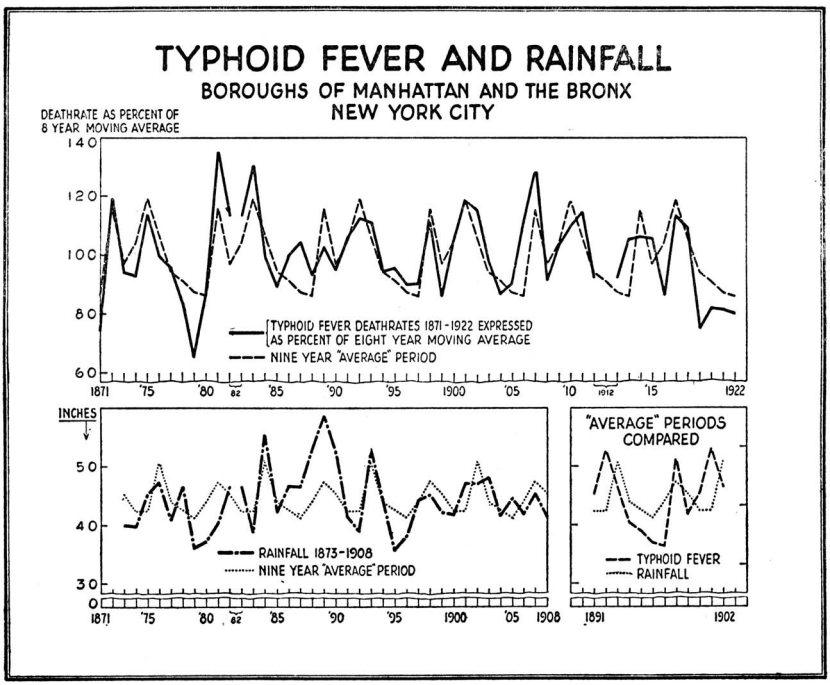
the actions of the herd. When the pressure rose, out would come the caterpillars even though the storm outside were still continuing. When it fell they remained at home even though the evening without was clear and calm.—*N. H. B.*

TYPHOID FEVER AND RAINFALL

In the October, 1925, issue of this *Bulletin*[1] we presented a number of graphs of the deathrate from typhoid fever in certain cities of the Union. These graphs brought out very clearly a periodic alternation of crests and troughs spaced about eight years apart.

Since then the corresponding figures for the Boroughs of Manhattan and the Bronx in New York City have been analyzed with interesting results. We find here a clear picture of a nine-year wave, rising to a crest in 1872, 1881, 1889, 1898, and 1907, and dipping to the trough of the wave in the years 1879, 1888, 1897, and 1905. There is also a clearly marked secondary crest at the years 1875, 1883, 1892, 1901, and 1909, and a secondary trough at the years 1874, 1882, 1890, 1899, and 1908. It will be seen that the intervals between corresponding crests are 9, 8, 9, 9 years for the primary crest; 8, 9, 9, 8 for the secondary crest; 9, 9, 8 for the primary trough, and 8, 8, 9, 9 for the secondary trough. Thus,



[1] *Statistical Bulletin*, Metropolitan Life Insurance Company.

in all its parts the wave preserves its typical periodic eight or nine-year undulation. This situation is brought out rather strikingly in the accompanying diagram. . . .

The second diagram [first one not reproduced here] brings out essentially the same facts in another way, and at the same time exhibits certain other features of interest. Here deathrates are plotted not directly, but expressed as percentage of an eight-year moving average. This series is shown in a solid line. The line of dashes is the plot of an "average" period repeated over and over. This average period was computed as shown in the appended table by writing the deathrates of the years 1871 to 1879 as successive items in a first line, then in a second line, item for item, under these figures, the deathrates from 1880 to 1887, repeating the figure for the year 1882 to fill in the gap in this "short" period; under these figures were placed those for 1888 to 1896 and under these again the figures for 1897 to 1905. The nine columns of four figures each were then added, and the sum divided by four, as shown below. This gave a set of nine "average" deathrates corresponding to the nine successive years of a typical period. The years 1906-1925 were omitted in this computation, as the deathrates here became small and the periodicity was not quite so regularly apparent. In the upper fully drawn curve a gap of two years has also been inserted at the year 1912; but this part of the curve was not used in computing the average period.

It was thought that there might be a connection between the periodic fluctuations in the deathrate from typhoid fever and any possible periodic fluctuations in weather conditions. The series of figures for the rainfall in New York in the years 1873-1908 were, therefore, treated in practically the same way as the figures for the deathrate from typhoid fever, except that in this case there was no need to go through the step of expressing the data in terms of a moving average, as there is practically no secular trend in rainfall. The figure for the year 1882 was here also written twice over, as in the case of the deathrates, so as to make the correspondence between the two series of figures complete. The actual rainfall figures are plotted in dots and dashes on the lower left in the second drawing, together with the "average" period shown in dots, and repeated four times. The diagram on the lower right is a comparison of the run of an average period of typhoid fever deathrates, against the corresponding average period of rainfall. It will be seen that the two W-shaped curves show a rather close resemblance, crest falling essentially upon crest, and trough upon trough. There is nowhere more than one year's discrepancy in the position of corresponding crests and troughs. In judging the two discrepancies of one year that do occur in the crests, it must be borne in mind that *absolute* coincidence can hardly be expected. There will necessarily be chance variations in the exact position of the several crests and troughs; and if there should be only as much as a just over three months' chance deviation in one direction in a rainfall peak, with a three months' chance deviation in the opposite direction in the typhoid fever peak, the combined relative deviation of

just over six months would, in the graph, appear as one year, since fractions of a year are not shown. There is, accordingly, some uncertainty as to the precise significance of the findings expressed by this graph. We present the facts and figures here for the study and consideration of our readers, without bias. Parallelism such as this must be viewed with some caution, but it certainly seems very suggestive.

That there should be a relation between rainfall and the deathrate from typhoid fever is in itself plausible, though the precise nature of the relation may be somewhat complicated. For, on the one hand, in an exceptionally wet year the rising level of the ground water is liable to sweep contaminating matter into sources of drinking water that in ordinary times are relatively pure. On the other hand, in very dry weather, consumers may be induced by shortage at their customary sources to draw upon other sources which they would ordinarily avoid. So two conflicting influences may be at work, and it is difficult to say *a priori* just what their resultant effect would be.—*Statistical Bulletin, Metropolitan Life Insurance Company, Sept., 1927, Vol. VIII, pp. 5-9.*

OCEAN TEMPERATURES AND LAND TEMPERATURES

Because my statement on page 149 of the October BULLETIN that the air moves from continent to ocean in summer and back again in winter was misunderstood by at least one person, it seems well to amplify the statement somewhat so as to make my meaning clearer. What I had in mind was the air mass movement as indicated by the atmospheric pressure. As the temperature rises over the interior of the continents in summer the pressure falls and rises over the oceans in corresponding latitudes. This means that a large mass of air has moved from the continent to the ocean. The movement probably takes place in the upper currents of the atmosphere. After the differences of pressure are established, a surface current arises directed from the ocean to the land in the effort to restore equilibrium. But as long as the temperature remains high over the land the low pressure is maintained. When winter comes the land surfaces become cold and the pressure becomes higher over the continents and lower over the oceans at corresponding latitudes. In each case I am speaking of surface pressures reduced to sea level. This fact indicates that an immense mass of air has moved back from the ocean to the land. If another explanation of this change of pressure is found, other explanations of the facts will be possible.—*H. Helm Clayton.*

WORK OF THE COMMITTEE ON AERONAUTICAL METEOROLOGY

Though this committee sponsored by the Daniel Guggenheim Fund for Promotion of Aeronautics has existed only since the end of July, it has already embarked energetically upon its duties. One of its first