THE ETIOLOGY OF TYPHOID FEVER.*

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TYPHOID fever shared with tuberculosis and cancer the distinction of being the most important of the diseases throughout Australasia. The deaths for the Commonwealth and New Zealand for 1896-98 were great. Typhoid is so serious, also, because it carried off so many of the young and vigorous, just when their powers had arrived at maturity. We know now that the patient may be touched and handled without danger, and if the community could be educated up to the present state of knowledge of prevention, it might be safely said that the whole of the disease would disappear in the course of a single generation. The colon bacillus had so many points of resemblance to typhoid that the two were regarded as members of the same group. The bacillus was discovered in 1884, and probably no single organism had received a larger share of attention ever since. Advancing knowledge seemed, for the present, to upset old ideas and created confusion—a darkness, it was hoped, that preceded the dawn. The bacilli contaminated the soil, milk, drinking-water, and other ingesta. In some cases the source of the poison cannot be traced, hence many authorities have believed that typhoid fever may sometimes arise spontaneously. The facts ascertained with regard to the outbreak of typhoid fever were, briefly, that in very few cases is there any evidence of direct contagion from the sick to the healthy. In a considerable number of cases, especially of isolated cases, no direct or indirect contagion can be proved. In a large number of cases, especially in large epidemics, typhoid arose among persons who drank unfiltered and unboiled water into which the germs had got. Dr. Schrader of Berlin, observing typhoid epidemics, chiefly in England and Germany, gave the following results in 650 cases: Attributable to water, on 462 occasions; milk, 110; other stuffs, 23; clothing, bedding, etc., 23; all other causes, 43. While the above observations could be relied on, still many sporadic cases, and not a few epidemics, had had origins which could not be so explained. More attention should be devoted to the way in which bacteria are distributed by flies and dust. If a fly was caught and left to walk on the surface of a prepared plate, its footsteps would, in the course of forty-eight hours, be marked by parallel rows of tiny colonies of bacilli, many

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of which would be found to be fever organisms. The fly itself probably deposited only one or two bacilli at each contact with the plate; but these rapidly multiply, till, in the course of forty-eight hours, the colonies grow to the size of a pin's head. Similar facts hold good with regard to particles of dust. The fly obtains the organisms on its feet simply because these bacilli are practically ubiquitous in the neighbourhood of human dwellings. This goes far to explain the disappearance of typhoid fever as soon as an efficient system of drainage is introduced into places where it was rife before. Where cesspits and closet-pans are in use, flies have access to their contents, and may convey the bacteria direct to articles of food and drink, thus allowing, in some cases, for a colony of the bacteria to be developed before the food is eaten; or the flies may convey them indirectly by alighting in the gutters and other damp places in the neighbourhood of a house. A trace of organic matter was sufficient to enable the typhoid bacilli to multiply, and thus the germs may be conveyed a distance from the original focus, and contamination be distributed to water, milk, and foodstuffs. Dust settling on roofs of houses was often washed into tanks of drinking-water, carrying fever germs into it. The following conclusions may be stated:

1. Many mild cases of fever are slight attacks of typhoid, and may serve to distribute the contagion.
2. Typhoid fever itself may be a composite disease, or a series of diseases caused by closely allied organisms.
3. While from the bacteriological evidence the *de novo* origin of the disease is not disproved, still a general survey of all the known facts enables us to explain most cases without having recourse to this hypothesis.
4. Typhoid fever at once disappears from a community with the introduction of a proper system for the disposal of excrement and household refuse. In towns this can only be done by a properly constructed water-carriage system of sewerage.
5. The disease is spread chiefly by the contamination of water, milk, and articles of food. In hot countries, at least, flies and dust have a considerable share in bringing about this contamination.
6. The length of time during which the bacilli can exist outside the body is unknown. There is evidence to show that the contagion hangs about old cesspits and contaminated soil for several years.