

THE PREVENTION OF INFECTIOUS DISEASE,

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ABSTRACT.

THE origin or cause of "communicable" disease is alike in animal and plant, the cause in each being minute life-forms preying upon larger and higher lives. These microscopic parasites are known by the general term of "micro-organisms," and include a vast number of genera and species. The great majority of micro-organisms which swarm in air, water, and soil, are not disease-producing, but others are, and it can be proved that a few, originally innocent, may, by being placed under certain conditions, in the course of a few generations produce a parasitic, malignant race, endangering the life of the animal which they attack. Since the origin of communicable disease is practically the same throughout the world of life, so the laws of communicability, and the methods of prevention, are in their essence ever the same.

Communicable human diseases cannot in the present state of science be classified as yet on a really scientific basis, but the following may serve the purpose for a time: 1, *Eruptive fevers*, e.g., small-pox, measles, scarlet fever, typhus; 2, *Diseases affecting the Nervous system*, e.g., rabies, tetanus, whooping cough; 3, *Diseases affecting the Organs of Respiration*, e.g., pneumonia; 4, *Septicemic maladies*, e.g., septicæmia, erysipelas, diphtheria; 5, *Tubercular diseases*; 6, *Malaria*; 7, *Diseases affecting the Intestines*, e.g., cholera, typhoid fever, diarrhœa, dysentery.

There are three ways by which communicable diseases can enter the system: the infective particles must be either breathed, swallowed, or inoculated. If infectious diseases were classified simply from the point of view of contagion, they might be arranged thus:—1, those which enter with the breath and

attack the lungs or the mucous surfaces of the throat and air passages: phthisis, small-pox, measles, typhus, whooping cough, diphtheria, malaria, pneumonia; 2, those that are swallowed: scarlet fever, pneumonia, cerebro-spinal meningitis, (cancer?) tuberculosis, cholera and diarrhœa, dysentery, leprosy; 3, diseases inoculated: rabies, tetanus or lock-jaw, erysipelas, anthrax, tubercle, cancer, syphilis, leprosy.

It will at once be noted that some of the maladies appear in more than one group. For instance, tubercle may be acquired by sucking it in with the breath, by taking it into the stomach in tuberculous meat or milk, and by inoculation. Nor is this a mere idea, it is founded upon experiment; Koch has produced a tuberculosis of the guinea pig by causing it to breath dust impregnated by tubercle. In a similar way it has been proved that milk drawn from the tuberculous udder of a diseased cow is likely to produce tuberculosis. And lastly, tubercle inoculated under the skin of almost any animal promptly shows its effects.

In these experiments it has also been shown that, as a rule, when tubercle-contaminated dust is breathed the disease primarily affects the lung; when tuberculous matters are swallowed the first beginnings of the malady are to be found in the intestines, or the membrane covering them (*Tabes mesenterica*); and when the infectious matter is inoculated the tubercle is generalised. Hence from these experiments we obtain important information as to the way in which a person has probably been infected, if the seat of the beginning of the disease is ascertained at a sufficiently early stage.

I have also put pneumonia under two headings, believing that it may be acquired by the breath, and also by taking food which is in some way specifically infected. That the infectious pneumonia is communicable by food may be suspected, by the experimental fact that mice fed on bread contaminated with pneumonic sputum become affected with pneumonia. I have also seen a limited and extraordinarily fatal outbreak of pneumonia sweep away almost all the members of a family, and had good evidence to suspect contamination of their food.

It ought, on theoretical grounds, to be easiest to prevent the class of diseases which are conveyed by inoculation; next, those which are most commonly swallowed, such as cholera and typhoid; and lastly, most difficult of all to prevent, those in which (*e.g.*, typhus) the disease we may presume is inhaled.

The records of epidemics do not, however, lend much support to this theory, possibly because until quite recently no preventive measures have been taken on these lines. For example, if we hold that phthisis is mostly inhaled, *tabes* swallowed, it ought to be far easier to prevent *tabes* than phthisis. The

records of mortality of phthisis and tabes for three decades are as follows :—

	1851—60.	61—70.	71—80.
Phthisis ...	1305 ...	968 ...	767
Tabes ...	1920 ...	2267 ...	2250

That is to say, in the first ten years the deaths from tabes are a little more than 1·6 times those of phthisis; in the next ten years the proportion had increased to more than twice; and in the ten years ending 1880 they were more than three times the deaths from phthisis.

What is the meaning of this increasing disproportion? Is it from the feeding of the young on tuberculous milk or meat? From the one or the other, or both? Or is it again from the general advance in the art of diagnosis, tubercle in the bowels being more frequently detected than formerly? No answer can be given to these questions, but what we can affirm is that tubercle in all its forms is communicable; and the time has therefore come for measures of isolation and prevention to be taken in all those cases in which there is a fair possibility of danger to the healthy.

It is now a well-ascertained fact that certain fatal and infectious diseases produced by micro-organisms can only be propagated in certain animals, the one class of animals being "susceptible," the others "immune." So again, it is known that a person having had scarlet fever once is to a considerable extent protected from a second attack. Previous to the first attack he was "susceptible," after the attack he has become "immune." Thus immunity may be natural, hereditary, or acquired. Mice and rats are naturally immune against diphtheria, frogs are naturally immune against tuberculosis. Immunity against small-pox may be artificially acquired by a previous attack or by vaccination; immunity against rabies may be also obtained by a similar process. Careful experiments are being made with the object of ascertaining whether the blood, or some substance separable from the blood, of animals which are either naturally or artificially immune, may be used as an agent to confer immunity, or even work as a curative agent, and much is in the future to be hoped from this channel of experiment. There is likewise some evidence that certain definite chemical compounds—like quinine, trichloride of iodine, and corrosive sublimate—may confer a temporary or complete immunity against a few zymotic diseases. Quinine has long been used as a preventive of malaria, and used with a fair amount of success.

1. Hence one of the methods of preventing the zymotic class of diseases is by scientific means to obtain "immunity."

2. Pure air, free from dust and suspended matters and the contaminations caused by overcrowding; light is also good. Sunlight is fatal to some of the disease-producing organisms.

3. Pure or uncontaminated water; water being largely concerned in the spread of typhoid fever.

4. Pure, sound, healthy food. The meat supply of the present day is practically uninspected, and a large amount of diseased meat is consumed. Important under this heading is the preservation of food, and sterilising of food, such as the storing of food in proper and suitable places, thorough cooking, and the boiling of all milk.

5. Lastly must be mentioned "the prevention of spread"; and communicable diseases are prevented from spreading by—firstly, isolation; and secondly, the proper use of disinfecting substances. This proper use differs according to the main channels of infection, which are not in all diseases the same. In cholera, diarrhœa, and typhoid, the discharges from the bowels are most dangerous; in typhus, the volatile emanations from the skin; in phthisis, the matter coughed up; in septicæmia, the fluids of the body generally, and so on.

The above short summary amply shows that much infectious disease can be prevented by cleanliness in food and habit, and by simple common sense precautions, possible in most households.

The Chairman, Sir DOUGLAS GALTON (London), said physicians say that all diseases are due to attacks of microbes, which surround us in innumerable quantities; but, fortunately, the body when in a healthy state is able to repel their attacks; if it were not so we could not live on the face of the earth. However facts may be with regard to recent investigations in diseases, they have not shaken the broad principles of sanitation, namely, that our surroundings should be as healthy as possible.

Mr. T. W. MAULE (London) asked whether the microbes in Thames water are destroyed by the filters of the water companies; and whether the storage of water in cisterns is likely to contaminate the water.

Mr. F. R. DOCKAY (Croydon) said the boiling of milk was frequently suggested as a precaution against disease, but what could be done with cream, which, of course, could not be so treated?

Mr. H. B. COLLINS (London) said in some old buildings inhabited by the working classes he had three cases of pneumonia in one family following one upon another, two recovered but the last died.

Since these old buildings had been pulled down, scarlet fever had decreased, and he did not remember a single case in any of the new buildings; all the infectious diseases were much more rare than formerly.

Mr. J. YOUNG (London) asked if all cases of typhus reported under the Infectious Diseases Act were accepted as such.

Sir DOUGLAS GALTON (London) asked whether in lofty blocks of artisans' dwellings children's sickness is greater than in the dwellings formerly occupied by this class.

Mr. COLLINS said that it was not so in his experience, the general sickness among the children being much less in the model lodgings.

Dr. P. W. G. NUNN (Bournemouth) thought that the causation of diphtheria was a question that required consideration. The disease may be caught from the breath of others, but it is frequently taken in other ways, and is more probably due to bad air from the sewers. At a house where some alterations were being made the workmen broke into the old soil-pipe on a Saturday and left it open until Monday, so that sewer gas in the meantime came into the house: on Tuesday one girl was ill with a bad throat, her sister also caught it, and both died of diphtheria. Three weeks previously there had been a case of diphtheria in a house in the rear, and the germs had probably remained in the sewer. Pneumonia appears to be infectious, as, in a house where there were seven children, one after another was ill with the disease, probably due to using the same handkerchief or food-vessel. It was surely possible as a means of prevention to kill the germs of diphtheria, typhus, and other infectious diseases while in the drains. Liquid disinfectants were not however sufficient alone, gaseous ones were also required, as the germs might be in the air or on the upper portion of the sewer-pipe.

Mr. H. C. SOPEE (London) said there appeared to be very little disease or illness among the flushers of sewers, and if sewer air were so deleterious how was this to be accounted for?

Mr. J. CAYE (Kensington) asked whether parasites in meat could be killed by freezing.

Mr. WOOD (London) said that Anthrax germs brought to the laboratory in cold weather when inoculated into animals took some days longer than usual to develop.

The CHAIRMAN moved a vote of thanks to the Lecturer.

Mr. WYNTER BLYTH (London), in reply to the several questions that had been asked, said that Thames water must often be much polluted, at the time of the Henley Regatta for instance. A great

deal of the pollution was destroyed by fish, micro-organisms, and oxydation, and about nine-tenths of the remainder was arrested by the water companies' filters. Cisterns for the storage of water are undesirable if they can be avoided, and the water is often polluted by the cisterns being contiguous to closets, stables, &c. Cream can be sterilised by heating intermittently to a lower temperature than boiling, for example about 80° centigrade. It is a remarkable fact that although there is evidence of cream being contaminated with disease, there is no definite evidence that butter or cheese have been contaminated in the same way. Cases of typhus fever are probably sometimes wrongly reported, but mistakes of diagnosis are sure to happen where the patient is only seen once at the commencement of the disease. Probably, however, more are overlooked than wrongly certified. The causation of diphtheria is very obscure, and the case given by Dr. Nunn was of real use in considering the question. It would appear in this case to have been breathed, as no doubt it may be, but it can also be swallowed. Disinfection of sewers could not be perfectly carried out, but in cases of infectious disease house drains might be disinfected by carbolic acid or corrosive sublimate. This, however, should not be done as an ordinary proceeding. The immunity of sewer flushers proves that most of the infectious maladies are swallowed and not breathed. Then again, sewer flushers have only short hours of work, and in many sewers the air is not very bad. With regard to the freezing of microbes, experiments show that activity is only arrested and not destroyed.
