PROPHYLACTIC INOCULATIONS AGAINST ANIMAL DISEASES IN THE BRITISH EMPIRE

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Over sixty years have elapsed since the classical experiments of Pasteur on preventive inoculation against anthrax in sheep—so well depicted in the Pasteur film—opened up a new epoch in the history of medicine. The relief of human and animal suffering that has resulted from subsequent progress in that field of research is simply incalculable. Certainly several hundred millions of animals in the world at large have been saved from severe suffering in the past half-century by these means. Some faint idea of the benefits to animals as a class may be gathered from the data in the following table of the officially recorded preventive inoculations against five only of the principal epidemic diseases of animals in seven recent years in the British Empire (Table I). Brief notes on the nature and prophylaxis of those diseases may be of interest.

TABLE I.—*Prophylactic Inoculations against Epidemic Animal Diseases in the British Empire, 1931–7*

Country	Rinderpest	Black-quarter	Haemorrhagic Septicaemia	Contagious Pleuro-pneumonia	Anthrax	Total
India ..	10,631,825	1,140,039	5,455,929		212,590	17,440,383
Nigeria ..	3,228,128	3,299,393	150,158	433,881	37,806	7,149,366
Kenya ..	1,407,040	180,794		1,310,694	40,688	2,939,216
Uganda ..	396,237					396,237
Sudan ..	664,362			262,310		926,672
Gold Coast	217,426			2,024		219,450
Tanganyika	646,949			577	900	648,426
South Africa					20,000,000	20,000,000
New South Wales					1,366,004	1,366,004
Total ..	17,191,967	4,620,226	5,606,087	2,009,486	21,657,988	51,085,754

Rinderpest, or Cattle Plague

Rinderpest was prevalent in Great Britain as recently as 1865–9. It was only stamped out by the wholesale slaughter of infected animals and contacts at a cost of £1,119,994. In 1896–9 it carried off over two million cattle in South Africa before methods of immunization, worked out by Koch, Kolle, and Turner, enabled the epidemic to be stamped out and the Dominion saved from ruin. In 1899 it fell to my lot when in charge of the Mukhtesar Veterinary Research Laboratory to make and test the protective serum in India during outbreaks of rinderpest. Among some five hundred inoculated cattle not one developed the disease after the four-days incubation period. Yet among about the same number of uninoculated animals 50 per cent. became infected, and half of these died. So successful was the method that in the twelve months of 1929–30 the animals inoculated against rinderpest in India totalled 1,161,986, with a mortality of only 0.37 per cent. This was a twenty-ninth of that of uninoculated animals in the same outbreaks. By 1936–7 the number had risen to 2,768,421, so popular are

these entirely voluntary inoculations among the agriculturists of India, who are mainly dependent on their cattle for both ploughing and draught animals. In the seven-year records the rinderpest inoculations in Indian and African British countries numbered no fewer than 17,191,967. The number of animals saved from serious suffering probably exceeds eight millions.

Rinderpest produces high fever, with extensive painful ulcerations of the mouth and gastro-intestinal tract, of about one week's duration, with purulent discharges from the orifices. In outbreaks among herds not protected by inoculation or previous attacks the usual mortality is about 50 per cent., and may reach 80 per cent. Up to recently the cost of preparing anti-rinderpest serum on a large scale has somewhat limited its use. This difficulty has now been overcome by the discovery of an efficient vaccine as the result of the work of J. T. Edwards, M.R.C.V.S., and others at the Mukhtesar Laboratory. Nearly a thousand doses can be made by the sacrifice of one goat, and it is being prepared provincially. It has already largely replaced the more expensive serum in India, where a recent report states that when this vaccine "is used in the face of actual outbreaks control is rapidly established and the outbreak can be stamped out." The saving of cattle by this means is therefore far greater at the present time than the eight millions or so directly resulting from the inoculations shown in the table.

Blackquarter

Blackquarter, also known as black leg or quarter ill, mainly attacks cattle, and to a less extent sheep and other animals. It produces high fever and painful swellings in various parts of the body which contain black blood and gas. Some 97 per cent. of those attacked die in one to two or more days (Edmonds and Walker, 1929). It occurs in nearly all parts of the world, and is caused by the *Cl. chauvoei* bacillus, which infects soil. Various forms of vaccine are used, but the most solid immunity is obtained from a formalized sterile vaccine made from an unfiltered broth culture of the causative organism (Wooldridge, 1934). In India in 1929–30 127,981 animals were inoculated against blackquarter, with a mortality of 0.004 per cent. The ratio of the deaths among the inoculated was an eighty-fifth of that of the uninoculated in the same outbreaks. The inoculations during seven years in the British Empire amounted to 4,620,226.

Haemorrhagic Septicaemia of Bovines

This infection is widespread in India, Africa, Europe, and America. It is caused by an easily cultivated short coccus-bacillus of the Pasteurella group. It produces fever and painful oedematous swellings and effusions into body cavities, accompanied by diarrhoea and congestion of the oral and other mucous membranes, with painful swelling of the tongue. The duration is from a few hours to several days, and the case mortality 50 to 95 per cent. (Wooldridge, 1934).

For protective inoculation both a serum and a vaccine are of value. The serum also has some curative properties in early cases. In India the vaccine is being increasingly used, as it produces longer immunity, or both may be given at the same time. The Mukhtesar Laboratory annually makes 3,000 litres of the vaccine. It is reported to be "very effective when employed during outbreaks of haemorrhagic septicaemia, the mortality being arrested" (Wooldridge, 1934). Among 806,901 inoculations of cattle and buffaloes in India in 1929–30 the

mortality was only 0.02 per cent. The ratio of deaths among the inoculated was only a sixty-sixth of that of the uninoculated in the same outbreaks. The animals protected by inoculation in seven years in Indian and African British countries amounted to 5,606,087.

Contagious Pleuropneumonia of Bovines: Anthrax

Contagious pleuropneumonia of bovines is widespread in Asia, Africa, and parts of Europe. It is caused by a small filterable organism, which can be cultivated. Painful effusions of fluid into the pleural cavities and lungs occur. It is not so fatal as the above diseases, but the long period of infectivity necessitates the slaughter of the affected animals. Immunization is effected by the use of vaccines made from cultures or from the virus containing effused fluids. Seven years' preventive inoculations in India and Africa amounted to 2,009,486.

Anthrax and wool-sorters' disease in man derived from infected hides of animals are too well known to require description. In South Africa anthrax has for some time caused greater loss than all the other animal diseases put together. In 1924-5, therefore, 2,085,365 animals were inoculated with vaccine supplied free by the Government. By 1936 the annual protective inoculations had risen to nearly eight millions. The figure in the table of 20,000,000 in seven years to 1937 is thus a conservative one. During the same period in New South Wales 1,366,004 animals were protected against anthrax.

Recent Increases in Animal Protective Inoculations

The following data illustrate the rapidity with which animal inoculations are increasing in different parts of the Empire (Table II). The yearly reports indicate that the lower rate of increase in African countries was due to insufficient trained staff to comply with the demands. There is scope for much further increase.

TABLE II

Area	1931 or 1930-1	1937 or 1936-7	Ratio of Increase
India	1,499,564	4,272,061	2.8-fold
African Colonies.. ..	1,481,188	2,385,359	60 per cent.
New South Wales	74,478	377,396	5-fold

From the foregoing considerations it may safely be concluded that anything between ten and twenty millions of the fifty-one million inoculated animals shown in Table I have been saved from severe and prolonged suffering. When we bear in mind that in many cases epidemics have been controlled and stamped out by these means, the higher figure would appear to be a conservative one. Except in the case of anthrax, nearly all the inoculations have been in cattle. The economic saving can therefore be hardly less than forty to fifty million pounds in the seven years.

Need for Public Enlightenment

There is another aspect to this question that should be borne in mind by the medical profession. In 1907 I gave evidence regarding the suffering-saving value of rinderpest serum in India, from personal experience, before the Royal Commission on Animal Experiments. Questions on the subject were put by members of the Commission to the only two medical witnesses who supported the demand for the total prohibition of animal experiments. Both admitted their ignorance of rinderpest serum. Both

demanded that its use should be prohibited by law. That demand is still made, although it is now clear that compliance with it could only increase the sufferings of animals as a whole a thousandfold; for under our humane laws in no experimental animal is "severe pain that is likely to endure" permitted.

Yet I have shown elsewhere that since the 1912 Royal Commission's final report found an emphatic, and unanimous, verdict for the scientists, over £500,000 of charitable money has been wasted on such wholesale attempted cruelty to animals as a class. Moreover, three-fifths of that huge sum—much of which might otherwise have gone to good charities such as hospitals—is derived from legacies and their investment. If only the kind-hearted legatees could be made aware of their own unwitting cruelty to animals much of this waste could be stopped. It is to the medical profession that we must look to enlighten the public on this aspect of animal experiments. The facts in this paper should furnish them with an incontrovertible argument with that vast majority of people who do not subscribe to the opponents' so-called "ethical" contention. This was clearly stated by an opposition witness before the Royal Commission in these words, in reply to question 8636: "I would not have one mouse painfully vivisected to save the greatest of human beings nor the life dearest to me."

REFERENCES

- Edmonds, C. R., and Walker, G. K. (1929). *Diseases of Animals in Tropical Countries*, 2nd ed., London.
Wooldridge, G. H. (1934). *Encyclopaedia of Veterinary Medicine*, vol. 1, London.

THE WATER SUPPLY OF LONDON

REPORT FOR 1937

The report on the chemical and bacteriological quality of the water supply of London during the year 1937, which now appears,¹ has the mournful interest of marking the close of Colonel Harold's brief but distinguished term of office as Director of Water Examinations to the Metropolitan Water Board. When he was granted sick leave in May of last year much of the report was still in draft. Through his lamented death in the following July the work remained unfinished, and the task of its completion was committed to the hands of Mr. Denison B. Byles, the deputy director. Mr. Byles, who pays in his preface a feeling tribute to his principal and modestly claims indulgence for his own handling of the material, has discharged his responsible duty in a highly competent manner.

The total average output from the waterworks in 1937 was 310.79 million gallons a day, of which amount 304.97 million gallons were supplied to consumers at an average standard of purity of 99 per cent. All the 127 works units, which derive water from a variety of sources, maintained under normal conditions a 100 per cent. standard, any slight fluctuations occurring only when season or temperature called for some readjustment of the chlorine cover. The filtered supply, all of which is now chloraminated terminally, surpasses in its perfection even the Kent wells. In the last two years the total water supply has increased by 30 million gallons a day. The number of water samples examined in 1937 was 38,000, of which 22,000 were routine bacteriological.

¹ Thirty-second Annual Report on the Results of the Chemical and Bacteriological Examination of the London Waters for the Twelve Months ended December 31, 1937. By Lieutenant-Colonel C. H. H. Harold, O.B.E., M.D., Ch.B., D.P.H. London: P. S. King and Son, Ltd. (10s. 6d.)