

national matter, and it should be considered as a whole, and a town should not be allowed to appropriate a particular area unless it can be shown that in a general survey of available sources of supply that area can economically, from a water point of view, be allotted to it."

The value of the paper would have been increased if some information had been given as regards what is being done in other countries in connection with systematic investigation of water resources. There is no doubt that such an investigation is of more value and of greater necessity to the United Kingdom, where the population per acre is large, than to some of those countries which are at present rather sparsely inhabited, but which, at the same time, spend money on proposals such as have been suggested. In the United States this work was undertaken as a national one some years ago, a beginning having been made in 1894-5 by a grant of 12,500 dollars. This amount was gradually increased, until the grant in 1905-6 was 200,000 dollars. Since then there has, we believe, been some variation in the amount voted for this purpose.

Considering the large amount of work which the author must have gone through to prepare this paper, it may seem almost ungracious to suggest that he should add anything further to it as regards other countries, but he has shown such a large capacity for putting information together that we hope he may be tempted to even further research in connection with this subject.

MAURICE FITZMAURICE.

THE WAR AGAINST TUBERCULOSIS.

THE National Association for the Prevention of Consumption and other Forms of Tuberculosis was well advised to open its exhibition or collection of object-lessons in the Borough of Stepney. It may safely be said that the Whitechapel Art Gallery never had any company of more interested sightseers than the thousands who, at this exhibition a few weeks ago, examined and discussed death-rates, ventilation, graduated labour and the apparatus used in performing it in the treatment of consumption, apparatus for the treatment of tuberculous diseases, playgrounds, pathological specimens, back-to-back houses, overcrowding, food-stuffs and the principles of nutrition, methods of disinfection, and the like.

Any interested onlooker would have seen at once that the official conferences and set discussions constituted, after all, but a small fraction of the educational work that was being carried on. Here was an exhibition of which the main object was not to direct the attention of the public to any patent medicine or "all curing" nostrum, but how to regulate their daily life, how to avoid disease, and how to get the best food value out of their weekly wages, be these great or small. Nevertheless, the promoters of this exhibition, realising what an opportunity they had, also gathered together a number of medical and municipal delegates interested in the matter, to discuss the best means of preventing and curing tuberculosis.

Even those dropping in casually found an enthusiastic band of demonstrators, nurses from dispensaries and hospitals, attendants from graduated labour homes, from sanatoria and similar institutions, all hard at work explaining to small groups of interested men and women the meaning of the exhibits of which they were in charge. It was interesting to see the keenness with which both teacher and listener tackled the subject; and that these demonstrators were doing their work well was apparent from the numerous and intelligent questions that were put at the end of the demonstrations. Even to the sharp, snarling Londoner the importance of ventilation, of cleanliness, of light, of suitable feeding, have been small, but a few exhibitions and demonstrations such as those seen and heard in Whitechapel Art Gallery will soon change all that; and the President of the Local Government Board has done nothing better for some time than in giving his countenance and support to what promises to be a really living movement.

What is the object and what are the lessons insisted upon at these conferences? Anyone visiting the exhibition

would have it brought home to him in some way or other that between 1858 and 1907 there had been a fall in the annual death-rate due to tuberculosis from 2700 per 1,000,000 living to 1150 per 1,000,000 living. He would also see that, were the fall to continue at the same rate, tuberculosis would be an extinct disease early in the 1940 decade. Although this is too favourable a state of things to look forward to, as there will always remain a certain substratum of tuberculous patients and foci that it will be almost impossible to reach, tuberculosis should undoubtedly be an almost negligible quantity in our death-rate by that time.

How has this fall been brought about? In the first place, even before Koch was able to prove the presence of the infective agent, the tubercle bacillus, in tuberculous lesions, it was realised by those who were studying the disease most closely that it could be transmitted from one person to another, and that crowded and badly ventilated rooms were, therefore, fruitful centres of infection. This was a very great step forward, the full effect of which, however, was not felt until Koch gave his wonderful demonstration of the presence of the tubercle bacilli. He isolated the infective agent—this tubercle bacillus; its life-history was studied, and its relation to the tissues of the animal body during the course of the development of the disease, demonstrated. In the history of the treatment of any infective disease little progress has been made in fighting against it until the causal agent has been demonstrated. Once this stage has been reached, however, the fight waged against infective disease of all kinds has become more and more effective. In the case of tuberculosis, the attack can now be delivered along many parallels. Every patient is looked upon as a possible centre of infection, and before setting about the cure of the patient those dealing with the case have set themselves the task of attacking the bacillus from every quarter and at every point. It is realised that the first thing to be done is to secure it, or kill it, if possible, immediately it leaves the patient, especially, of course, in the sputum, as it comes from the lungs.

In the case of tuberculosis, isolation, in the ordinary sense of the term, is out of the question, but although the patient cannot be segregated from his fellows—and in many cases it would be both unwise and cruel so to do—he should be carefully trained to isolate himself, so far as the tubercle bacillus is concerned, by taking every precaution to prevent any undisinfected material from getting beyond his immediate vicinity. More is necessary, however, than the mere killing of the bacillus as it leaves the human body; some attempt must be made so to build up the strength of the patient that his tissues may be capable of carrying on war with the bacillus either on fairly level terms or on terms in favour of the patient. This can only be done by ensuring good hygienic conditions—plenty of fresh air, light, good food, work enough with plenty of rest. Given these conditions, and the tubercle bacillus has a bad time of it; remove the conditions, and the bad time falls to the patient. It has been stated above that it is often unnecessary to segregate consumptive patients; it must be remembered, however, that in the late stages of the disease, when the patient is weak and when the various discharges from the body, sputum and other excreta, may contain enormous numbers of the infective bacilli, it may be advisable, and even necessary, in the patient's own interests as well as of those who daily come in contact with him, to keep him in hospital, to make his last days, or even weeks or months, as easy and as pleasant as possible for him. Moreover, under these conditions the destruction of the enormous number of tubercle bacilli coming from the body is a comparatively easy matter.

Those interested in the treatment of tuberculosis have for long been convinced that good feeding and fresh air are factors of prime importance in such treatment. Up to a few years ago, however, the results obtained, though very much better than any obtained under the old methods of treatment, were in certain respects extremely disappointing. The patients were not properly classified for treatment, and many died who apparently ought to have lived. Those who went to Whitechapel to learn would find that the treatment of consumptives under Dr. Paterson at

Frimley is a very different thing from the treatment carried on in the early days of sanatoria. Patients are no longer stuffed and rested indiscriminately. They are given work, rest, and food on a carefully graduated system; they are taught how to treat themselves—what to do and what to avoid. The sanatorium treatment, however, deals with but a small proportion of the cases; tuberculosis must be tackled on a much more extensive scale. Calmette in Lille and Philip in Edinburgh, seeing the importance of bringing the treatment of tuberculosis to the working classes and even the very poor, have organised what is now known as the dispensary system, in which are combined an intelligence department, an ambulance service, a training school, an out-patient and in-patient hospital service, and a sanatorium department. In Edinburgh the result has been a fall in the death-rate beyond that of other cities equally or more favourably situated, except in that they have not been provided with this well-organised system.

It is recognised that prevention of tuberculosis is certainly more important than its cure, and all interested in this question must realise what enormous impetus has been given to the whole movement by the energetic action taken by the President of the Local Government Board. His keen interest in the Milk Bill, in the Washington Congress on Tuberculosis, and in the Whitechapel Exhibition, his grasp of principles and the wealth of detail contained in his opening address at that exhibition, gave evidence of complete conviction and determination to act up to his conviction. All this marks a great advance in the public treatment of the question in this country. Medical men have long suspected that tuberculous milk was a prolific cause of abdominal consumption amongst their little patients. They have known how readily delicate children recovering from measles, whooping cough, inflammation of the lungs, and similar conditions, have been infected, sometimes from tuberculous patients, at other times, however, under conditions where infection from the human subject appeared to be impossible, and they now welcome with enthusiasm any legislation that will render impossible the spread of tuberculosis by the milk from infected cattle. Medical officers of health, aware of the insanitary conditions under which a large proportion of the population, not only urban, but rural, live, hail with satisfaction the idea that in any well-considered action they may take they will now, not only be commended, but helped. The National Association for the Prevention of Consumption has done well, not only to follow Ireland and America, but to improve upon the methods adopted in those two countries. Nothing but good can be the outcome of this movement, and we hope that the seventy thousand visitors to the Whitechapel Art Gallery will be followed by hundreds of thousands, who will have the opportunity of seeing this or a similar exhibition at the "White City" or on its tour through the large and populous centres of England, and perhaps even of Scotland.

VISION IN RELATION TO HEREDITY AND ENVIRONMENT.¹

THE Francis Galton Eugenics Laboratory at University College, London, has already done much valuable work in many directions under the supervision of Prof. Karl Pearson. With the assistance of Miss Barrington, a useful inquiry has been made into the question of the inheritance of vision and the relative influence of heredity and environment on sight. The paper is a mathematical investigation of statistics culled from a variety of sources. Of these, two communications by Dr. Adolf Steiger, of Zürich, on the corneal curvature, and the report on 1400 school children issued by the Edinburgh Charity Organisation Society, afford the best material. Other contributory material of less value is taken from reports on the refraction of London elementary-school children by Dr. A. Hugh Thompson and the Education Committee of the

¹ University of London. Francis Galton Laboratory for National Eugenics. Eugenics Laboratory Memoirs. V. A First Study of the Inheritance of Vision and of the Relative Influence of Heredity and Environment on Sight. By Amy Barrington and Karl Pearson, F.R.S. Pp. 61. (London: Dulau and Co., 1909.) Price 4s.

London County Council, and on the eyesight of 500 Glasgow school children by Dr. Rowan. Throughout, the difficulty which specially besets such statistical investigations is present in the fact that all the material is intensely selected. There is no means of supplementing it by a knowledge of the distribution of astigmatism and other errors of refraction in the community at large. Thus, in dealing with percentage statistics of the heredity factor in myopia, the authors say that "the distribution of parents of the normal and the proportion of myopes to the normal in the general population (or at any rate in the 'universe under discussion') must be found before any appreciation of the effect of heredity can be made."

The first moot point which arises in dealing with the inheritance of refraction concerns the determination of the unit to be used to obtain a quantitative scale. It is now customary to measure the refraction in terms of the refractive power of the correcting lens instead of, as formerly, in terms of its focal distance. When the variations of the mean values in the population are small compared with the mean value in the individuals under discussion, it matters little which unit is adopted. This is true of corneal refraction (3 per cent.), but untrue of corneal astigmatism (75 per cent.). The difficulty is overcome by using, whenever possible, the method of contingency, fundamentally, or for purposes of control.

Investigation of the inheritance of corneal astigmatism leads to the conclusion that it is certainly inherited, as evidenced by minimum limits of 0.3 to the parental and of 0.4 to the fraternal coefficients, but the material is neither sufficient nor sufficiently classified to determine with any degree of certainty the accurate value of the inheritance coefficients. The authors point out that "there is a splendid field for a man who will measure the corneal astigmatism in a non-selected population." As this would be an easy and accurate task with the ophthalmometer there ought to be no difficulty in getting it carried out. Investigation of corneal refraction shows that it is inherited at the same rate as other physical characters in man. In dealing with the inter-relations of refraction, keenness of vision, and age, the results show how much more influence myopia has on visual acuity than hypermetropia, and that refraction defects contribute more than half the abnormality of keenness of vision. They further show that there is not the least doubt of a sensible relationship of age to each of the several categories of eye defect. It is probable that a great deal of hypermetropia, hypermetropic and mixed astigmatism disappears, probably owing to growth, between six and ten, thus swelling the number of emmetropic eyes, but that after this age there is not sufficient evidence to say whether these categories vary or not. Myopia and myopic astigmatism increase throughout, but this increase does not balance the total gain due to rectification by growth; it may be caused by continued action of some environmental factor, or by a growth factor.

The general conclusions derived from the slender data of this first study are as follows:—There is no evidence whatever that overcrowded, poverty-stricken homes, or physically ill-conditioned or immoral parentages are markedly detrimental to the children's eyesight. There is no sufficient evidence that school environment has a deleterious effect on the eyesight of children. Though changes of vision occur during school years, they are phases of one law of growth, a passage from hypermetropia to emmetropia and myopia of the eyes of "unstable stocks." There is ample evidence that refraction and keenness of vision are inherited characters, and that the degree of correlation between the eyesight of pairs of relatives is of a wholly different order to the correlation of eyesight with home environment. Intelligence as judged by the teacher is correlated with vision in only a moderate manner (p. 16). We scarcely think that the data justify so strongly worded an *ex cathedra* statement as that made by the authors in conclusion:—"The first thing is good stock, and the second thing is good stock, and the third thing is good stock, and when you have paid attention to these three things fit environment will keep your material in good condition. No environmental or educational grindstone is of service unless the tool to be ground is of genuine steel—of tough race and tempered stock."