investigating "the major pestilences" or while maintaining quarantine regulations. These men are highly trained experts, and their chief duty is to prevent the introduction of diseases from foreign countries into the United States. They may be said to form the "far-flung" skirmish line in our constant battle against disease. They literally rub elbows with death every day in the year, and have their roll of honor on which appear the names of those who have died or become infected in the service.

Let us call the roll:

McClintock died of Rocky Mountain spotted fever while investigating that disease in the Bitter Root Valley.

Wightman died of yellow fever at Guayaquil, Ecuador, while in a fight against yellow fever, small-pox and plague in order to prevent their introduction into the United States!

Groenvelt, Glazier, Brannon, Bratton all died of yellow fever!

Miller died of typhoid fever while investigating that disease!

Richardson died of typhoid fever during a yellow fever campaign! Other names that could not be secured belong on this roll.

Of those living, Lloyd, McKeon, Glennan, Guthrie Rucker, Goldberger and many others have had yellow fever!

Long and McLaughlin have had cholera!

Holt and Nydegger have had amebic dysentery!

Goldberger, McCoy, Ames and several others have had dengue!

Goldberger has had typhus!

The value of the work done by these men cannot be measured in dollars and cents, or figured in human lives. Every step of it depended on experiments, the results of which indicated the logical method of excluding diseases from our shores.

Shall we call a halt on future experiments or "be here dedicated to the great task remaining before us" and, "from these honored dead take increased devotion to that cause for which they gave the last full measure of devotion"?

Vivisection! It has revealed man at his best, almost on a par with the Man of Calvary.

It has done much, and points the way for much more than remains to be done.

It has replaced conjecture with fact, substituted cold logic for a suspicion of the truth, transformed a figment of the imagination into a reality.

It has substituted hope for despair, exchanged funeral trappings for the laughter of children.

It has relegated to the dark ages the monstrous belief that somewhere beyond the clouds lives a being so steeped in envy that he rebukes love for children by unloosing the plagues. It has robbed God of those human attributes, malice, envy, hatred and revenge.

It has substituted exact laboratory methods for incantations and charms; a quarantine based on exact knowledge, for one founded on brute force and fear.

It has removed the greatest obstacle to the South's material development and made the tropics a white man's country, where he can take up his burden unafraid. It has gathered the plagues from the four corners of the earth and safely imprisoned them in laboratory test tubes.

This record of achievement is our justification for past experiments, our argument for their continuance.

IS INSANITY ON THE INCREASE?

A. J. ROSANOFF, M.D.

First Assistant Physician, Kings Park State Hospital

KINGS PARK, N. Y.

During the past several decades the number of insane in institutions has been increasing at a faster rate than the general population. Thus, according to the United States census statistics there were, in 1880, 81.6 patients in institutions for the insane per hundred thousand of the general population; in 1910 the number had risen to 204.2. To what extent, if any, does this fact indicate an actual increase in the prevalence of insanity in the American population?

There can be no doubt that, at least to some extent, the increase of patients in institutions is due merely to the general improvement in the kind and adequacy of facilities for their care; and if the statistics of various states for any one year are compared with one another, marked differences are found, corresponding to stages of progress in social organization, and altogether analogous to those shown by the entire country in years separated by decades.

Thus, for instance, in 1910 there were in the state of Oklahoma 67 patients in institutions per hundred thousand of the general population, while in the state of Massachusetts there were 344.6; and between these extremes all degrees of transition were presented by the statistics of other states.

It is obvious, therefore, that the number of patients in institutions, either in the entire country at different times or in different parts of it at any one time, cannot be taken as a correct measure of the prevalence of insanity among the people.

For this reason, attempts have been repeatedly made to enumerate the total number of insane persons both in and out of institutions in the various states.¹ The resulting data were, however, so manifestly untrustworthy that eventually it became apparent that the difficulties inherent in such an undertaking were greater than, for the present, we can cope with successfully, and such attempts have, accordingly, been given up.

Of these difficulties the greatest and, perhaps, the sole insurmountable one is that of formulating such a definition of insanity as to enable enumerators readily and uniformly to distinguish between sane and insane persons under all conditions.

Furthermore, whoever is familiar with psychiatric clinical material knows that, owing to the nature of things, even if it were possible to formulate a definition and thereby draw a line sharply distinguishing,

1. U. S. Census from 1850 to 1890.