

**A Note on an Epidemic of Measles at Rotumá, 1911.**

By B. GLANVILL CORNEY, I.S.O.

IT is now just twenty-nine years since I had the honour to lay before the Epidemiological Society a record of the great measles epidemic which took place in the Fiji Islands in 1875.<sup>1</sup> What I am permitted to relate to you now records, I regret to say, a similar calamity which has but recently befallen the interesting native community inhabiting the little island of Rotumá, an outlying dependency of the colony I have just named. In the paper referred to, I mentioned that, as far as I could vouch without my notes before me, measles had not up to that time (1884) extended from Fiji to Rotumá, nor to other adjacent clusters of islands. Since then, Tonga has acquired it from New Zealand; and Fiji experienced a second but milder epidemic of it in 1907 from the same source, when the mortality amounted—using round numbers—to 1,800 out of 30,000 cases in a native population of about 89,000, who had had no contact with measles for thirty-two years. It is a fact, however, that Rotumá continued to escape infection until the early months of 1911, and it is to what has taken place at that island in this latter year that I now invite your attention for a few minutes only, because my statement will necessarily be confined to bare facts and a few figures, for a reason that will appear.

As Rotumá is but little known to the outside world, perhaps I may be excused if I offer a brief description of it and its geographical position. It is situated in latitude 12° 30' S. and longitude 177° E., some 260 sea miles distant from the nearest part of the Fijian archipelago, from which it bears N.N.W. The most southern atolls of the Ellice Group lie about the same distance off in a north-easterly direction, and the nearest of the Samoan islands is Savaii, 600 miles E.  $\frac{1}{2}$  S. from it. It is of volcanic origin, being formed mainly of igneous rock and the products of its gradual weathering and disintegration, but is girt about all around at the sea-level with a fringing reef of coral. Its highest point reaches 840 ft. above the sea, and though no fewer than six ancient crateriform vents are recognizable, none of them have been active within the ken of local tradition or legend. The area of Rotumá is but 14 square miles,

<sup>1</sup> *Trans. Epid. Soc. Lond.*, N.S., 1883-4, iii, pp. 76-95.

its total length is less than 9 miles, and its width varies from a stone's throw to 2 miles and 1,280 yards. In dealing with the land I am employing statute miles.

Although but a tiny spot upon the face of the waters, Rotumá is one of the most fertile and productive of South Sea islands; while, notwithstanding its remoteness and isolation, and in spite of Home Rule holding sway amongst them, its couple of thousand natives rank with the most prosperous, law-abiding, gentle and loyal subjects of the British Crown, under whose ægis and protection they came in 1880 by virtue of their own independent desire.

It was therefore a most unfortunate circumstance that, on January 29, 1911, a steamer called at the island with a case of measles on board. Whether it was definitely apparent, or as yet only in the incubative or pre-eruptive stage, I am not aware. The Government of the island is administered by a European Resident Commissioner; and the Fijian Ordinance to regulate pratique and quarantine matters is not only in force at Rotumá, but there are special restrictive regulations made under it applicable to communication with this island. It is now some twelve or thirteen years since a recommendation I made that a medical officer should be selected for the position of Resident Commissioner was acted upon. But owing to the debilitating nature of the climate, which is not merely hot, but very humid, it is necessary to allow the Commissioner leave of absence at least once in every two years. This officer had proceeded on leave in the customary way towards the close of 1910; and the exigencies of the service in Fiji at that time made it impracticable to supply a medical deputy to act for him during his absence. So that, briefly stated, the infected steamer arrived at Rotumá at a moment when there was no medical officer on the island; communications took place, and measles became implanted amongst the people. I am in a position to state positively that this disease had never previously visited Rotumá during the lifetime of the generations now living; but the late paramount chief of the island, whose titular designation is Marafu, told Professor Stanley Gardiner<sup>1</sup> in 1897 that "when he was a boy measles ran though the whole island, and, he believed, carried off about one person in every house." Marafu remembered, too, to "have heard of an epidemic which followed the great Malhaha war, and was still more fatal." Whether Marafu really knew what measles, as differentiated

<sup>1</sup> "The Natives of Rotumá," by J. Stanley Gardiner, B.A. Communicated by Professor Alexander Macalister, M.A., F.R.S., to the Anthropological Institute. Vide *Journal*, February and May, 1898.

from other zymotic diseases, means, is an open question, for it is within my personal knowledge that intelligent Fijians have sometimes used the term *misila* in reference to any widespread epidemic, such as influenza or dengue, since they learnt it in 1875. Marafu was an oldish man in 1897, and is not now living; it is reasonable to suppose that "when he was a boy" might refer to any time between 1830 and 1850. Peter Dillon, who was at Rotumá in 1827, described it as eminently thriving and populous, and mentions that "there were more than a dozen white men, deserters from whale ships, then living there, and all of them married two or three wives, according to the custom of the country, and had large families growing up."<sup>1</sup> Another voyager—Lucett I think—writes of as many as fifty-four white men being there about ten years later.<sup>2</sup> The Malhaha war occurred between 1800 and 1805, as nearly as can be fixed; and it is a significant fact that there is other evidence, both traditional and in print, of a very fatal and widespread epidemic of undetermined identity having prevailed in many of the Pacific island groups in 1802 or 1803 when whaling vessels and sandal-wood traders were beginning to become really numerous in those seas. That such was the case in Hawaii and in Fiji is certain; and there is reason to think that in the latter islands, where it was heralded by a parti-coloured three-tailed comet, and marked by an eclipse, the symptoms quoted in the native saga seem consistent with the idea that it may have been measles followed by ileo-colitis, as has happened since.

More than eighteen months have passed since I received, in private letters, news that my friends in Rotumá were in trouble. Measles had broken out there, during the medical Resident Commissioner's absence on leave, and the deaths due to it and its sequelæ were proving very numerous. A few further remarks of a general nature confirming this appeared in the Fijian newspapers, which may be seen in London at the Royal Colonial Institute. But it was not until December last that the Commissioner's Annual Medical Report for 1911 came to my hands. From it I cull the particulars, which, though dealing generally with vital statistics as an annual report should do, has in it some passages with special reference to measles. I may here explain that during the time I was Chief Medical Officer of Fiji a monthly medical report was rendered me by the Commissioner at Rotumá—a practice which I presume has been

<sup>1</sup> "Narrative . . . of a Voyage in the South Seas . . .," by the Chevalier Captain P. Dillon; London, 1829.

<sup>2</sup> "Rovings in the Pacific," by a merchant long resident at Tahiti; London, 1851.

continued to my successor; but those reports are not printed, and I have naturally not been in touch with them since my retirement from office, which dates from 1908. The population of Rotumā in my time fluctuated but little, and stood usually at about 2,200; but it is believed with reason that it was quite double that number in the first half of the last century, though I doubt whether it even reached 5,000, as an eminent missionary<sup>1</sup> has suggested.

I now proceed to quote from the Commissioner's (Dr. Hugh MacDonald's) Report<sup>2</sup>:—

“The estimated population of the island at the mid-year was 1,973 persons; and the actual number ascertained by a census taken on November 27 was 1,983.

“The births numbered 79, and the birth-rate, calculated on the number of people on November 27, only reached 39·8 *per mille*. This is a low rate for this place, where rates of 50, 52, 56 and even 59 *per mille* have been recorded. Of the total number, one was a stillbirth and five premature, and the cause of these was infection with measles on the part of the mothers. . . . The male births were seventeen in excess of the female, and numbered 48, the female only 31.

“The deaths numbered 489, and the death-rate reached the enormous figure of 246·5 *per mille*. The death-rate has always been high here, and in former years the lowest rate I have registered has been 37 *per mille* and the highest 54. A death-rate of 73 *per mille* was recorded in the year 1901, when Dr. Hall visited this place in connexion with an epidemic of choleraic diarrhoea [? ptomaine poisoning], which had prevailed for some time before his arrival. The explanation of the high death-rate this year is, of course, the epidemic of measles which, allowed to run through the people for the first time, during my absence on leave, swept them off literally in hundreds. The female deaths were 65 in excess of the male and numbered 277, as against 212.

“I have shown a return<sup>3</sup> of the age-period at which death occurred, and from it will be noticed that death has been most busy among young children, and adults from 20 to 25 years of age. From 5 to 20 years the incidence has not been so heavy, and over 45 years it has been comparatively slight.

<sup>1</sup> The late Mr. James Calvert.

<sup>2</sup> Legislative Council Paper No. 28, Fiji, 1912 (Annual Medical Report, 1911).

<sup>3</sup> Not printed with the original.

“The causes of deaths are shown on another return, and among the chief measles leads the way with its 326 victims. The disease, as I have already reported, was in most cases complicated with ileo-colitis, most likely of bacillary origin; in some with tubercular disease of the lungs; in a few with yaws, pneumonia, pregnancy, childbirth, miscarriage. Phthisis pulmonalis follows next with 26 deaths. Since the measles epidemic its prevalence has been widespread. Always regrettably common here, it has become more so of late. Acute broncho-pneumonia carried off twenty children—in most cases the disease might be put down as an after-result of measles. I have put down twenty-three cases to ileo-colitis—following measles in all cases, but where complete recovery from the latter disease had taken place. . . .

“Measles were introduced on January 29 when I was absent, and on my return on March 26, 700 cases were reported to me as existing. The epidemic continued throughout April and May, and finally died out in June. It caused 50 deaths in March, 198 in April, 74 in May, and 4 in June. It was accompanied with or followed by acute ileo-colitis—a very fatal complication in most cases.<sup>1</sup>

“Influenza appeared about the close of April, and continued its course through May. It was unfortunate that it should have followed as close on the heels of the last-mentioned epidemic, as it must have undoubtedly proved fatal to many measles convalescents.

“Mumps were also prevalent in May, and the swellings in many cases disappeared very slowly; it was not, however, very widespread.”

The Report adds that owing to the epidemic of measles the progress of vaccination in the island was much interfered with; and that, with regard to the future health of the people, an increase of tubercular disease, only to be expected, however, since the introduction of measles, should be noted. This, Dr. MacDonald hoped, might perchance only weed out the undesirables and leave those best fitted to survive to propagate the race.

The following table represents the vital statistics of the community for the same year :—

TOTAL POPULATION.\*

Estimated at the mid-year ...	...	...	...	...	...	...	1,973
Actual, by census on November 27 ...	...	...	...	...	...	...	1,983

*Births.*

Males ...	...	...	...	...	...	...	...	48
Females ...	...	...	...	...	...	...	...	31
Total ...	...	...	...	...	...	...	...	79
Rate <i>per mille</i> ...	...	...	...	...	...	...	...	39·8
Stillbirth ...	...	...	...	...	...	...	...	1
Premature ...	...	...	...	...	...	...	...	5
Illegitimate ...	...	...	...	...	...	...	...	7
Births of mixed parentage ...	...	...	...	...	...	...	...	15

*Deaths.*

Males ...	...	...	...	...	...	...	...	212
Females ...	...	...	...	...	...	...	...	277
Total ...	...	...	...	...	...	...	...	489
Rate <i>per mille</i> ...	...	...	...	...	...	...	...	246·5

*Marriages.*

Total number ...	...	...	...	...	...	...	...	31
Rate <i>per mille</i> ...	...	...	...	...	...	...	...	15·6

\* Including about a dozen Europeans.

The marriage-rate also was somewhat higher than has been customary, as a consequence of the measles epidemic: some of the survivors whom it bereaved having lost but little time in contracting new alliances.

## DISCUSSION.

The PRESIDENT (Dr. W. H. Hamer) said the interesting papers just read had been written by two experienced epidemiologists. They were all familiar with the work of Dr. Butler, but he might perhaps remind them that Mr. Corney read papers before the Epidemiological Society as long ago as in the Session 1883-84, on "Epidemic Diseases in Fiji"; and, again, three or four years later, on "Epidemic Cerebrospinal Fever in Fiji." There were present members eminently capable of discussing the papers, including medical superintendents who had charge of institutions in which measles came under treatment, and also members qualified to discuss measles from the statistical side, such as Sir Shirley Murphy, Dr. C. J. Thomas, and Mr. Major Greenwood. Members had all been reading Mr. Greenwood's extremely interesting paper published in a recent number of the *Lancet*. They all felt chastened, and recognized with a sense of resignation that the conclusions of epidemiology, like the conclusions of every other branch of science, had to come under the review and criticism of the expert statistician. Mr. Greenwood was at the present time the only officially constituted appeal authority in this country, and members of the Section were proud to know that one of their number occupied a position in the modern world which could only be compared with that held by the Chief Priest of the Temple of Delphi in the ancient world of Greece. They all hoped the oracle would speak that night.

Sir SHIRLEY MURPHY said he would like to hear discussed the influence which could be effected upon epidemic measles by any step which might be taken by an education or health authority. He confessed his knowledge of the subject was limited to what he had read; and it had given him a rather hopeless view of the prospects of dealing with a rising epidemic of measles. He was sure Dr. Thomas, who had specially investigated the subject, must have something to tell.

Dr. C. J. THOMAS said he was not at all convinced that the elementary schools played such an evil part in measles as was generally attributed to them. It was difficult to conceive of a community of civilized people in which such schools did not form a part; and it would be an extraordinary thing if the way in which measles spread was not modified in some direction by the fact that children attended school; the majority of the children being in school the spread of measles must take place amongst them while in school. But this did not necessarily mean that the same children would not suffer if schools did not exist. Before dealing with some points arising out of Dr. Butler's paper, he wished first to express his satisfaction at hearing two such papers, one dealing with outbreaks in "the Hub of the Universe,"

and the other in one of the far outposts of the Empire. Measles being, perhaps, the most important disease we had to deal with, it was most desirable to arrive at a true appreciation as to the way in which the disease spread, and hence, what could be done to mitigate its effects. Measles was modified in big towns by the elementary schools in this way. Each child able to contract measles he would represent by a grain of gunpowder spread on a plane surface. In time these grains of powder would so approximate to each other that a light applied at one edge would ignite the whole train. This is what occurred in a community without schools. In a district in which school attendance was enforced, however, the conditions were different. During waking hours of every day this material was swept into little heaps, leaving spaces between, over which there was some difficulty in passing. Instead of having one sheet of flame of equal intensity, there were a progressive series of definite explosions. Heap after heap exploded, but there was a certain amount of resistance offered in passing from heap to heap, and occasionally a heap missed fire altogether. An advancing wave of measles passed thus from school to school in London. At the present time it took six months for measles to spread two miles in London. He did not think it could be said that the separate explosion method of spread of measles was worse than the other. A point of the utmost importance was that without the elementary schools one would lose the source of knowledge of cases of measles. That brought him to Table VI. Here Dr. Butler modestly said his numbers must be wrong. But how could they be wrong? They were the number notified in elementary schools, and the number of deaths among those notified in this way. Yet Aberdeen gave a mortality of 13.9 per cent. and 10 per cent. at two ages, whereas for the same periods of age Willesden gave 2.8 per cent. and 5 per cent. respectively. Optimist though he was, by race and temperament, he felt a pessimist in reference to ability to stamp out or arrest an epidemic of measles. Still, by trying to mitigate the effects of it, and reduce the mortality from it, much could be accomplished. The knowledge with regard to individual cases which the elementary schools furnished would greatly help in bringing that about. Attempts to postpone the age of incidence by rough methods of school closure meant a gross interference with school work, with very small results; at the best one could hope only for postponement for some five months or so. More was to be hoped for by following up notifications from the schools and giving advice to parents and others. A Medical Officer of Health in London sent a letter recently complaining that he had had notifications of cases of measles which were a month old, and he wanted to know if anything could be done to speed up notifications. Investigation showed that those cases arose in children who had been excluded on the appearance of the first case in their class of the disease, and they were notified on the return of the class to school, the earliest day that the attacks could become known. There had been no means of the Medical Officer getting knowledge of those cases, and so bring to bear his resources upon them. The success of the School Medical Officer



meant the failure of the Medical Officer of Health. Raising the age of school life had often been put forward as a means of postponing measles. If part of these islands could be taken as an experimental area, and children were not allowed to start school until 6 years of age, and in another part children were allowed at 3, probably some difference in incidence and mortality would be found if schools had really the effect sometimes ascribed to them. That experiment had, however, actually been carried out; for in Scotland the age of commencing school was higher than in England; in Aberdeen there was no modification of the severity of measles; children got measles at younger ages, and the mortality was as great at the younger ages as in the large towns of England. In the case of the diagrams with the peaks, he could not say Dr. Butler showed the cloven foot, but he certainly dropped a few feathers from his wings when he said he wished the lowering of the peak came after the holidays, instead of before. That table became clear as soon as one looked upon the schools as a steadying factor in measles, and the holidays as a disturbing factor. During school time, one had all, except 2 or 3 per cent. of children who could run about to any degree, under observation, and the striking area became notably limited, whereas during holidays they were scattered far and wide, and the same conditions obtained as if there were no schools. Moreover, at that time there was much visiting, and possible sources of infection were distributed to wider areas. Holidays extended the striking range, hence measles took a number of new holds on communities during the holidays. Then followed the steadying effect of schools limiting the range of infection, and before the end of the school term one began to see a sinking of the measles figures. Again it was interrupted by holidays, and up went the figures during the earlier part of the succeeding term.

Dr. SHRUBSALL asked whether Dr. Butler considered what was the importance from the standpoint of the individual child of the different mortality at different age-periods in school life? If one postponed the age at which measles came on, was one thereby materially increasing the chance of younger members of the family suffering from the disease, since with the lapse of time more children might have been born?

Mr. MAJOR GREENWOOD desired to raise one or two questions which he regarded as of considerable historical interest. The first concerned the history of measles in this country. The difficulty seemed to be that, although the description quoted by Dr. Butler from Rhazes showed clearly that the clinical features of measles might have been very similar in mediaeval times to now, yet he thought that morbilli certainly comprised other diseases than measles. This was seen if one attempted to trace the history of scarlet fever. It was known that one of the earliest recognizable descriptions of scarlet fever was due to Ingrassia, of Palermo, in the sixteenth century; but, if one looked at the large number of quotations from the Arabian school, given in Haeser's classical work, it was clear that a good many of the descriptions of morbilli given by

that school were, in all probability, anginal scarlet fever; and it was usual in the passages quoted to regard morbilli as a more serious disease than variola. The most interesting point was whether such fraction of morbilli as corresponded to true measles consisted of a disease virulent to a degree comparable with experience of it when it attacked virgin soil now. The second point which he regarded as of historical interest was as to the passage which Dr. Butler quoted from Dr. Robert Watt. He (the speaker) thought the President's iconoclasm was tending to affect him, so that he was beginning to doubt whether Dr. Robert Watt's work was so extremely important a contribution to epidemiology as Dr. Creighton had said; for Dr. Creighton described it as "one of the earliest and most memorable inquiries in vital statistics in this country." Of course, Dr. Creighton's reason attached great importance to Watt's view, since he (Dr. Creighton) regarded the decline of small-pox as an example of one disease being substituted for another. He (Mr. Greenwood) would be interested if other members of the Section had turned up Watt's paper. What Watt gave was the total number of burials classified by disease, and what he showed was, that the proportion of deaths from measles to the deaths from all causes had increased. So far as he had read Watt, he was not clear that he was talking about *fatality*, or that the fatality of measles was 10 per cent. and 1 per cent. in the different periods. He believed in the table it was that the ratio of deaths from measles to deaths from all causes was 10 per cent. in the last period and 1 per cent. in the first period. He did not see how Watt could get at the fatality, because he did not believe Watt knew the number of cases of measles. Dr. Creighton mentioned that Watt did not give the constitution of the population, and although it was probable that the absolute population was available, still it was certain that he had not got the population at different ages. As that was a period in which the effects of the industrial revolution were being felt, it could not be denied that the public health of Glasgow might, for all Dr. Watt said to the contrary, have been better at the end of that period than at the beginning; it was a question of a disease being relatively more important, not necessarily absolutely more important. If one could show that the death-rate of one disease diminished faster than the general death-rate, it was obvious some other diseases must have increased relatively in importance. That did not seem to him to be a very epoch-making discovery. Watt's paper was referred to by Farr many years ago.<sup>1</sup> It was remarked that the rate of child mortality in Glasgow was extremely bad, even as late as the forties; and Farr considered that the defects just mentioned did not invalidate Watt's induction that measles was substituting itself for small-pox, and offered an explanation, in which he admitted the principle of natural selection among organisms of disease. The interesting point was, how far this principle of substitution, which Dr. Creighton had made much of, was an important principle in epidemiology as it was known

<sup>1</sup> "Vital Statistics," 1885, p. 321.

now. His last point was theoretical, and he merely wished to ask a question with regard to the diminished fatality of measles at the later ages. He believed it was Dr. Whitelegge who, in a paper on scarlet fever, some years ago, pointed out the diminished fatality of that disease at the later ages, and suggested that isolation and measures to prevent spread led to a saving of life, because they warded off the disease until later years of life, when the fatality was less. Surely it was very important to decide between the alternatives indicated by Dr. Butler. Was it that the people who got measles later in life showed a lower case mortality because they had already survived small doses of the disease, natural vaccination, as it were, from the disease? If so, supposing by some method, which was conceivable but not practicable, one could take a section of the child population, and absolutely shelter each child in that section from measles, when they got measles by exposure later in life, might the fatality not be as high as in the case of children at earlier ages who got it in the ordinary course? In other words, was the lower fatality at later ages due simply to a weeding out, as it were, of susceptibles plus inoculation or vaccination of normals, or was it due simply to the increased physiological resistance which came with years? He took it that an approximate solution of that problem was very important in determining whether delaying, if it was artificially done, was likely to produce the same effect as a delay which naturally occurred.

Dr. MILNE said he would like to give a short résumé of his personal experience with regard to measles, especially after the pessimistic views given on the subject of the control of measles. For over thirty years he had been deeply interested in the subject, and two years ago he read a paper before the same Section. The experience of the past two years most fully confirmed his position—that measles could be controlled and prevented. From many instances he gave the following: Two years ago, owing to neglect of precautions he insisted on, the cases of measles, in all, ran up to eighty in a community of 1,400 children. One of our best-known physicians, as well as a celebrated surgeon, together, visited the home where the outbreak was at its worst. The physician said that there ought to be an isolation hospital among so many children. He (Dr. Milne) pointed out to him that it was by far the worst outbreak that had occurred for twenty-seven years, when there were 144 cases among less than 500 children. When the disease increased so rapidly, two years ago, he kept 200 children from school; he specially visited all the cottages in which measles cases had occurred, twenty-three in number, to ascertain if the plan of treatment had been carried out. It had not. Printed directions were sent for every cottage mother, and a nurse set apart to have it carried out. The children returned on the same day to school. He assured the physician and surgeon that all would be over in less than three weeks after the treatment was fully carried out. This was actually so, except for two cases the following month. From what Dr. Bezly Thorne said at the debate on his paper two years ago, a most interesting test has been carried out. From two to four

drops of the best eucalyptus oil was given on sugar, according to age, to every boy in a home of 400 boys, of from 4 to 12 years of age. These boys attended four different public schools. In the vicinity measles had been very prevalent, and some of the schools closed on that account. The eucalyptus oil was thus given to prevent infection. It failed. A fresh arrival developed measles fourteen days after his admission to the home. Other cases, by the dates, were infected from the schools where many cases had occurred. Sixteen days ago he commenced giving the eucalyptus oil, as he formerly described, by inhalation, and which he had never found fail. To-day, when he visited the home, the Governor said "they were out of the wood." The **only** cause for anxiety was that pens and pencils were indiscriminately distributed, twice daily, in the schools these boys attended, and he wondered whether the eucalyptus oil would be sufficiently powerful to prevent infection from mouth to mouth. If not, then next week he would keep all the children from school, unless supplied with individual pen and pencil, carefully marked, and kept for the individual; then the full benefit would be realized. About three weeks ago he had a telephone message from the Governor of The Girls' Village Home stating that a service girl had been returned from Highgate in a motor ambulance suffering from measles, and asking what could be done with her? His reply was to ask the matron of the hospital to take her into an empty ward, and thoroughly rub her with eucalyptus oil, and treat her throat with 10 per cent. carbolic oil, then put her in the large ward where nineteen children were, and carry out the usual treatment. She was there all the time. There was neither infection nor complication. During the past two years at their seaside home at Felixstowe, where they had a most experienced matron, measles had appeared on three different occasions, amongst three different lots of children, and months apart. The different parties numbered from thirty to fifty. They were treated at once. There was neither spread nor complication. The medical attendant said, "It was most wonderful." Combined with the evidence given in the paper referred to, this proved that measles was as much under our control as scarlet fever.

Dr. E. W. GOODALL said he had listened to both the admirable papers with great interest. Measles appeared to be one of the diseases known to the ancients; but he was of opinion that some of the cases described by Rhazes as having been measles, which turned to small-pox, were really cases of small-pox with an initial morbilliform rash. Some years ago he had been desirous of ascertaining the number of cases of measles occurring in London, a point on which Dr. Butler had touched in speaking of the Willesden figures. Dr. Butler had the cases in schools notified to him, but he (Dr. Goodall) did not know to what extent this was done in London generally. It was of some importance for the body of which he was an officer—the Metropolitan Asylums Board—to have an idea as to the number of cases which were likely to occur in any given time and in any given locality. It was, however, very difficult to ascertain the number. The only long series of notifications he had been able to find in

the limited time he had to conduct a search into the question was the Aberdeen series for twenty years. In London, figures had been available only since school investigations had been carried on; otherwise there were only the deaths to go by. Was one justified in assuming that the fatality, as shown by the Aberdeen figures for twenty years, could be applied to London? He calculated that, if one took as a basis for the morbidity the average case-mortality which was exhibited in Aberdeen for those twenty years, then there must have been 100,000 cases of measles in London in the year 1906. In 1896 there were upwards of 3,600 fatal cases, and the total number of cases must have been very large indeed. The number of beds which would have to be provided for the isolation of the bulk of measles cases in London during an epidemic would be appalling. Dr. Butler had shown how curiously epidemics varied from time to time. He was surprised no reference had been made to the epidemic which swept over London two years ago. It began in July, 1910, and culminated in the following March. He believed the number of deaths in one week in March, 1911, was 197, or about 130 above the corrected average. One would have gathered from the large number of deaths in the first quarter of 1911 that London was in for a record year of measles deaths in London. But the deaths fell short of those for 1896 by considerably over 1,000. Though there were 1,428 deaths in the first quarter of 1911 there were only 140 in the last. Recently another epidemic seemed to have commenced, judging by the number of cases now being admitted to hospital. He would like to hear whether there was any special reason why these epidemics should occur about every two and a half years. Did it not seem as if they were not much influenced by school attendance? With regard to the case-mortality, only the worst cases were being sent to hospital. At present they were admitting only the Poor Law cases and the poorest of the class just above the Poor Law class; hence the case-mortality was extremely high. For the year 1911 the case-mortality at the Eastern Hospital was 20 per cent., which was very high indeed for such a disease as measles. But for the year 1912, though the cases were drawn from the same classes as before, and though there were about the same number of cases (700), yet the case-mortality was 13 per cent. Whether an epidemic was particularly fatal at the same time that it was particularly infectious, he did not think had been worked out in regard to measles. He did not believe that those two factors necessarily went together, nor that one could assume the number of cases from the number of deaths. The statistics of the cases treated in the Asylums Board Hospitals bore out the statement that the younger the patient the more fatal was the disease. It was especially fatal in very young children. The principal cause of death in measles in London was broncho-pneumonia; and, if the cases could be placed under treatment earlier, so as to ward off that complication, something definite would be done to decrease the mortality. He agreed that in a prophylactic vaccine would probably be found the most efficacious means of dealing with measles.

Sir SHIRLEY MURPHY asked if Dr. Butler could give information concerning the age-distribution of the first attacks in houses during the holiday period, and in the rest of the year, separately. If schools were productive of measles in any large degree, one would expect to find the age-period distribution of the first cases in houses during the holiday season quite different from that at other periods.

Dr. SANDILANDS said there was one question which seemed to him to be of importance—namely, the question as to the cause of death in measles. It had been said to be essentially broncho-pneumonia; and he wanted to know what was the cause of the broncho-pneumonia which led to death. It was important to decide whether it was due to exposure to cold and draught through failure to keep the child in bed. Or was it due, on the other hand, to overcrowding and to closeness of the atmosphere in a stuffy, ill-ventilated tenement? Until the matter was clear, it was difficult to know on what definitely to advise the mother, when one visited the home to point out the best course to pursue in the event of younger children being attacked. That led to the question whether one could really be satisfied that a single visit would produce, in an unsatisfactory home, conditions which would materially influence the chance of a child either surviving or dying. If there was no particular condition on which one could lay one's finger, if it merely came to the question of nursing, which could only be obtained in hospital, it seemed that, short of hospital treatment, a visit to the home was not likely to have any material influence. He would like to hear what Dr. Butler had to say on the essential causes of the mortality being higher among cases nursed at home than in those tended at hospitals. In many cases, the value of the advice to parents about calling in a doctor was discounted by the fact that medical men could be found who would prescribe for a child without seeing it, having accepted the mother's diagnosis. He was not satisfied that the commonly accepted theory which attributed the broncho-pneumonia of measles to "cold" was based on the results of scientific observations. The polluted air of an over-heated and over-crowded tenement might well be a more important cause of the same fatal complication. Or, again, the pneumonia might be due to an inevitable microbial invasion in debilitated subjects. In order to give effective advice, more precise knowledge was required as to the relative importance of these three possible factors in the production of death from measles.

Mr. CORNEY, in reply, said the paper he read was almost entirely historical rather than debatable, because the Medical Officer not being in the island when the outbreak occurred, the details were very scanty. The paper stated that death had occurred most frequently among young children, and among adults of 20 to 25 years. He had no figures dealing with the general incidence of the disease. In the Fiji epidemic of 1875 the incidence was practically universal; almost every native in a population of 150,000 took the disease; and the deaths were nearly 40,000 in four months. In the Fiji outbreak in 1904 there were

30,000 cases, limited largely to persons under 25 years of age, doubtless because the older inhabitants had been immunized by the previous visitation. There had been no case from 1884 to 1904. In Fiji the chief advice to natives was as to what not to do: copies were sent to all the headmen, who had the instructions read out to assemblies of the natives; they were also printed in a native magazine and almanack. Many of the deaths were precipitated by the practice of sitting in the streams and pools, to get cool when they felt the fever on them, from which broncho-pneumonia resulted. But in the Rotumā outbreak most of the cases seemed to get ileo-colitis or dysentery, there being no streams or pools in that island. Naturally the discussion had been mostly concerned with the behaviour of measles in this country, but he was appreciative of the attention which had been accorded to his contribution.

Dr. BUTLER, in reply, desired first to thank Mr. Corney for his paper, and to express the hope that when the more detailed figures from the annual report came into Mr. Corney's possession, he would add them to his paper, so that they might be included in the *Proceedings* of the Society. He thought it very important that an outbreak of that kind should be placed on record as fully as possible, as such instances afforded valuable information of the manner in which measles acted upon a totally unprotected population. Another point of interest in Mr. Corney's paper was the extraordinary high mortality in that year from phthisis pulmonalis—namely, twenty-six deaths in a population of under 2,000, which was ten times the rate in London, and occurring, moreover, in a population living not under urban conditions and in a climate which was supposed to be favourable to protection from tubercle.

He thanked members of the Section for the manner in which they had received his own paper. He could not complain of undue criticism. Even Dr. Thomas found it necessary to play the part of *advocatus diaboli*, and had felt impelled to overstate his case. Dr. Thomas was much more sanguine about the means at the disposal of the profession for controlling measles than he himself was. While he (the speaker) had had to modify his attitude as to the part played by schools in diffusing the disease, Dr. Thomas concluded that the schools were positively a means of throttling the disease. He did not think the depression in the curve shown in the diagram which occurred during the holiday period had anything to do with the fact that it had been throttled during the time of school attendance, and the curves did not bear that suggestion. It was very difficult to conceive how any means at present available could have that effect. The seasonal curve of measles did not apparently bear any relationship to attendance at school. It might be that it would be longer drawn out, that it would be a flash along a straight line rather than a hump if the children were not aggregated to the extent now obtaining. But one always got, during the middle part of the year, the lowest incidence from this disease, an incidence which he could not believe would be modified even if one did away with school attendance altogether. But there

was no doubt that measles was spread in schools. Experimentally that could be demonstrated, for by closing the schools the cases fell during the period of non-attendance, and one could re-open after such a period and the schools remained free. If the children attending those schools were unprotected by previous attacks of measles, one would otherwise have had the whole of the school children attacked. It was possible, by preventing contact, to protect children from the incidence of measles at the earlier ages, as shown by the experience of the public schools. The outbreak at Osborne could not be paralleled in any public elementary school in London. One could not get among boys of 13 years of age and over, an outbreak of measles such as frequently occurred in public schools. One could have measles introduced into the senior departments of public elementary schools without disturbing them much, because the children were already protected. But at Marlborough, and other public schools, when a disease broke out, down the boys went. They were a class in the community which had been protected by not being brought into contact with the disease. And that brought him to Mr. Major Greenwood's point as to the diminished fatality at later ages being possibly due to acquired resistance owing to a species of natural vaccination by small or attenuated doses of the virus. Against such explanation was the fact that one found that the fatality rate was uniformly low in all the experiments at the higher ages. The elder children in a family who took measles in the public elementary schools at 5 years of age had a low fatality-rate, although their younger brothers and sisters at home died at a higher rate. It was not that they had been protected by attenuated doses, because they went to school for the first time at 5 years of age, and 80 per cent. took the disease at this period of maximum susceptibility, though only a small proportion died. One did not find a high fatality-rate among public-school boys who presumably had not been protected by the attenuated dose. The natural vaccination against measles, if it operated at all, operated in protecting against attack rather than fatality, and accounted for the diminishing number of persons who with advancing years showed a susceptibility to measles. The cause of the measles fatality was the pulmonary complication, and that was the answer to Dr. Sandilands's question as to what advice should be given to the mother. It was a question of hygiene. Where one could anticipate an outbreak of measles in a household, it was possible to maintain a low fatality, even among the younger children, by insisting on the observance of the elementary rules of hygiene. Above all, the children must be kept warm; exposure to cold precipitated pulmonary complications; the rooms should be well ventilated, and the children warmly clad. In reply to Sir Shirley Murphy, he regretted he had not got a table showing the age-distribution of first attacks during holidays in houses, and he feared his data would not enable him to construct such a table. What struck him about his figures was that, assuming the fatality-rate was the same among the cases which did not come to knowledge as among those which did, there must have been during several years over 3,000 cases a year in Willesden,



where the births numbered 4,000 per annum—i.e., a number equal to three-fourths of the births. He did not think there were as many as that number. He thought the case-fatality was greater among those who did not come to knowledge. He agreed with Dr. Thomas as to the importance of the schools in enabling one to know what houses were attacked by the disease,\* so that due measures could be taken. It had been interesting to him to hear the discussion on a disease with which most households made acquaintance, by reason of its wide prevalence, and which appeared to remain unmodified by all the measures which had been taken. For that reason it had a pre-eminent claim on the attention of epidemiologists.