

Or we may assume that certain ptomaines derived from the gastro-intestinal tract, either circulating in the blood, or present in the intestinal mucosa, act so as to neutralise the local action of the typhoid virus and bring about intestinal immunity. Finally, we may assume that toxins derived from germs other than typhoid may antagonise their virus and a local immunity be thus acquired.

To decide between these hypotheses is an impossible task in our present state of knowledge. As yet they are merely hypotheses, based, it is true, upon experiment, but exactly the degree of importance they possess in relation to the cases here referred to it is impossible to say. Still they are very suggestive. The first assumption indeed explains the process as a partial vaccination of the Peyer's glands and consequent immunity to a second attack. But why should the glands be singled out? Possibly the action of the intestinal mucosa in excreting circulating toxins may have something to do with this, the poison as it were being concentrated upon the emunctories, and thus an immunity is conferred upon the intestinal glands while other organs are not protected.

The last two hypotheses are based upon the theory of a mutual antagonism between the toxins of various germs. This opens up a vast subject in which we are still groping in the darkness of ignorance. The relations of the *B. Typhi* to the colon bacillus and other members of the colon group, and to the bacteria of the intestinal tract generally, are still unknown, although we are gradually beginning to see the light. But indeed the whole subject is so entangled with the variability in the toxic power of the germs concerned and the question of the resistance of the bodily organism, that the difficulties assume gigantic proportions.

The recent experimental studies of Sanarelli throw considerable light upon this subject.

It may be objected that no proper inferences can be drawn as regards the human organism from a study of experimental animals, but this is not so. The character of the lesions in the lower animals depends very much upon the amount of the toxin inoculated and its virulence. When strong toxins are used, a condition is obtained bearing very close analogies to that which obtains in the case of human beings, including the intestinal lesions.

Sanarelli took two series of guinea-pigs and administered for five days 4 cc. of a typhoid culture in glycerinated bouillon kept for a month in the incubator at 37°C., and then sterilised at 120°. In the first lot of animals the vaccine was introduced into the stomach by means of a sound, and in the second inoculated subcutaneously. The