

to be directly opposed to it. The old idea that vital force was opposed to putrefaction was now extended to mean that external putrefaction extinguished the causes of diseases and could have nothing to do with life. Henle introduced more modern views. From the labours of Schwann, Latour, etc., he believed putrefaction to be dependent upon infusorial life, and on the ground of the observations of Bassi and Andouin connected infectious diseases with the life of micro-organisms, thus associating decompositions whether occurring within or without the body. According as the infection multiplied without or within the body, Henle called it a *miasma* or a *contagion* and further believed the true contagion could live for some time apart from the body. He further makes the following clear-sighted statement: "But since the putrefaction does not invariably cause disease, it must depend upon special conditions what kinds of infusoria and plants develop, and they do not act equally detrimentally upon health." In any case where the body in health has not resisted the entry and multiplication within, of organisms, "a special direction is given to the putrefactive process, which still remains essentially the same as external putrefaction." This position is maintained by the teachings on the chemistry of bacteria of Nencki, Gautier, Selmi and Brieger. Pettenkofer, later, in subscribing to these views, gave the infectious material the terms *entogenous* and *ectogenous* when internal or external to the body, and maintained that the *entogenous* completed their cycle in the external air (as for instance the germs of typhoid and the spore-formation in the bacilli of anthrax). Believing with Pettenkofer that infection was borne into the body only with the atmosphere, Vogt maintained that the gases and ground vapours were the true causes of putrefaction.

With these views we arrive at the bacteriological era, ushered in by the endeavours of Pasteur, Hallier, Klebs, etc., to cultivate pathogenic bacteria.

The ectogenous cultivation of various pathogenic bacteria by Koch, proved that they possess a saprophytic stage like ordinary putrefaction bacteria, and that a parasitic stage within the human body is not necessary to their existence as a species, but is merely accidental. This view had long been taught regarding the parasites of plants. Panum supposed that bacteria within the body produced a poison which was the cause of the trouble; which poi-

sons (e.g. tyrotoxin) was equally potent apart from the presence of the organism.\* Finally, Sirotium, Peiper and Deumer showed that typhoid bacteria, which in man act as invasive parasites, acted in animals experimented upon like the ordinary bacteria of putrefaction. A tissue already diseased offers so much the less resistance to pathogenic organisms, and every one will now admit that putrefaction is a predisposing cause of infectious disease. Naegeli maintains that the contagious organisms are derived from the miasmatic, and these again form the putrefactive, these later organisms having an unlimited variability of form and action. Various experiments have, however, proved that the more contagious the organisms are the more distinct are they from those of putrefaction; indeed, there is antagonism between true contagion and putrefactive bacteria, the former succumbing in the struggle, e.g. Koch's *comma* bacillus surviving for about a fortnight.

Turning to the bacteria which accompany intestinal decomposition it is known that they may cause disease by means of their formation of ptomaines (and not necessarily with Wernich by becoming invasive bacteria). Pasteur formerly taught that bacteria in the intestines always act beneficially. It is satisfactory to be assured that the production there of ptomaines in such amounts as to be injurious to health would be abnormal biologically and chemically. Here the distinction between saprogenic and pathogenic bacteria is wholly effaced, and it must be granted for the whole class of cases, from the simplest diarrhoea to cholera nostras, that no line of demarcation can be drawn between putrid "intoxication" and specific infection. Dr. Hueppe contends that all specific bacteria owe their origin to putrefaction bacteria, on the Darwinian principle of modification by descent, and that a hygiene of cleanliness is the best prophylactic against infectious disease.

With such views the closest observations of the practical sanitarian and Medical Health Officer must coincide; and the argument through all the teachings of the eminent scientists of a whole century brings us back simply to the old crusade against filth in its Protean forms, and to the common sense though old teachings of the Jewish economy.

\*This subject is developed fully in the article on "Ptomaines," found on page 118 of February number.