PART III.

MEDICAL MISCELLANY.

Reports, Transactions, and Scientific Intelligence.

*The Rinderpest of 1897 in Cape Colony.** By JAMES HARPUR.

IN bringing forward this subject I will endeavour to tell as plainly as I can something of the ravages of the great Rinderpest, or cattle plague, which invaded Cape Colony in the early months of 1897, and also something of the exertions put forward in trying to check its fatal progress.

It cannot be regarded as a disease of recent years. The German appellation of Rinderpest, the steppe murrain of Russia, and the cattle plague of England, are now fully recognised as one and the same disease. It seems to have taken up its abode in Russia. Every year in that country it carries off cattle to the value of close on two million pounds sterling.

In this century it appears to have been limited to Russia until 1827, when, in consequence of the invasion of the Turkish dominions by the Russian army, the area of the disease was extended into that country. It afterwards penetrated into Prussia, Saxony, Hungary, and Austria, and committed great ravages in those countries before it could be extirpated.

In 1841 it was introduced into Egypt, and in three years destroyed 350,000 head of cattle—in fact, almost all the cattle then in the country.

It attacked England during the years 1866–67, and the death-rate amongst the cattle was enormous, rising to over 500 a day. It is calculated that over 500,000 head were carried off, besides costing the Government many millions of money.

The evolution of this epidemic in Africa is unique amongst the epidemics of the world as regards the steady course which it pursued, and the amount of destruction and ruin, famine and war, which it left in its trail.

Rinderpest is a specific disease belonging to the class of con-

* Read before the Dublin University Biological Association.

tagious fevers. It is conveyed in the excreta from the deceased animal. How long the virus lasts in the excreta is not known, nor to what distance it may be diffused. In addition, it may travel in the hide, horns, hoofs, and intestines of the dead animal, or in anything that may come in contact with the blood of the animal. The contagious matter is one of the most subtle and prolific of any of the known elements of disease.

Belonging to the class of disease termed zymotic, one would expect to find the period of incubation, then the onset, then the period of high fever, then the period of local effects, and lastly the time when the disease tends of itself to get well, and the patient's fate depends on one point—has the disease made such havoc that the patient has strength to recover from it or not? It must, however, be borne in mind that whilst we speak of the different stages of a zymotic disease, and can always separate them in idea, they may be all crowded together, constituting what may be termed the malignant type. To this special type Rinderpest belongs. The period of incubation is from three to five days, and the animal usually dies from four to six days after the onset. Recovery, when it does occur, is very slow, and takes place by lysis. At the period of onset the first symptom is a marked rise in temperature, rising from 101° F. to 107–8° F. The animal then gets a dull, dispirited look, the eyes lose their brightness, the ears hang in a peculiar fashion. It ceases to ruminate, and leaves off eating. There is a certain amount of stiffness in the movement of the animal. The eyes next become bloodshot, and appear sunken in the head from the œdema of their lids. The inflammation of the eyes soon leads to secretion of what is at first a mucous, then a muco-purulent, discharge, which can be seen running down from the inner canthus, leaving a dirty whitish or greenish streak along the hair of the face. This is a very characteristic sign of the disease. The nasal mucous membrane becomes very vascular, and readily bleeds if roughly handled, as, for instance, in making an animal open its mouth by inserting the fingers into the nose. The mucous membrane of the gums and inner side of the lips, and other parts of the mouth, become excoriated. These excoriations are of various extent and of irregular shape. Another very early symptom of the disease is the congestion of the mucous membrane of the vulva, which becomes reddened, and exhibits abraded spots similar to those observed in the mouth. The appetite suddenly fails, and in milch cows the secretion of milk disappears almost entirely. Purging is another very marked symptom of the disease.

On *post-mortem* examination one finds that the changes produced by the disease affect chiefly the digestive system. The fourth stomach presents a congested lining membrane ranging in tint from a reddish pink to a deep plum colour. The upper part of the small intestine partakes in the congestion of the fourth stomach, presenting the same variety of tints. The mucous membrane is not in an ulcerated condition, nor are the products of inflammation present.

The congestion is capriciously distributed, more intense in some places than others. Peyer's patches are not necessarily affected. The lungs are slightly emphysematous.

This is a short description of a disease which has engaged the attention of scientific men at various epochs. The mortality of the disease has varied slightly in different countries; in Africa, however, it approached the enormous fatality of 98 per cent. As might be expected, many different lines of treatment were advocated at different times, but without any evidence of success. I cannot do better than here quote the words of Dr. Arthur Wynne Foot, of this city, who, when Rinderpest was raging in England during the years 1866-67, had special opportunities of studying the disease, and who has written largely and with great accuracy on the subject. He says:—"The prospect is gloomy in the extreme when we approach the treatment of an animal actually affected with 'the cattle plague,' for the results of experience almost invariably show that the percentages of recovery are about equal, whether animals are medically treated or not, and medicines which succeed in one case may fail in the next. When the cattle plague first appeared in England, and those who had observed it in Eastern Europe pronounced that the poleaxe and isolation were the only remedies to be employed, and confidently predicted the result of dallying with the disease in the hopes of exterminating it otherwise, their warning was not acceptable to the scientific tendency of the age. Yet the truth of their words is now evident. However mortifying it may be to the scientific mind of the present day, the fact is yet unpleasantly true and may certainly now be received as established, that as a general rule treatment of any kind is worse than useless." Such was the opinion expressed and very generally accepted in 1867. Let us now turn to the methods employed in South Africa just thirty years later for the purpose of combating this dreadful disease.

Many months before Rinderpest reached Cape Colony many measures were discussed in the House of Representatives at Cape

Town how best to protect the country from its onslaught. It was decided to requisition the services of Professor Koch, from Berlin. He came and at once set up his laboratory at Kimberley, and began a series of experiments so as to find out some means which would confer immunity from the disease. After many experiments with several animals without any tangible result, he at length began to study the bile contained in the gall-bladder of a beast suffering from Rinderpest. He noticed the gall-bladder was nearly always over-distended with bile, and also that this bile was, of all parts of the animal, the least affected by the disease. The quality of the bile in different animals, however, varied. In some it was of a dark green colour, free from blood and decomposing matter, and to all appearances normal. In others it contained both blood and elements of decomposition, and was of a dirty yellow or brownish colour; in fact these various conditions of the bile seemed to depend on how much or how little the disease had affected the mucous lining of the gall-bladder. He now began experimenting with bile of the first type—namely, dark green in colour, free from blood, and of normal consistency, taken from a beast suffering from Rinderpest and in the collapsed condition of the fever. After many experiments he found that by inoculating a beast which was perfectly healthy with 10 cc. of this bile, he was able to confer on it immunity from the disease, provided due precautions were taken during the operation that the animal did not become infected either by the attendants or the operator. This immunity he also found did not set in till the fifth day after the inoculation, so that for the success of the operation it was also necessary that the animal did not become subject to infection up to that time. Koch now made known his experiments and the results. Rinderpest, however, had not as yet broken out in Cape Colony. The Government, after carefully considering the matter, decided not to introduce Koch's method of inoculation, because that measure would not only increase the risk, but almost inevitably result in the introduction into the country of the disease. They resolved in the meantime to adopt other measures so as to prevent the disease getting into the country.

With this purpose in view, a double line of wire fencing, enclosing a belt of country two thousand yards in breadth, was erected. This fence extended along the entire border line of Cape Colony, and was continued by the Natal Government on the east, so that there extended across the entire country a fence reaching from seaboard to seaboard. Thousands of volunteers were now enrolled at fixed salaries of ten shillings a day for the purpose

of guarding and patrolling this fence. One portion of it, about 50 miles in extent, was considered of great importance, and a squadron of Cape Mounted Riflemen were appointed to take charge of it. It was while a member of this squadron that I was first brought face to face with Rinderpest.

This was the position of affairs at the beginning of 1897. The huge fence had been erected, and was being patrolled night and day by thousands of men awaiting attack from this dreaded and invisible enemy. Step by step the disease approached at the rate of about one hundred miles a week, and many were the conjectures as to the possibility of its being stayed. In spite of every precaution, however, the disease broke out on a farm at the border, on the Cape Colony side of the fence. On this farm, on which I happened to be stationed, there were over four hundred and ninety head of cattle.

The Government now sent up orders that all the cattle on this farm were to be shot, and also the cattle on any other farms, on which Rinderpest should happen to break out. This was compulsory shooting, for which the Government had to pay compensation to the farmers, to the extent of about two-thirds value of the cattle. In a week's time from the first outbreak, four farms had become infected, and over eight hundred head of cattle had been shot.

The Government now became frightened and sent up another order cancelling the stamping out policy, and leaving everything in the hands of the farmers themselves, who were to do the best they could to prevent Rinderpest from spreading. The farmers now decided to adopt inoculation as a last hope. The resources of the Veterinary Department were, as a result, taxed to the uttermost, because once inoculation was started it had to become more or less general. Through a friend of mine I was appointed on the staff for the purpose of carrying out inoculation, and was at once installed in this district in which, as I have described, Rinderpest had broken out.

The method of inoculation advocated by the Veterinary Department was the method of Koch. The operation in detail is as follows:—A beast suffering from Rinderpest, and in the last stages of the disease, is shot. It is placed with its right side uppermost. An incision is made into the abdominal cavity along the lower margin of the ribs. The gall bladder is exposed, and the neck of it is seized between the fingers and thumb. It is now detached with a small portion of the liver. The gall bladder is now thoroughly washed with water, and disinfected with some antiseptic

solution. It is now punctured at some non-vascular part, usually at the bifurcation of a small artery, and the bile is received into vessels which had been previously sterilised with alcoholic solution. The Government were very liberal in the supply of Cape brandy for this purpose. It was also used for other purposes, indeed I might say principally other. If the bile answered the conditions laid down by Koch, it was retained for inoculation purposes. Of the number of cattle shot for the purpose of bile, on the average only two out of every five rendered bile fit for inoculation. Indeed no rule seemed to be able to be laid down, as far as experience went, with regard to the animals most likely to furnish bile answering Koch's conditions. The next thing that is done is to repair to some place where every person taking part in the work of obtaining the bile can be thoroughly fumigated. This is performed by exposing oneself to the fumes of burning sulphur in a fumigating box for about twenty minutes. These fumigating boxes were something like large sentry boxes with three round holes, one in the roof and two in the sides, for the purpose of allowing the heads to be put out. The saddlery and other accoutrements were also fumigated, and the horses had their hoofs washed and their noses wiped with a solution of Jeyes' fluid. Having obtained the means for carrying out the operation, we now proceed to the actual operation itself.

The cattle are driven together into an enclosed place, called in South Africa a cattle kraal; this is usually a rectangular space surrounded by a wall, about five feet high, built of rough stones. Fifty or one hundred head are driven into these kraals, according to their size, and a band of natives, of about ten or twelve, is employed catching and throwing them. They first lasso the beast by the horns, which in South African cattle are exceedingly large. Then a rope is passed round the hind legs, and another round the fore legs. The horns and the tail are now pulled in one direction, and the feet in the opposite, and the animal is most expeditiously brought to the ground. The temperature of the beast is now taken; if it be normal, and no other suspicious symptoms be present, the animal is inoculated in the dew-lap with 10 cc. of bile, having previously disinfected the surface of the skin where the needle was inserted. With a handy set of natives it was possible to inoculate in this way up to two hundred head in a single day. It was, however, a very hard day's work, and such as in South Africa white men are not accustomed to.

Koch's method of inoculation in South Africa proved a failure.

However favourably one may regard the results obtained by him in the compound at Kimberley, surrounded as he was by skilled assistants, who had ample means at their disposal for preventing infection, we cannot overlook the fact that to perform the operation in the open country, and in a district already infected with the disease, was a work which had in it many of the elements of failure.

The first attempt I made with Koch's method was in a small herd of fifty-seven. These belonged to a farmer on whose farm Rinderpest had already broken out, but they were completely isolated on the top of a mountain from the rest of the cattle on the farm. These fifty-seven were each inoculated with 10 cc. of bile. After the inoculation their temperatures went up to 105° and 107° F., but gradually became normal. On the tenth day after the inoculation the cattle appeared again in perfect health. To prove that these cattle were now immune from the disease, they were inoculated again on the twelfth day after the first inoculation with 1 cc. of Rinderpest blood mixed with 9 cc. of salt solution. Their temperatures again rose, and the animals to all appearance were suffering from mild Rinderpest, which also passed off in from seven to ten days.

Of the fifty-seven thus treated, seven succumbed to the second inoculation, while the remainder remained in perfect health, although subjected all round to Rinderpest infection. This result made me for a long time a firm believer in Koch's method.

Other cases, treated in precisely the same way, gave results sometimes good and sometimes very bad—in fact the unfavourable results were so discouraging that already in a great many districts Koch's inoculation had been abandoned. If we bear in mind the fact that in all cases where the gall inoculations of Koch were successful the cattle must have been free from all infection or traces of Rinderpest, not only at the time of the inoculation but for five days later, when the period of immunity sets in—if we bear this in mind I think we will be able to find some good reasons why Koch's method of inoculation did not succeed. We have first of all the method of obtaining the bile. In a disease, the subtlety of the contagion of which is without a parallel, one must confess that it is a method involving great risks of infection.

Secondly, the immunity conferred by the bile did not set in till the fifth day, and if in the meantime any infection should reach a herd thus inoculated it will generate the disease in a most disastrous manner.

Thirdly, the period of incubation being from three to five days there was always the great risk in an infected district of herds, apparently healthy, having already the germs of the disease in the process of incubation. These three reasons amply account to my mind for the failure of Koch's gall inoculation. It was no doubt a great theory, but practical men could not make use of it with much prospect of success. While Koch's method was being tested, another way of combating the disease was gradually forcing itself upon the attention of inoculators. It is a very novel method, and one which I am sure will appeal to all of us. It owes its success to two French experts, Drs. Dansyx and Bordet, who were experimenting in the Transvaal while Koch was carrying on his experiments in Kimberley. It is a curative method of treatment as opposed to Koch's method of prevention. It is essentially a system of immune blood treatment. After many experiments with the blood of animals which had recovered from the disease, they found that by taking blood from an animal between 30 and 100 days after its complete recovery and using that blood for the purpose of inoculating cattle already infected with the disease, they were able to check the disease, and the animal rapidly recovered, provided the disease had not gained too much hold. The quantity of blood used for the inoculation varied from 100 to 200 cc., according to the progress of the disease.

This is a method for the success attendant on which I am prepared to vouch. I inoculated many hundreds of cattle already infected with the disease by this method, and saved 70 per cent., those cases that succumbed being invariably cases where the disease had gone too far. The method of procedure is as follows:—An animal that has suffered from Rinderpest, and between 30 and 100 days after its complete recovery, is bled from the external jugular to the extent of about three or four quarts. The wound is closed up again. The blood is now defibrinated and used for inoculating purposes. The blood is injected subcutaneously. The quantity used for one inoculation was usually about 150 cc.

Not having any hypodermic syringe of this size, and being unable to get one, I used an ordinary enema syringe, one end of which was inserted in a bottle containing a fixed dose, while to the other end was attached the needle.

This method of immune blood inoculation eventually proved to be the means by which Rinderpest was baffled in Cape Colony. Many improvements have since been made upon the method, which was first brought before the public by the two French experts,

Dansyx and Bordet; instead of using the blood which had been previously defibrinated, the serum only need be used. This serum can also be preserved for an indefinite time in a solution of phenol. Besides, the curative properties of the serum can be increased by previously inoculating the animal from which the blood is to be obtained, with first 100 cc. of Rinderpest blood, followed by 200 cc., then 400 cc., up to 800 and 1,000 cc. of Rinderpest blood. By this means the curative properties of the serum are greatly increased, and much smaller quantities of it are sufficient for inoculation.

Is not this one of the purest experiments that has yet been made upon the question of the antitoxin treatment, if I may call it so, of zymotic disease? We have here the immune blood taken from an animal of the same species. This is, I think, an important point, and should not be overlooked, and just as the immune blood taken from an animal of the same species would contain the curative properties in a greater degree than that taken from an animal of a different species, so I hold that immune blood taken from an animal or man of the same family is even better than that taken from the same species.

Note also that the serum derived from this immune blood can be preserved for an indefinite time without losing its properties, and so is always available. And again, the curative properties of this serum can be increased to a wonderful degree. Are not all these points of practical importance?

In describing these two methods of inoculation—*i.e.*, Koch's preventive and Dansyx and Bordet's curative—I have not said anything with regard to the means by which one or other method confers its immunity. The theories that have been put forward to account for the action of these and similar methods of antagonising bacterial diseases are, to my mind, insufficient, and based upon results that have reacted in individual cases. To have a sound theory one must be able to observe its workings towards similar results in very dissimilar objects of application.

M. Pasteur may justly be deemed the first to overtake and suppress by inoculation a process of specific infection. His theory of action may be called "the Theory of Attenuated Virus."

With regard to this theory, which has deeply permeated the mind of each one who engages in the study of immunity, I shall ask this question—has it been proved to be a sound theory by its successful use in many dissimilar objects of application, or is its more or less general acceptance due to the success attendant on its application to hydrophobia? To my mind we must conscientiously

admit, after carefully studying the matter, that it is due to the latter fact. The success which M. Pasteur obtained in the treatment of hydrophobia by what he called "attenuated virus" can be explained by a very different theory, and which is in reality but a part of a more general theory which explains all the various and subtle processes of inoculation conferring immunity.

The preventive method of vaccination against small-pox, the so-called attenuated virus methods of inoculation for cholera in chickens, anthrax in sheep, and hydrophobia in man, the antitoxin method in diphtheria, and the coming methods in typhoid fever and tuberculosis, are all brought in this theory very closely together, and are represented as special examples of the general means by which immunity is conferred. I do not for several reasons bring this theory under the fire of criticism in this paper, but merely show that my views are somewhat opposed to the present expressed theories as to immunity conferred by inoculation.

Whatever in the future I see, or fancy I see, in store for the antagonising of disease by inoculation may be mere dim visions, nevertheless, through whatever medium each one of us may look, I think you will all agree that there is an extensive field for interesting observation and research.

ANATOMICAL PROPORTIONS OF DIFFERENT RACES.

PROF. ARTHUR THOMSON, in *Knowledge* (June, 1899), gives us an elaborate article on the proportions of the human subject in various races—trunk to limbs, limbs to limbs, segments of limbs to each other, and so on. The advantage of this kind of information is best displayed in graphic form, so that the eye may pick out the characteristics of each type. He therefore gives skeleton sketches merely of straight lines. "The long arms and the long legs of the negro are at once apparent, the shortness of the upper in contrast with the lower limb in the white man is very evident, whilst the short trunk, and proportionately longer lower limbs of the Australian are strikingly displayed. The proportion of the upper limbs in the Javanese and Southern Chinamen is almost the same, but the shorter lower limbs of the latter are readily recognised. It is along such lines as these that we venture to think progress will be made. Provided we can obtain the necessary measurements we can then present the results in a form which will demonstrate with greater clearness and more lasting effect those minor differences, on the sum of which racial distinctions depend."