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Contributors

Fleming, George, 1833-1901.
Royal College of Surgeons of England

Publication/Creation

[London] : [publisher not identified], 1882.

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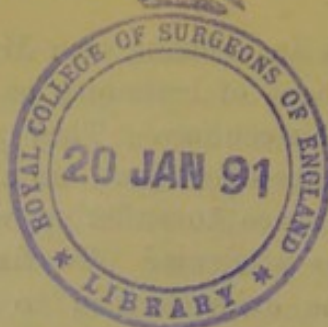
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VIVISECTION AND THE DISEASES OF
ANIMALS.

IN venturing to join in the seemingly never-ending discussion of the lawfulness of vivisection, I may say at once, with the object of defining my position, that I abhor cruelty to animals in any form whatever, and by whomsoever inflicted. Cruelty—*i.e.* production of unnecessary pain or suffering—has ever been to me a source of discomfort, disgust, or anger; and for now more than a quarter of a century I have done all I could, as a veterinary surgeon and lover of animals, to ameliorate their condition, suppress cruelty in every form, and render their existence as pleasurable as was compatible with the services demanded from them.

That a fearful amount of useless and wanton animal suffering is daily and nightly inflicted, no one for a moment can deny. In our streets, cattle boats, markets, slaughterhouses, and everywhere around us, we meet with cruelty in many forms and in variable degrees; though we are so accustomed to it that, unless it is a flagrant case, it rarely attracts attention. It is not uncommon to see a cabman vivisectioning his horse by means of his whip, without a word of remonstrance from the lady or gentleman in the cab; or a half-drunken drayman belabouring his horses about the head with the butt-end of a whip, or kicking them on the legs or belly, without any passer-by attempting to interrupt his enjoyment.

For those who care to protect inoffensive creatures from cruelty, there is abundant occupation; and the sentiment of humanity cannot be too strong or too prevalent, in order to diminish, if not suppress, the cruel practices to which animals are submitted every day without benefit to science, to humanity, or to themselves. Of those who are in a position to help in this good work, the veterinary surgeons in this country, I am proud to say, have been, and are, among the foremost. To excel in their calling, they need special qualifications; and among these a love of animals, and an intuitive or even instinctive knowledge of their individual peculiarities, desires, and modes of expression in health and disease, are absolutely essential. The absence of the tender sympathy which is excited when performance of a painful operation is necessary, and which abbreviates time and quickens the

fingers, cannot be compensated by other qualities. The abhorrent method of instruction carried on in at least some of the Continental veterinary schools, by which students gain manual dexterity by practising surgical operations on living animals, has never been, and, I am confident, never will be, tolerated or attempted here. It is as repugnant to the feelings and inclinations of British veterinarians as it is antagonistic to the genius of veterinary medicine and surgery, which are nothing if not founded on humanity and practised on humane principles; and it is equally repugnant to the objects and practice of physiologists.

I consider it necessary to offer these observations in order to justify me in the line of argument I am about to adopt, and to show that, both by sentiment and profession, I am as strongly opposed to the wanton infliction of pain as any one can possibly be. On every occasion I have unhesitatingly offered opposition to cruelty, and would be the last to countenance it. It is for that very reason that I hope what I have to say may aid in allaying the exaggerated or morbid sentiment which has been developed in recent times; for, if allowed to prevail so as to hamper or prohibit experiments on animals by properly qualified persons, it would prove a most serious injury not only to human welfare, but to that of animals as well. It would gravely compromise the wealth and material progress of nations, and would check that advance in sanitary science upon which public health mainly depends.

In treating of experiments on animals for the purposes of science, I do not deal with those which have been made in the branches of medicine known as physiology, toxicology, surgery, and pharmacology. Their defence may be left to the able writers who have already dealt with these several parts of the subject. I will confine myself to those which belong to pathology, *i.e.*, which are performed to elucidate the nature of disease, whether in man or beast. I will demonstrate, to the best of my ability, the benefits which have been already conferred by these experiments, and show reason to anticipate fresh advantages to which they will lead in the future. In leaving these other subjects, however, it may be as well to state that every advance made in physiology, pharmacology, and other branches of medicine, benefits animals as well as man. There is no wide line of demarcation between human and veterinary medicine; they are closely allied, and whatever advance of knowledge is beneficial to man is nearly always capable of application to the benefit of the brute.

The term 'vivisection,' as applied to experimental pathology, and, indeed, to experiments on animals generally, undertaken with scientific aims, is eminently misleading. 'Cutting up animals alive' is not a scientific procedure. Opening a vein, or injecting a few drops of liquid under the skin, is etymologically 'vivisection,' and (if performed with a scientific object) is forbidden by the present law except under hampering restrictions.

Experimental pathology, the youngest and most brilliant branch of medical science, investigates the causes, course, and natural history of disease by producing it in the lower animals. It is the synthesis, as clinical diagnosis is the analysis, of disease. The latter leads to rational treatment, the former to efficient prevention. In the maladies experimentally produced, we have only before us what veterinary surgeons have to deal with every day, what we are often unable to cure or to prevent; but we are far better able to investigate the conditions which produce them in the laboratory than in the stable, cow-shed, or kennel.

When we produce diseases experimentally—painful diseases they may be—we must not forget that Nature herself is a cruel experimenter. Excepting human diseases, let me ask what can be more painful to witness than tetanus, cattle plague, rabies, pleurisy, and many other disorders with which she afflicts the lower creatures?

The pains inflicted by the experimental pathologist are those of disease, the effect of the 'vivisection' but not the operation itself. The pain of inoculation is usually no greater than that caused by the prick of a pin: but inoculation may be unnecessary, indeed, often is; for experiments may be made by simply feeding animals on certain matters, giving them fluids, or making them breathe an atmosphere charged with particles of virus.

The mystery which surrounds the origin, development, and course of many deadly maladies of man and beast has ever proved a terrible obstacle to their prevention or cure. 'The pestilence that walketh in darkness,' devastating the hearth and the homestead, the herd and the flock, and striking terror into the stoutest heart, has been ascribed to a miasma, a 'something in the air,' as vague as it was dreaded and uncontrollable. Other scourges, which, because of their constant presence and less sudden and general fatality, were not so appalling, were nevertheless grave and harassing in their consequences, and quite as obscure in their origin. It is with these mysterious diseases more especially, that experimental pathology has been called upon to deal; and perhaps no more astonishing chapter in the romance of science could be written, than that for which this branch of investigation has already supplied the materials. As I hope to show, the benefits which these experiments on living animals have yielded are already great; while prospectively the same method promises to change half the art of medicine, from a curative system, with all its difficulties and uncertainties, to a preventive or protective one, applicable no less to animals than to mankind. How much pain and sickness will the world then be spared! How much loss, embarrassment to commerce, and danger to human and animal life will then be averted!

The contagious and infectious disorders are those which have ever been most destructive and intractable. Some of these are special

to the human race, others to one or more species of animals; while some, again, are widely transmissible from species to species. Many of those affecting the lower creatures can be conveyed to man—as rabies, glanders, anthrax, foot-and-mouth disease, and probably tuberculosis and diphtheria. There are also the parasitic diseases of animals, several of which may be transmitted to ourselves—as trichinosis, and those due to various kinds of worms and to vegetable parasites.

The intimate nature of the infective materials, or *contagia*, of communicable maladies is a discovery of almost yesterday; but it has thrown a flood of light on their phenomena, and, with the aid of experimental pathology, will enable us in all probability either to abolish them altogether, both in man and beast, or at least to render them nearly harmless. The agents in the transmission of contagious diseases—proved in some cases, and probably present in all—are minute organisms, which need almost the highest magnifying power of the microscope in order to examine them. They are endowed with most marvellous powers of multiplication, which enable them to act with deadly energy in a very brief space of time. *Their discovery as lethal agencies was only, could only be, determined by means of experiments on living animals.*

And by experiments on animals alone was the next great advance made. Having seized and identified the agent which produces deadly disease, and having rendered it amenable to artificial cultivation in appropriate fluids, the organism which had hitherto been productive of such direful results in the bodies of its victims was now, by means of experiments on living creatures, to be made the servant and benefactor of mankind.

The germ which under ordinary circumstances produced painful, and only too frequently fatal consequences, was, by means of artificial cultivation, so modified, so attenuated in energy, that when again transferred to the animal body it had not only lost its dreadful malignity, but had been transformed into a protecting agent: it afforded immunity against the disease which it formerly produced.

Every step in this grand and fecund discovery was accomplished by experiments on animals, and in no other way could it be effected. Inoculations had to be made to test the potency of the cultivated germs, and to ascertain to what extent their diminished energy was compatible with the existence of the inoculated creature, and with its immunity from the original disease. Experiments and control-experiments, very numerous no doubt, were absolutely essential in order to arrive at conclusions; and the result has been the greatest discovery of this century, so far as medicine is concerned, a discovery which is destined to be of such vast benefit, as to rival, or perhaps ultimately excel, that conferred by Jenner upon his too often ungrateful fellow-men.

The two diseases of the lower animals in which the experimental

method has hitherto led to the most complete results are anthrax and chicken-cholera. Anthrax, or splenic fever, known in France as 'charbon,' and in Germany as 'Milzbrand,' is one of the most fatal and wide-spread of all the scourges of the lower animals, destroying, as it does, not only those which are in a state of domestication, but also those which are untamed. It prevails, in one or more of its diversified forms, over the entire surface of the globe. It sometimes decimates the reindeer herds in the Polar regions, and is only too well known in the tropics and in temperate latitudes. The carefully tended ruminants of the most highly civilised countries suffer equally with the wandering herds and flocks of the Mongol steppes; and it is as much dreaded by the Finn and the Lapp as it is by the Mexican, the Arab, the Annamite, or the South African and Australian colonist. It has been carefully described by travellers, as they have observed it in Siberia, Lapland, Russia, Central Asia, China, Cochin-China, the East and West Indies, Peru, Paraguay, Brazil, Mexico, North America, Australia, Egypt, and other parts of the African continent. In Europe the writings which have been published on its nature, its characteristics, and the damage it inflicts, are innumerable. Countries with extensive marshes, or a tenacious subsoil, are usually those most frequently and seriously visited. Thus it happens that there are regions notorious for the prevalence of anthrax, as the marshes of Sologne, Dombes, and Bresse, and certain parts of Germany, Hungary, and Poland. The disease is enzoötic in the half-submerged valleys and the maritime coasts of Catalonia, and also in the Romagna and other marshy districts of Italy; while it is epizoötic and even panzoötic, in the swampy regions of Esthonia, Livonia, Courland, and above all in Siberia, where sometimes, in order to suppress the ravages of the terrible 'jaswa,' as it is called, the aid of the military authorities is called in, and battalions of soldiers are sent to bury or burn the thousands of infected carcasses. I do not know of a region in the whole world where anthrax is unknown; and its antiquity is as great as its geographical extension is wide. It was one of the scourges with which the Egyptians were punished, when there was 'a breaking forth of *blains* upon man, and upon beast, throughout all the land of Egypt; upon the horses, upon the asses, upon the camels, upon the oxen, and upon the sheep.' Virgil¹ has depicted its deadliness and contagion with the greatest accuracy, pointing out the dangers of the tainted fleeces of sheep to mankind, as if he were describing the cause of what is now known as the 'wool-sorters' disease.'² It frequently occurs in the histories of the Early and Middle Ages, as a devastating pestilence among animals, and through them as a plague of mankind. Our oldest Anglo-Saxon manuscripts contain many fantastic recipes, charms, and incantations for the preven-

¹ Georg., lib. iii., vv. 478-514.

² *Ibid.*, v. 561.

tion or cure of the 'blacan bleyene' (black blain), and the relief of the 'elf-shot' creatures. From these up to our own times anthrax has attracted more and more attention; even in this century it has spread in some of its outbreaks over the whole of Europe, from Siberia to France.

The losses inflicted by anthrax are appalling.³ Some idea of their extent may be derived from the fact that in one district of France alone, Beauce, it kills about 178,000 sheep, which (at only thirty francs a head) are worth 5,340,000 francs, or 213,600*l.* In 1842, when sheep were much less valuable than now, the loss in the same district was estimated at 7,080,000 francs. The disease also prevails among sheep in Brie, Champagne, Berri, Poitou, Auvergne, Dauphiné, and Bourgogne. In the arrondissement of Chartres, 17,800 perish from it every year. It is estimated that sheep to the value of twenty millions of francs are lost annually in France. Cattle, horses, and other creatures suffer also severely. In Russia the losses are enormous, especially among the horses and cattle. In 1837, in one district alone, 1,900 died of anthrax; and in 1857, for the Russian Empire, it was reported that 100,000 horses had perished. In 1860, 13,104 cattle, out of 18,883 attacked with the 'jaswa,' succumbed; and from the official report for 1864 it appears that in the five governments of St. Petersburg, Novgorod, Olonetz, Tver, and Jaroslav, 10,000 animals died, most of them horses, few cattle, and still fewer sheep; while 1,000 persons were infected and perished. From the 15th of January to the 27th of March, 1865, 47,000 cattle, 2,543 horses, and 57,844 other domesticated animals were lost in the governments of Minsk, Vitepsk, and Mohilev; and in the government of Tobolsk, in June and July 1874, there perished from the 'Siberian plague' (as anthrax is sometimes designated) 4,735 horses, 516 cattle, 1,030 sheep, 52 pigs, 15 goats, and 106 human beings. In other European countries it is very prevalent and deadly, and in our own islands it causes heavy losses. In India it is witnessed in all animals, and as 'Loodiana disease' is well known as a fatal scourge among cavalry horses. In South Africa, as 'horse-sickness,' it is most destructive, particularly in low-lying, damp regions, at a certain season, when it kills nearly all the horses after only a few hours' illness.

Brauell, the eminent professor at the Veterinary School of Dorpat, Russia, was the first to describe the organisms called *Bacilli*, which have since been proved to be the active agents in the production of anthrax; and the laboratory experiments of Delafond, Davaine, Chauveau, Toussaint, and others, but above all, Pasteur, have perfected our knowledge of the action of the poison, and the means by which its energy may be so modified, that, when inoculated into healthy animals,

³ For details I may refer to the second volume of my work on *Veterinary Sanitary Science and Police*.

instead of destroying them, it only gives rise to, at most, a slight ephemeral disturbance, and confers immunity.

These laboratory results were received with incredulity by many authorities. It was therefore decided that a practical and public demonstration should be given; and only last year Pasteur publicly demonstrated that in this disorder, as in the disease of silkworms, the results of his experiments were correct. At Melun fifty sheep and twelve head of cattle were placed at his disposal. Half the number of these animals were inoculated with the cultivated or attenuated virus, and fifteen days subsequently the entire number were inoculated with uncultivated or deadly virus. Forty-eight hours had not elapsed before his prophecy was verified. Those which had not been inoculated with the cultivated virus were all lying dead, while those which had been so protected were grazing in perfect health among them. This appeared to be most convincing evidence, and the majority of the incredulous were converted; but as the virus had come from the laboratory, it was thought that another demonstration was still needed to make the proof complete, and that anthrax blood itself, the deadly effects of which on men and animals were so well known, should be employed as the test of protective inoculation. An official commission was therefore appointed at Chartres to set the matter at rest, and twenty sheep were allowed. As at Melun, so here; those inoculated with the attenuated virus were not in the least affected when they received what would have been otherwise a fatal quantity of anthrax blood, while of those that had not been previously inoculated, all died except one.

There was now no longer any doubt as to the value of protective inoculation, and the greatest anxiety was manifested to have the flocks in the anthrax-haunted districts so insured with all possible haste. Up to the first day of last October, 160 flocks, comprising 58,900 animals, had been inoculated in the proportion of 3 to 2; *i.e.* 33,576 against 21,938, which were not inoculated on purpose to show the difference. Before inoculation was resorted to, the loss had been, in all the flocks, 2,986. During the inoculations and until their effects were completed, 260 died in the group of 33,576 which had been operated on; and during the same time, in the non-inoculated group, 366 perished of the 21,938. But when the effects of inoculation were achieved in the first group, the mortality from the disease fell at once to 5, and then ceased; while in the other group it continued at the usual rate. At Alfort a hundred sheep were protectively inoculated, and subsequently received a sufficient quantity of the crude virus to cause death to animals not so protected, and yet not one died.

The value of this new method cannot be exaggerated, even if it were applicable to anthrax alone. We have glanced at the

geographical distribution of the disease, the destruction it works among animals, and the deaths it causes in mankind. By means of this discovery, made through experiments on living animals in the laboratory, this scourge, hitherto irrestrainable and incurable, is now completely under the control of man, all over the world.⁴ The discovery is greater even than that of vaccination, inasmuch as that was only applicable to the one disease, small-pox; whereas this method can probably be applied to many contagious diseases besides anthrax.

The same method of cultivation and inoculation so successful with anthrax had already been adopted in the fatal pestilence of poultry known as 'fowl-cholera,' a disease which is very contagious and incurable, so that it clears out poultry-yards in an incredibly short time. By inoculating fowls with the cultivated virus of the malady, they are rendered proof against it.

Rabies and hydrophobia (if we may employ the two designations for one disease) are only too familiar to the public by the terror they inspire. Much of the knowledge we possess with regard to rabies, particularly as to its symptoms and latency, has been derived from inoculation experiments on animals: but no cure has yet been found for it; and the preventive measures are merely those of police, consisting in destroying rabid or suspected animals, keeping down the number of ownerless dogs, and guarding against the infliction of bites. Experiment has disproved what was long believed, that the virus exists in the saliva alone; and now it is not only ascertained that it is to be found in other fluids, and especially in the brain and spinal cord, but that it is more virulent in these than elsewhere. In no other disease is the latent period so uncertain and prolonged; and often weary months of painful suspense have to be endured before it is known whether safety to a bitten person or animal is possible. Inoculation experiments with the brain-fluid of a rabid dog have developed the disease in a week or fortnight, the inoculated animal dying from acute rabies in about three weeks. And a more important discovery still, with regard to this frightful malady, has recently been made by Galtier. By the injection of the virus of rabies directly into the circulation, not only is the disease not produced, but, after exhibiting slight fever, the animals are protected from contagion in future. Ten sheep have been in this way rendered resistant, while the same virus introduced beneath the skin of others which had not received injection has produced fatal effects. Galtier is inclined to believe that this injection of the virus into a blood-vessel might even prevent the development of rabies *after* an animal (or perhaps a human being) has been bitten by a mad dog. But it is more than probable that for

⁴ I have already suggested the adoption of the method for anthrax in India and South Africa, as well as for other diseases in these countries, and other portions of our dominions.

this and other communicable diseases, cultivation of the virus will lead to the production of a material or modified germ which, while causing little or no general disturbance after inoculation, will effectually destroy the receptivity which had previously existed in the system.

It is to experiments on animals that we must look for protection from the death-dealing and destructive contagions which are never absent from our homes, our stables, cowsheds, pastures, kennels, and piggeries. A long series of disorders, against which the curative skill of man contends in vain, may soon be brought into the list which only at present comprises fowl-cholera and anthrax.

The ravages of cattle plague are a terror to every European country, while it is a desolating scourge in Asia, which is its home. India is always more or less seriously visited, but Russia is more especially its victim, and, in consequence of its continued presence, cannot dispose of her immense surplus stock of cattle and sheep. Ordinary inoculation has been tried for many years, but the mortality attending it has been nearly as serious as that from the disease itself. There is every probability that Pasteur's method of cultivating virus will protect from cattle plague without any attendant loss, and thus throw open a great source of food supply to Western Europe.

Contagious pleuro-pneumonia of cattle is a disease that has caused immense havoc on the Continent and in this country, whence it has been extended to South Africa, Australia, New Zealand, and the United States. It is impossible to estimate the losses it has caused, but their magnitude must be considered as great. By a long-continued series of experiments on animals, Dr. Willems, of Hasselt, Belgium, has succeeded in perfecting a method of protective inoculation which is certain in its results. Further experiments with the cultivated germs of the virus are now being carried on, with a view to obviating troublesome accidents which sometimes accompany this inoculation, and with every prospect of success. By this means, what has been hitherto a pestilence among cattle can be easily combated, and should be finally exterminated by its own germs.

The ravages caused by swine plague in Europe and the United States are of the gravest description. The disease is very contagious, experiments having proved it to be not only readily transmitted by inoculation, but also by cohabitation of healthy with sick swine. It is due to a special germ like that of anthrax, and there is every reason to believe that by cultivating this germ and experimenting on living animals, this plague will also be subdued.

Sheep small-pox closely resembles the same malady in man, so far as infectiousness and mortality are concerned, but differs in the fact that vaccination does not afford protection; cultivated virus will, in all likelihood, do so.

The so-called 'distemper' of the dog is a very contagious, painful,

and fatal disorder, and it is quite possible that experiments with cultivated virus will prove that it can be averted by a trifling operation.

Tuberculosis, or consumption of cattle, has been demonstrated, by many series of experiments on living animals, to be not only contagious and inoculable in cows, but to be communicable to a large number of species, both by inoculation and feeding them with the tubercular matter, as well as the milk and flesh of diseased creatures. Without these experiments this important discovery could not possibly have been made; indeed, the communicability of the disorder through the digestive organs, by means of the flesh and milk, was never suspected until inoculation experiments were made. By this discovery a most serious sanitary question arises as to whether and to what extent the public health may suffer from the existence of the disease among cattle which furnish milk and flesh. Tuberculosis is, we fear, on the increase among these food-producers, and often prevails extensively in dairy stock. Consumption in its various forms is painfully common in mankind, and the relationship between the human and the animal malady is a problem that presses urgently for solution. This can only be afforded by careful *observation* and *experiment*, the two indispensable methods of progress in natural science. Meantime, it may be interesting to note that the pig (a creature whose organisation approaches in some respects nearest to that of man, and which is not naturally liable to the disease) is very readily infected, and suffers from it in an acute form, when fed on infected milk or flesh. Toussaint believes he has discovered a germ peculiar to the disorder. If so, by the cultivation method, cattle likely to be exposed to the contagion may be protected by inoculation, and danger to themselves, as well as those persons who chance to consume their products, may be averted.

Glanders, as every one knows, is a highly contagious disorder of solipeds, and is now very prevalent in the United Kingdom. In London it is especially so, and causes great losses to owners of horses. It is readily communicable between the horse and ass species, less so between these and other species, but man is frequently infected. It is a most repulsive malady, and is incurable. Very much of our knowledge respecting it is entirely due to experiments on living animals. Not unfrequently it manifests itself in a chronic form, and with such vague symptoms (though it is, nevertheless, as contagious as if these were well marked), that the most skilful veterinary surgeon cannot tell for certain whether it is the disease or only an ordinary catarrh. If it be glanders, then to allow the animal to live is to endanger the life of every horse and man who come in contact with it; while to destroy it, if the malady is not contagious, would be cruel and unnecessary. When time is an object, or facilities for isolation are not present, then test inoculation must be resorted to. For this

purpose a worthless horse, or, better still, an ass, is inoculated, and a few days suffice to decide whether glanders is present. If the result of the inoculation is affirmative, the experimental animal manifests symptoms, generally at the seat of inoculation, which cause it little if any discomfort, and it is at once destroyed, as is also the suspected horse. By this precautionary procedure, many horses, possibly those of an entire regiment or army corps, may be saved from peril, and human lives preserved from a loathsome and fatal disease.

In elucidating the processes of disease, in framing preventive measures, in investigating the spread of contagious disorders, as well as in perfecting modes of cure, and the most humane methods of surgical operation, experiments on living creatures are *absolutely necessary*, for their own interests no less than for those of mankind. Veterinary medicine and surgery are based on humanity no less than on utility, and their aim is to remove or alleviate pain among the animals placed under the dominion of man. By experiments in pathology, disease and mortality have been vastly diminished, and continued experiments in the same direction will cause further diminution. If mankind benefits, so do animals. A discovery which will avert disease in one will probably do so in the others: every advance of knowledge is a boon to all. To prohibit resort to experimental pathology would be at once to doom creatures which we are bound to protect, to the endurance through all time of terrible suffering from diseases that might otherwise be vanquished. Abhorring cruelty in every shape, and desirous of abolishing it by every possible means, I must nevertheless deprecate the attempt to place a barrier across the path pursued in pathological investigations on animals.

GEORGE FLEMING.