ON ARTIFICIAL DISINFECTION AS A MEANS OF PREVENTING THE SPREAD OF INFECTIOUS DISEASES

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649300891

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Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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LONDON

J. & A. CHURCHILL, NEW BURLINGTON STREET

1878

PREFACE

In the following pages I have shewn the practical results of artificial disinfection in its successful application for the eradication of smallpox, scarlet fever, and diphtheria, in numerous outbreaks of these diseases which occurred during the years 1875, 1876, 1877, and 1878, in the local board districts of Maidstone, Tonbridge, Southborough, Bromley, and Dartford; and in the rural sanitary districts of Maidstone, Bromley, Malling, Tenterden, and Cranbrook, in the county of Kent. As I am not in the medical profession, it may be necessary to say, as my apology for having undertaken a work of this nature, that I have had a regular medical education, including attendance on hospital practice, as a medical student at St Thomas' Hospital, during four consecutive years.

ARTIFICIAL DISINFECTION.

Diseases commonly called infectious may be divided into two classes. The first class consists of those diseases which are properly contagious, which can only be communicated to a healthy person by a contagium derived from a person suffering from the disease. To the second class belong those diseases which are generated by exhalations from the soil, or from decomposing vegetable and animal matters in certain states of the atmosphere, or by animal effluvia, secretions, and septic matters; but which, when they have been once thus generated, may become more or less infectious, so that exposure to infection from them may either reproduce the disease or cause it to assume a more severe form. Smallpox and scarlet fever are examples of diseases of the first class, and typhoid fever, yellow fever, and diphtheria of the second. To prevent the spread of the first class of infectious diseases we have only so to modify the contagium during its transit from the sick as to deprive it of its specific power of infecting a healthy individual. To prevent the spread of the second class of infectious diseases we must, besides this, purify the atmosphere by aërial

disinfection, and remove the causes of its contamination.

Communicable fevers are caused by infection, where particles of infective matter proceeding from the sick are absorbed into the system of a healthy person. The particles on which infection depends are not, as is commonly supposed, volatile—*i. e.* they are not diffusible, as noxious gases, in the atmosphere, but solid, though exceedingly minute and numerous. A virus is known to be capable of undergoing almost unlimited multiplication when once received into the body, as may be familiarly illustrated by the results of inoculation for smallpox. Whether it be generated there in the form of albumenoid principles in a state of molecular change, or, as Professor Tyndall and others insist, as septic germs, it is within some portion of the substance of the body that it must multiply itself. The gases given off by the breath and skin of a person suffering from a severe form of infectious fever are undoubtedly more or less of a noxious character. Those who have to inhale these gases for any length of time in an ill-ventilated sick room often suffer afterwards from an illness of a low type, the symptoms of which are so marked that they cannot be mistaken by any one who has once experienced them, but do not ordinarily include the phenomena characteristic of the fever from which the sick person may be suffering, though such exhalations from the fever patient may, through their effect in depressing vital power, increase susceptibility to infection. But although these infective matters be not volatile, it is probable that, if not

destroyed, they will sooner or later find their way into the air, as is the case with the pollen and seeds of weeds and flowers, and with those numerous particles of organic matter of whose presence in the air we become painfully conscious when they come into contact with an open wound. The scientific investigations of Professor Tyndall have led to some important discoveries by bringing powerful beams of light to bear upon substances which are suspended in the atmosphere. The air is full of organic matters, animate and inanimate, and these are necessarily most abundant in crowded places, in streets and houses where ventilation is defective, and especially in the sick rooms of the poor. It is by means of such floating matters that infection is ordinarily disseminated. Every shirt which has been on a fever patient's back, every sheet on which he has lain, every towel or handkerchief which he has used, every article on which he has placed his moist hand, every blanket or counterpane over which he may have coughed, every glass or cup which he may have placed to his lips, every spoon which he may have had in his mouth, every vessel which he may have used for any other purpose, may contain particles of infected matter, which may eventually float about in the air, fall upon the floor, be thrown upon dust heaps, carried through the streets, blown about by the wind, conveyed along drains and gutters, or deposited on the persons and dresses of doctors, nurses, and friends, and again shaken off, and scattered right and left when they leave the sick room. Any one who folds up or unfolds a piece of linen, or calico, or woollen, in a strong beam of sun-

shine may see how multitudes of particles fly off and float about in the air, and can readily imagine what might be the result if all these particles had been saturated with infected matter from the skin of a fever or smallpox patient. Under ordinary circumstances the substances which float about in the atmosphere are, at the worst, but organic dirt; but when proceeding from articles of clothing which have been in contact with infected bodies, they may become countless seeds of disease, which may be swallowed with our food, imbibed with our drink, or inhaled with the air we breathe. On this account the isolation of fever patients by the appropriation of a room for the infected has only been attended with partial success, even where the buildings have been such as to facilitate the isolation of the infected. A sheet moistened with a disinfectant and hung up before the door of a sick room may disinfect such particles of infected matter as may adhere to it, but nothing more. It will not prevent persons and articles of clothing which may have been in the sick room from becoming the vehicles of infection when they leave it.* In the course of experiments conducted by Professor Tyndall in the laboratory of the Royal Institution, he found that it had become filled with an infected atmosphere. To escape from this he had a shed erected on the roof, but the air of the shed proved sensibly as infective as that of the

* The "Instructions" issued by the Medical Officer of Health for districts in West Kent direct that woollen substances be beaten in the open air. This would thrash out the fever seeds and sow them broadcast. No infected substances must be carried out of the sick room before they have been rendered innocuous by disinfection.

laboratory itself. The cause of this was that his assistants had passed from the laboratory to the shed, and from the shed to the laboratory, unconscious carriers of infection. It was not until the shed had been disinfected, and uninfected clothes had been employed by the assistants, that the evil was remedied.

It is thus that infective matter is disseminated, not in a gaseous state, but in minute solid particles, whether animate or inanimate is unimportant; and this accounts for the fact that persons who are exposed to infection and are susceptible of it often escape the effects of it. If they were breathing an uniformly infected atmosphere this would not happen. A lady who had attended many of her children in smallpox and had never taken it was successfully inoculated for it at the age of eighty-three. It is like the distribution of shot in a general action; those who are struck by it are killed or wounded, and those who are not hit are uninjured. Infection depends not merely on the nearness of an infected person, but upon the circumstance of a particle of infective matter being brought into contact with some surface capable of absorbing it. In this way malignant scarlet fever has been produced by contact with a small portion of the discharge from the throat of a person suffering from anginous scarlatina.

As the virulent matter of communicable diseases consists of solid particles, all that we have to do is to expose it to agencies capable of destroying its specific infecting power. And if this can be affected with any certainty, we shall not only have the means