

## CONTACT THEORY OF TRANSMISSION OF CONTAGIOUS DISEASES<sup>1</sup>

By H. L. F. LOCKE, M.D.

*Hartford, Connecticut*

In discussing the so called "contact theory" of the source and spread of contagion, it is of interest to look back a few years to the days preceding and subsequent to the development of the theory of germ origin of disease, and then to trace the gradually changing trend of opinion up to the present.

Previous to the elaboration of the germ theory, various miasms, mysterious emanations, poisonous vapors, and the like, had always been believed responsible for the origin and spread of contagious diseases. Thus it was that the neighbor's cesspool was blamed for a case of diphtheria, a nearby stagnant marsh was the cause of malaria, a damp cellar was the cause of the daughter's scarlet fever, and so on. This belief is still held by many uneducated laymen and is a not infrequent reply to our questions concerning history of known exposure to the disease in question. When the germ theory was first accepted it tended to strengthen the belief in miasms, poisonous emanations, etc., especially when the bacteriologists added the comforting information that these germs are resident in our skin, clothing, food, in the air we breathe, in our intestines, in dead organic matter, everywhere, we could not escape! A little later our desperate situation was somewhat relieved by the announcement that many of these germs were not only harmless but quite necessary to the maintenance of our animal life. As a result of further studies to acquire more definite information concerning the real status of germs, it was discovered that practically all germs are parasitic; in other words, they flourish only when in proper environment, most of these parasites requiring a living organism as environment or host. A sub-division, known as saprophytes, thrives only on dead organic matter. Obviously the proof of whether contagion could emanate from unsanitary external conditions, as previously believed, lay in properly classifying the causative organisms, that is, if they turned out to be saprophytes, then they could exist and thrive in stagnant pools, dead animal matter, and the like, but not on living organic tissue. On the other hand, if proven wholly parasitic, then it would be

<sup>1</sup> Read at a meeting of the Connecticut State League of Nursing Education, November, 1915.

impossible for these germs to thrive externally and hence impossible for the specific diseases they caused to originate in filth and unsanitary conditions.

Exhaustive tests have shown that the bacilli of diphtheria and many others begin to die the minute they are thrown off from the organism in which they have been resident. Cultures taken from walls, floors, books, etc., show a rapidly decreasing growth as the interval of time following contamination is increased. Various germs have different degrees of resistance to drying, effect of air, etc., for example, the tubercle bacillus has been frequently recovered alive from the hand that has recently shaken hands with a tuberculosis patient. It has been demonstrated in books after several months. Likewise the tetanus bacillus has been found in garden soil and is, so far, the only organism known to exist in soil, that attacks human beings. Also, the living diphtheria bacillus may be recovered from the dust of floors for a varying time after becoming resident there. However, it should be borne in mind that, with the possible exception of the tetanus bacillus, these germs are simply existing for a time, then dying, rather than thriving and multiplying as in the living animal. It is simply that they are out of their environment. Cultures taken from stagnant pools, damp cellars, and the like have failed to show the presence of the germs of contagion. The net result is that contagious diseases have been shown to be parasitic rather than saprophytic in their origin.

The one remaining point to clear up in the establishing of our present theory of contact infection, is the possibility of air-borne infection. This last-mentioned theory is still in considerable favor, especially among those who are not associated with contagious work. This theory arose from two sources: first, because germs on account of their microscopic size, were believed to float about in the air of a room or ward continuously, waiting for a chance to be breathed in by any person who might enter; secondly, because it was recognized that it seemed necessary to get somewhere in the vicinity of a patient in order to contract the disease. The possibility of intermediate hosts, such as clothing, dishes, and other articles freshly contaminated, received scanty consideration. As for the first consideration, numerous experiments have disproven the contention; one experiment in particular recurs to mind. It was performed at the Willard Parker Hospital in New York and consisted in vigorously stirring up the dust in a room just vacated by diphtheria patients. The room was closed tightly and at intervals of a few minutes, sterile culture plates were exposed on a chair inside. The plates exposed during the first half hour showed profuse growth, after this interval, the growth gradually diminished, until at the end

of two hours, sterility of the media was maintained constantly. In other words, all the bacteria-laden dust was settled to the floor in two hours. Of course sharp currents of air are capable of blowing germ-laden dust around to a certain extent, yet wherever the floor is exposed to such a draft, it is probable that the germs have been already killed by the exposure and hence are harmless. The most likely exception to this statement would be the tubercle bacillus, because of its unusual power of resistance.

The second consideration was primarily disproven in the Pasteur Hospital in Paris. Inadvertently, a few cases of scarlet fever and diphtheria were admitted to the general medical ward and no further infection developed, much to the surprise of all concerned. Recognizing the importance of this incident, definite cubicles or booths were created successfully. Low glass partitions were used, simply high enough to prevent particles of sputum being carried over to the patient in the next bed by the force of a cough or sneeze. The floor was marked off and definite separate units created. This, to the best of my knowledge, was the first actual demonstration of the contact theory technique. The world was slow to accept this new theory, principally because it was so revolutionary in character. To Dr. Charles V. Chapin of Providence, R. I., is due the credit, I believe, of promulgating the theory in this country. The excellent hospital at Providence is successfully carrying out the technique under Dr. Chapin's direction. During the past two or three years numerous hospitals for contagious diseases have been, and are being, constructed and equipped to operate on this principle. This hospital is one of them.

Now then, for a statement of creed:

We believe in the spread of contagion by actual contact, either direct or indirect, by fomites to a limited degree, and by air or miasms, not at all. Of course there are those who are only partially converted in their views, and again those who cling to the old ideas through stubbornness, but each year sees many new adherents, especially as a result of the successful working out of the new contagious hospitals.

By direct contact we mean kissing, coughing in one's face, sneezing, forceful breathing in close proximity, etc. By indirect contact we refer to the putting into the mouth of pins, pens, pencils, eating utensils, food-stuffs, etc., that have been recently contaminated by an infected person; also, to handling bed-linen, clothing, etc., recently in contact with a patient, and then putting the infection thus obtained, into the mouth on the fingers directly, or on food or articles handled and put into the mouth.

By fomites infection we mean that resulting from the handling of

clothing, books, toys, etc., by another person several days or weeks later. A commission once reported definitely that yellow fever had been brought into New Orleans in a shipload of stone from Cuba. That report was accepted and credited, simply because it seemed the only connecting link with other cases. We know now that this disease is communicated only through the bite of a mosquito, in the same manner as malaria is communicated. I am sure you are all familiar with, and still occasionally hear expounded, the low marshy land theory of the origin of malaria. What an enlightened age we live in! One important point I wish to emphasize is, that although the fundamental principle of operation under this theory is a constant factor, yet the working out of details must be fitted to the individual hospital, particularly is this true of hospitals not especially built to carry out the technique. The developing of this technique in an institution requires, first of all, a thorough understanding of the basic principle, and then merely being consistent. The same is true in its application to care of patients in private houses.

Strictly speaking, we could take care of a number of different diseases in the same room, provided that at least six feet of space on either side of each patient were allowed, and provided that each unit is absolutely divorced from the others. However, a chain is no stronger than its weakest link, and bearing in mind the varying degrees of carefulness and intellect of those coming more or less in contact with the patients, it seems wiser to place the different diseases in separate rooms.

In the carrying out of isolation, etc., in the homes, many problems are met and we find many grotesque inconsistencies on the part of health officials and others. One most glaring weakness is the isolating of the diphtheria patient in a family, meanwhile allowing other members of the family to go and come at will without culturing their throats to find carriers. The antiquated custom of hanging sheets soaked in antiseptic solution in doorways to prevent the supposed passage of germs from room to room can have no effect unless it be to remind other members of the family to keep out. The portals of entry of infection into the body are almost entirely the mucous membranes, principally the nose and throat. The normal skin is impervious to all of the so-called contagious diseases. Whether the disease develops or not depends entirely on the degree of specific immunity resident in the receptor. The term medical asepsis applies to the technique developed to carry out the principles of the contact theory.