

Similar results were obtained in two cases of simple tonsillitis and in two cases of scarlet fever I produced the same reaction when I used 100 millions of a streptococcus pyogenes vaccine. A similar reaction has been reported by Russian observers when using a streptococcus vaccine as a preventive of scarlet fever in the case of normal children.

I do not know if any significance can be attached to these facts but, if worked out in a number of cases, the reaction might perhaps lend support to the view that the streptococci in the scarlatinal throat are not different to common non-scarlatinal streptococci.

It is interesting that this local reaction does not occur until a dose of 100 millions is given, and that no rise of temperature or general reaction accompanies it. I found also that the absence of previous complications in no way affected the production of the reaction.

In work of this nature, where one is dealing with a small number of cases, it is not possible to give definite conclusions.

One can only give one's impressions and the results of vaccination in scarlet fever with stock streptococcal vaccine, as I have used it, appear to point to the probable truth of the following statement:—

The treatment is:

1. Of little effect in the case of Scarlatina Simplex.
2. Of benefit in the more severe cases of Scarlatina.
3. Of definite value in septic cases as shown by:—
  - (a) Improvement in the general condition.
  - (b) A lowering of temperature.
  - (c) The early cessation of the rhinorrhœa.
  - (d) The cutting short of the septic process.

In conclusion, I wish to express my sincere thanks to Dr. Stewart, medical superintendent of the hospital for permission to publish details of the above cases and for much kindly criticism.

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DR. T. H. JONES, county medical officer of health for Surrey, in his annual report, states that in one district not one-half of the children are protected against smallpox by vaccination.

## SOME OBSERVATIONS OF TEMPERATURE IN ELEMENTARY SCHOOL CHILDREN.\*

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Medical Officer of Health, Wigan.

I MUST, in the first place, apologise for bringing before this Society the results of observations which are still very far from complete. My object in recording the result of these experiments as far as they have gone, is to obtain the advice and suggestions of members as to further lines of investigation which may be pursued in the future, and perhaps the co-operation of colleagues in other parts of the country.

I am fully conscious of the fallacies which lurk in deductions made from insufficient data, but I hope that the tabulated results of 1,000 temperature observations may prove at least suggestive, and provide material worthy at all events of being tested by future experience. Unfortunately I have not all the particulars even in these 1,000 cases that for my present purpose I should like to possess. The reason for this is that at the outset of this enquiry it was undertaken for a specific purpose, and it did not then seem necessary to record all particulars, except in cases where the temperature was markedly above or below the so-called normal. I am thus, for instance, unable from the present series of cases to compare the frequency of abnormal temperatures in various age-periods and in certain other respects.

The prevention of measles in elementary schools is, I think, one of the most serious problems with which the medical officer of health and the school medical officer is faced, both with a view to the lowering of the lamentable mortality from this cause, and of preventing the very serious loss of grant to the school authority for which it is responsible. The results of school-closure, except in very exceptional cases, is, I think, admittedly unsatisfactory, mainly owing to the fact that all possibility of supervision of the children is lost, and they are left free to infect their families and playmates. Unfortunately the industrial classes are still imbued with the fallacy that measles is a trivial complaint, and deliberately expose their healthy children to infection, in order that the whole family may "get it over together." When the school is closed we accordingly lose our only chance of receiving early notifications of the disease, and

\* Read at a Meeting of the Society of Medical Officers of Health, December 13th, 1912.

the services of school nurses and health visitors in preventing this deliberate dissemination perforce comes to an end. Somewhat better results attend the process of rigid inspection and systematic exclusion of individuals. But, unfortunately, in most cases the child has been infectious for some days before the symptoms can be distinguished from those of a common cold.

The problem, therefore, resolves itself into one of early diagnosis.

It was while I was endeavouring to discover some means of making a diagnosis in the pre-infectious stage of the disease, that my attention was called to the result of a very interesting experiment that had been for some time in progress at a large private boarding-school in the South of England. About two years ago you will remember that in several public schools, including the Naval College at Osborne, and in many of the large private boarding-schools of the South of England, there were very serious outbreaks of measles, among the victims being the Prince of Wales and his brother. In many cases the schools were closed and the pupils returned to their homes. One large college for girls was almost alone in its avoidance of an epidemic. This result was due to the system which had for some years been adopted by the principal of having the girls' temperatures regularly taken for three weeks after their return from the holidays, the period of three weeks being chosen so as to cover the incubation period of mumps. In every case in which any rise of temperature was noted the pupil was immediately isolated, until all danger of any infectious condition supervening was removed. By this means, while several cases of infectious diseases occurred among the pupils, in no single case was it communicated to another, *because the patient was isolated in the pre-infectious stage*, the only danger signal being the initial rise of temperature. It was, of course, no part of this lady's object to obtain any statistical record; so that complete figures dealing with the experiment are unavailable, but she has very kindly supplied me with the following information: "For the past six years we have taken the temperatures of *all pupils* at 6.30 a.m., before they are allowed to get up, during the first 21 days of each term, and at 6 p.m. we take the temperatures of all those who share rooms with other girls. Any case showing the slightest rise of temperature is isolated and watched, and the process has saved the school

from epidemics, and over and over again has enabled us to isolate an infectious case early enough to prevent its spread. *Measles is invariably heralded by a slight rise to 99° or a little over* for from 24 hours to three or four days before any symptoms appear or the patient begins to feel poorly. If isolated at that stage you can effectually prevent its spread. We have found that measles is *invariably* preceded by this slight rise; other complaints, e.g. German measles, chicken-pox, mumps, etc., not *always*, but generally. There are, of course, many cases in which no result follows the slight rise of temperature, but in these it is usually down again in an hour or two. When it is the beginning of an illness the abnormal temperature is usually steadily maintained." As to numbers, this school has 364 girls at present, and the numbers have been over 300 for six years. These results are confirmed by this temperature chart which I have with me, and which appears to me to be very interesting and instructive. In this case a number of boys on returning to school had tea in the same room, and were in each others' company for 20 minutes, when one of them was found to be suffering from measles. This child was at once isolated and all the contacts were forthwith sent home. In the case of the subject of this chart, it fortunately occurred to his parents to take a continuous record of his morning and evening temperature, commencing some days before the expiration of the incubation period, so that we have the unusual advantage of having the exact date of infection fixed, namely, the afternoon of January 25th, 1911. Observations of the temperature were commenced on February 4th, that is, on the tenth day. The temperature remained normal until the evening of February 7th, the thirteenth day, when it rose to 100°, the patient being otherwise apparently quite well, and from that period 4-hourly observations were maintained. On the following, or the fourteenth day, it remained up, rising to 102 in the evening, and this was followed by a very remarkable drop to below normal on the morning of the fifteenth day, this being succeeded by an immediate rise to 101 at noon and 102.5 in the evening. From this point the temperature remained between 102 and 104 until the middle of the seventeenth day, when the rash was fully developed, after which there was the rapid and uneventful decline to normal with which we are familiar in uncomplicated cases. So complete a record as this is unusual and difficult to obtain, and I regret that hitherto

I have had no opportunity of obtaining similar observations with which to compare it. We are not justified in assuming that in every case the initial rise is followed by even a brief period of defervescence such as occurred in this instance, but taken in conjunction with the experiences referred to above, I think this chart strongly suggests that the initial rise of the period of onset corresponds also to a pre-infectious state, during which the patient may be successfully isolated. In any case I think valuable results might accrue if medical men or others attached to institutions in which they

leave the elementary schools just at the age when they are entering the schools of the well-to-do, and their physique cannot be compared with that of the well nurtured and carefully tended children of the comfortable classes. One would not, therefore, expect to find among these children so close an adherence to the recognised mean temperature as prevails among the pupils in the better-class schools. I was not, however, prepared to find, as I did, that more than 25 per cent. of all the children examined who were supposed to be in ordinary health, had temperatures of 99° or over, while

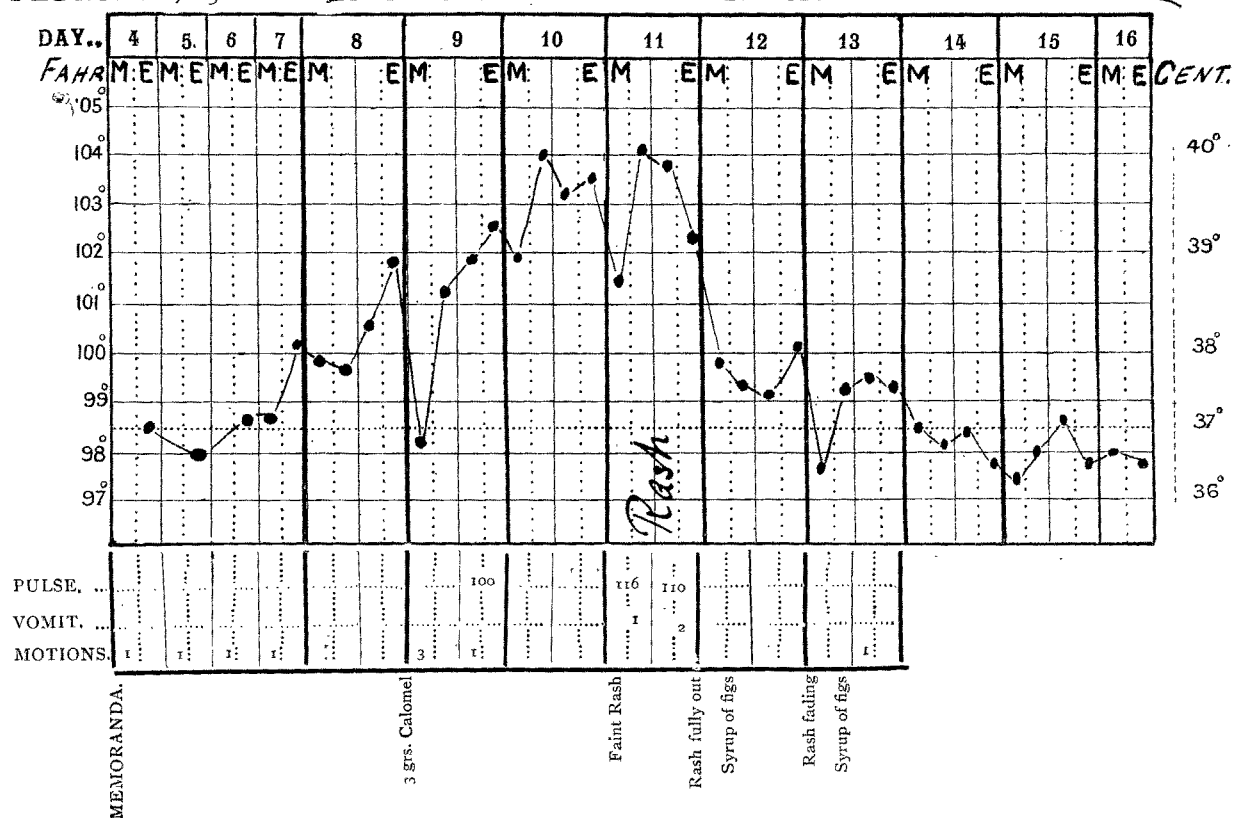
NAME: E.E.W.

DISEASE: Measles.

Exposed to infection for 20 minutes, on January 25th, 1911.

FEBRUARY, 1911.

Records taken daily at 8.30 a.m., 10.30 a.m., 4.30 p.m., 8.30 p.m.



have opportunities of ascertaining accurately the date of infection would take continuous records during and after the period of incubation. I hoped that it might be possible to obtain some results by applying this method in the elementary schools, and began to take the temperatures of children in affected schools with no other idea in view. But it soon became apparent that the method was not applicable. For one thing, it would be impossible to obtain the evening temperatures of large numbers of children without a large staff of angels as school-nurses. Besides, children

a considerable number had temperatures of more than one degree below the usual normal. It was obviously impossible to exclude so large a number of children, and further observations showed that in the great majority of cases the temperature very soon returned to normal, while very few cases of infectious disease were discovered. The results, however, showed such an amount of instability in the temperature level of children of this class as to justify further investigation. I can only regret, as I said, that so many observations were taken before I contemplated this wider object, so that

I am unable to include many interesting particulars in an analysis of the present series of cases.

Of the 1,000 children examined 531 were girls and 469 boys. I have taken the range from 97.4 to 99° as representing a normal temperature in children, and find that the cases examined may be tabulated thus:—

Below Normal.	Normal.	Above Normal.
82	343	261
or	or	or
8.2 per cent.	34.3 per cent.	26.1 per cent.

I will dispose at once of the result of these observations on the prevention of infectious disease. Of the 261 children with temperatures above normal only six developed measles. Of these three developed the disease on the sixteenth day and one on the tenth day, so that the association of the raised temperature with the subsequent appearance of the disease can hardly be supposed to be more than accidental. Three developed scarlet fever, one on the second day and one on the third day. The exclusion of these two children may have had a valuable influence in preventing the further spread of the disease. The third child had suspicious symptoms when examined, and subsequently peeled. One child developed mumps on the second day and one chicken-pox on the third day. From the point of view of preventive medicine I fear this cannot be regarded as other than a poor harvest for the work involved.

But there is another point of great importance, and that is the relation of these supernormal temperatures to tuberculosis. Of the 261 children with temperatures of 99° or over, 112 were found to have no obvious defect, which is the more remarkable as 70 per cent. of the children examined during the same period in the way of routine inspection were suffering from some form of physical defect. But of these 112 febrile children 72 were subjected to Von Pirquet's test, and of these no less than 57, or 79 per cent., gave a positive reaction. I am aware that these numbers are too small to base any very definite conclusion upon them. But these were all apparently healthy children, showing no evidence at all of tuberculosis, and in whom the existence of the disease would certainly not have been suspected without the tuberculin test. In the work of discovering early cases of tuberculosis among elementary school-children, I think considerable weight should attach to the occurrence of even transitory rises of temperature, and temperature observations would be a useful method of sorting out cases for the application of the

more troublesome methods of tuberculin diagnosis. Of the other physical defects associated with raised temperatures, the commonest was defective teeth, which were present in 131 cases, generally in combination with other defects, especially with nasal catarrh, which was present in 56 cases. The tonsils were enlarged in 18 cases, 16 of these being associated with bad teeth and two with adenoids. Adenoids were present altogether in 11 cases, of which six were associated with bad teeth and seven with nasal catarrh. Glands were enlarged in 11 cases, of which 10 also had bad teeth. The constant association of defective teeth with enlarged tonsils and adenoids is too well known to require further comment, but it is interesting to find this tendency to elevation of temperature completing the quartette of symptoms. Three of these children were suffering from persistent otorrhoea, and six had more or less severe coughs without obvious signs of phthisis, but the tuberculin test was not applied in these cases.

With regard to the duration of the pyrexia in these cases, we found that the temperature had returned to normal on the second day in 179, or 68.59 per cent.

Still above normal on 2nd day in	82,	or	31.4 per cent.
" " " " 3rd	"	55,	or 21.0 "
" " " " 4th	"	31,	or 11.8 "
" " " " 5th	"	16,	or 6.1 "

Those cases in which pyrexia lasted longer than the fifth day were all associated with more or less serious defect or definite illness. Twenty-seven cases were discovered in which there was a definite tendency to recurrent rises of temperature with normal intervals, and in which nothing was found satisfactorily to account for the condition.

A very remarkable difference between the sexes appears from these figures, girls showing a markedly greater tendency to these fluctuations of temperature than boys. Of the girls examined 28.55 per cent. had temperatures above 99, as against 23.24 per cent. of the boys, while 10 per cent. of the girls and 6.18 per cent. of the boys had temperatures below 97.4°. These results were so constant in every school and in every district in which observations were taken that I cannot but believe that the results will be confirmed by future investigations, and that perhaps increased excursions from the temperature base-line will be added to the list of secondary sexual characteristics, at all events as regards the growing female.

In considering these results we have to take into consideration what are usually regarded

as the normal variations of temperature, and of these the most important is the diurnal variation. This can hardly constitute a source of error, and, on the other hand, my observations can throw no light on the subject because all temperatures were taken in the first instance during school hours, and subsequent observations, if made at the children's homes, were made in the forenoon, and according to Jürgensen's investigations, which, though old, have not I think been disputed, the rise towards the maximum does not commence until after 4 p.m. In any case, a comparison between the temperatures taken during the morning and afternoon sessions of school reveals no difference in the series of cases under consideration. The alleged normal rise of temperature immediately after meals was obviously a matter which it was impossible to investigate under the circumstances. It has frequently been asserted that muscular exercise raises the temperature, but observations on this point give somewhat discordant results. Most of these observations have been made on adults, and it is natural that the results should be discrepant. Increased muscular exertion must necessarily result in an increased liberation of heat, and any alteration in the body temperature will depend on the ratio between this increased liberation of heat and the capacity of the individual for dissipating it. Thus we would expect a person who sweats excessively on slight exertion to have his temperature lowered rather than raised by exercise. Up to the present I have only been able to test this matter in school children in a few instances.

The temperatures of 80 children have been taken before and after a quarter of an hour's play, during which they underwent fairly violent exertion in the way of running, jumping, etc. The results may be tabulated as follows:

	Boys.	Girls.
Temperatures raised by exercise ..	12	28
Temperatures lowered by exercise ..	14	20
No change .. .. .	0	6

I think these observations, imperfect as they are, go to prove that there exists among the elementary school children, at all events in industrial districts, a tendency to more frequent departure from the accepted mean temperature than is generally recognised. The question that requires further investigation is what should be regarded as the normal range of temperature in healthy children, or what constitutes a true departure from the normal? In dealing with children of the industrial classes one difficulty is to find material for

control experiments, because so few are free from some defect.

In considering the question of body temperature generally we have to bear in mind the fact that the human species, with all its remarkable powers of temperature regulation, is only one stage in the advance from the *poikilo-thermous amphibian* to the ideal organism whose temperature should remain as constant under all conditions as though governed by a perfect thermostat. We are all familiar with the fact that the normal temperature of the infant is higher than that of the adult, and the frequency of its pulse and respiration is greater. We are so familiar with these associated phenomena that we are apt to forget to ask ourselves why they should be so associated? I think the answer is quite simple. It is because the bulk of the child is less than that of the adult. The temperature of the body is a ratio between its heat-generating and its heat-dissipating powers. Roughly speaking, we may say that its heat-generating powers are proportionate to its cubic capacity, and its heat-dissipating powers to its surface area, since it has been estimated that 77 per cent. of the heat of the body is lost by radiation and evaporation from the skin. Now it is obvious that as an animal grows its cubic capacity increases in a greater ratio than does its superficies: the one is a geometrical, the other an arithmetical ratio. The smaller the animal, therefore, the greater must be the activity of the katabolic processes which are the source of its heat, so that its comparative excess of heat-losing surface may be compensated. In the case of the infant it would seem that the tendency is to over-compensation, and we get accordingly a higher temperature than we do in the adult. As the bulk of the child increases, and its nervous control develops, we get a gradual approximation to temperature equilibrium, but the date of attainment of this equilibrium will vary in different individuals. It is reasonable, therefore, to expect, even in perfectly healthy children, a wider oscillation from the mean than we find in the adult. But the problem is complicated by the intrusion of abnormal factors, represented by the various pathological conditions which are unfortunately so much more the rule than the exception among the class of children under consideration.

I believe there is ample scope for further investigation into this matter on the lines I have indicated, and incidentally much good might result by the taking of continuous temperature records in institutions where children

are resident, as a means of preventing epidemics, but the method is not practically applicable to elementary day-schools, although in the latter it is likely to prove of material assistance in the detection of early cases of tuberculosis.

In conclusion, I wish to thank my colleagues, Dr. F. Hall, assistant school medical officer for Derby, and Dr. Cecil Berry, assistant medical officer for Wigan, for much kind assistance and many valuable suggestions in carrying out the admittedly very imperfect experiments which form the subject of this communication.

#### DISCUSSION.

THE PRESIDENT said that Dr. Wynne's paper was an exceedingly interesting one. The subject was not one which would attract everybody, and the fact that it had attracted Dr. Wynne was fortunate. The most practical aspect of the investigation from their point of view as medical officers of health, was that in connection with the prevention of measles. That disease had many peculiarities which made it, perhaps, one of the most difficult of all forms of infectious sickness to combat; and if any light at all could be thrown upon what might be called premonitory symptoms in very early diagnosis, it would be extremely helpful. No doubt there were institutions in which continuous observations of temperatures would be practicable; but in most, especially those occupied by children of the poorer classes, the inmates had already suffered from this form of disease, and were practically immune. But amongst the better classes with better protected children, that did not appear to be the case. Those interesting occurrences at Osborne to which Dr. Wynne called attention were an illustration of that. The subject of thermometry was extremely fascinating and in past times had thrown an enormous deal of light on infectious disease, its natural history, so to speak, its progress and development. Many a time an obscure diagnosis had been cleared up by those symptoms alone. In Wunderlich's very interesting book on Medical Thermometry, an article on Relapses in Typhoid, by the late Dr. Irvine, showed what the regular application of the thermometer brought about. Dr. Wynne's results were interesting so far as they went; but as he suggested, a far more extended investigation on the same lines would probably result in even more useful information being obtained. The main thing that he gathered from Dr. Wynne's paper was that in the event of pyrexia continuing for several days in an apparently otherwise healthy child, it implied and was almost invariably associated with some illness of a definite character; the casual rises and falls were of relatively small consequence. The routine practice of taking the temperature and the pulse of the pupils for fifteen days after their admission

to the institution referred to by Dr. Wynne, did result definitely in keeping that school free from infection, or, at any rate, it was followed by freedom from infection. Of course all these things pointed a way to what could be done under certain circumstances, and although unfortunately it might not be possible to adopt any means of that kind amongst the poorer classes, where infection was so rife, it would do a great deal of good in other directions.

DR. HERBERT JONES said that this was pre-eminently a paper such as the Society ought to welcome. It was just of that type for the study of which the Society was established. They all admitted that the greatest difficulty in their work in dealing with outbreaks of measles was that they could not foresee when a child was likely to have the disease. Any suggestion that could indicate whether a child was sickening ought to be of service. The line of investigation which Dr. Wynne had started should induce others to carry on observations, the result of which they only could appreciate.

DR. CLEMENTS said he had frequently found the presence of Koplik spots on the buccal mucosa of great assistance in the early diagnosis of measles, especially if associated with a slight rise in temperature. They were often present one to five days before the rash appeared, and when found a diagnosis of measles could be made with certainty. If isolation were adopted at this early stage it would limit and sometimes prevent the spread of the disease to other children. His observations were based on his experience of outbreaks of measles in institutions, and he considered that this early sign of measles, which was always to be found before the rash appeared, might be used with advantage in school epidemics to secure earlier isolation.

DRS. J. TUBB-THOMAS, A. H. BYGOTT and FAIRFIELD THOMAS also took part in the discussion.

DR. WYNNE, in replying on the discussion, said he was extremely obliged for the kind reception which had been given to his paper. He came there extremely conscious of its inadequacy and of the vague results which he had to put before them; but he knew that it was better to come even with vague results than to attempt to manufacture them. The President had referred to the fact that most institutions for the poorer classes contained children already protected from measles by having suffered from the disease. That was in the main true; but in some Poor Law institutions and cottage homes they did get very serious outbreaks of measles, and in cases like that, where an epidemic was threatened, this method of diagnosis was valuable. His experience was that where the pyrexia continued for more than five days, in every case there was some disease concurrent or developed. He was very gratified to hear

that Dr. Tubb-Thomas was going to apply the method in the two boys' schools with which he was associated. That gentleman had referred to the feature of the rise of temperature after severe exertion. He (Dr. Wynne) knew that that was one of the canons of physiology; but he must confess that he was very sceptical about it. He was making some control experiments with adults. Through the courtesy of the Wigan Football Club he had gone into the pavilion both before and after a football match and had taken the temperature of the professional players. He had not yet sufficient observations from which to base absolute conclusions; but they were most remarkable, because he found the temperature in not a few of the players was lower at the end of the match than before it. He had found temperatures as high as 101 immediately before the match, probably due to some extent to excitement, and a lower temperature at the close, probably due to fatigue and the fact that the excitement was past. The temperatures were taken with carefully equated thermometers. Reference had been made to Von Pirquet reactions. He quite agreed as to the uncertainty of the test, but had time been taken to go on with the diagnostic injection of tuberculin the result might have been different, and the number of positive reactions in children would probably have been found to be greater than even 79 per cent., which was extraordinarily high. He was much obliged to Dr. Herbert Jones for his kindly remarks. Dr. Clements had referred to the presence of Koplik spots. It was very important that those should be looked for, but the temperature in the mouth should also be taken. He had not himself found Koplik's spots in as early a stage as Dr. Clements.

COUNTY OF AYR.—MEDICAL INSPECTION OF SCHOOLS.—In Ayrshire the work of inspection is carried out by three medical inspectors, who between them examined over 21,000 children. This number is made up of infants, intermediates (children about nine years of age), leavers, non-routine cases, and cases re-examined. The intermediate class was added for the first time in 1911. Amongst the children examined a number suffering from pulmonary tuberculosis were discovered, and removed to the Ayrshire Sanatorium. The percentage of scholars found to be in a dirty and verminous condition, though lower than in the previous year, was still high; and it is pointed out that if the visits of the inspector were more in the nature of a surprise results probably much worse than those reported would be obtained. Dr. MacDonald is anxious to see more use made of the school-nurse, and in his introductory letter suggests that possibly assistance to this end could be obtained from the various nursing associations in the county.

## REPORT OF THE LOCAL GOVERNMENT BOARD FOR 1911-12.

THE portion of the report of the Local Government Board which contains a summary of the work done in relation to public health appeared most conveniently, almost simultaneously, with the report of the Board's medical officer. Both reports deserve and should receive careful consideration from medical officers of health, if not from all concerned or interested in public health work.

The views of the Board on the question of Housing, which is considered first, seem to be more or less optimistic. The local authorities who are not making active progress are apparently in the minority, the part of the work neglected being chiefly that under Part III. of the 1890 Act, viz., the provision of new houses. Rural districts are only, apparently, gradually grasping the fact that adoption of this part of the Act is not now necessary, but it is hoped that the example set by the few councils who have taken advantage of their powers will be followed by others.

Under Part I., improvement schemes by the London County Council and the Councils of Exeter and Portsmouth, each involving considerable sums of money, are referred to. Two instances in which the Board had to interfere in order to induce local authorities to give attention to representations from their medical officers of health are mentioned.

The proceedings of local authorities under Part II. of the Act are very fully considered, and it is shown that there has been a great increase in the numbers of those who took action in regard to houses unfit for human habitation. In the report of the previous year the figure given was 474, or less than 26 per cent. of the total; in this the numbers have practically doubled—850, or about 46 per cent. The number of representations to local authorities totalled nearly 25,000, the difference as compared with 1909-10 being an increase of 18,000.

Sections 17 and 18 of the Housing, Town Planning, etc., Act, 1909, were those chiefly used, but the Board believe Sections 14 and 15 also to be useful. The total number of houses dealt with under them was 18,927, of which 6,767 were situated in rural districts. Out of 1,840 local authorities, only 500 took action under the sections, the majority being satisfied to proceed under other powers.

Appeals against closing and other orders seem, from the figures given by the Board, to