SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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THE SELF-PURIFICATION OF RIVERS.[1]

WE have evidently placed too much confidence in the innate power of rivers to throw off the evil effects of pollution by sewage, which power we now see is largely imaginary. On the other hand, we find, if we may believe the authorities, some comfort in the fact that the bogy of the present day, the microbe, has not that miraculous vitality which popular belief has attributed to it, and is even to be disposed of by so commonplace a matter as sedimentation. Dr. Frankland in the course of his paper refers more than once to the remarkable powers of self-purification of the Thames. That our metropolitan river must practise this virtue to a prominent degree is manifest from the cruel ill-usage to which we subject it; but we gather that the author referred chiefly to the up-country reaches. Below bridge, especially in the neighborhood of Barking and Erith reaches, no self-purification could compensate for the filthy flood that is daily discharged at Crossness. There have been reports of various highly paid experts from time to time, the reading of which would lead one to suppose that there was nothing, or little, to be desired in regard to the state of the water in this region. But those who live near the banks, or whose duty takes them down the river, know how misleading these reports are. At low water especially, the banks are formed by reeking flats of sewage deposit, and when a steamer passes along and churns up the filthy sediment the stench is of a most sickening description.

To return, however, to Dr. Frankland's paper, which says nothing about the unsavory reaches below bridge, the author commences by saying that the subject of the self-purification of rivers admits of being considered from two perfectly distinct points of view, viz., from the chemical and from the biological aspects. Until recently the subject has only been discussed from the chemical point of view. The firm conviction possessed by many that rivers undergo spontaneous purification in the course of their flow is generally based upon personal observations made upon streams in which the process appears to be going on in such a striking manner that no analytical evidence is required. All engineers are acquainted with streams which are visibly polluted at one spot, and apparently pure a few miles lower down. When such cases are further submitted to analytical tests, the latter, of course, fully confirm the previous ocular impressions. In fact, such disappearance of organic matter does take place, but when these cases of supposed self-purification are carefully investigated, it becomes very doubtful whether the phenomenon is due to anything beyond dilution and sedimentation. The careful experiments which have been made to test this point are by no means numerous. A series of investigations was made by the Rivers Pollution Commissioners of 1868 to test the point, both as regards highly polluted streams and comparatively pure ones, but in both cases their results were of a negative character, and pointed to no real purifications, i.e., destruction of organic matter, although there was distinct evidence of considerable improvement in the quality of the water through sedimentation.

Some years ago Dr. Frankland undertook a series of experiments to further test this point in connection with the Thames, which has always been regarded by some as a river possessed of most remarkable self-purifying power, and which undoubtedly often does reach London after a long flow through a cultivated and fairly populated district in a surprisingly pure state. The experiments in question consisted in taking samples of the water flowing in the river at different points on the same day, with a view to establishing whether on the whole the chemical quality of the water was improved or deteriorated during the course of its long flow. Thus, on one day, samples were taken at Oxford, Reading, Windsor, and Hampton; on another day at Chertsey and at Hampton; and on three different occasions samples were collected both at Windsor and at Hampton on the same day. The results of analysis of these various samples are recorded in a table accompanying the paper. They clearly indicate that the chemical quality of the water undergoes slight but almost continuous deterioration in flowing from Oxford to Hampton. This deterioration is in spite of a very large increase in the volume of the water, a large proportion of which gains access to the river from springs in the chalk, and is of the very highest purity. Thus, Mr. Thornhill Harrison, C.E., has determined that the total increase in volume in the Thames between Maidenhead and Thames Ditton was (exclusive of the Colne, Wey, and Mole) in April, 1884, 249,500,000 gallons per day; on July 8, 1883, 49,000,000 gallons; July 22 to 26, 131,000,000; November, 1890, 45,000,000.

After quoting several columns of figures contained in tables, unfortunately too voluminous for us to reproduce, the author goes on to point out that by their study and that of the most recent investigations, we are led to the inevitable conclusion that sedimentation is the main cause of any self-purification in river water. Of any oxidation of dissolved organic matter there is still no reliable evidence, although of course dilution, which frequently takes place on the largest scale, as in the case of the Thames, without being suspected until made the subject of a most careful scrutiny, will produce a superficial appearance of such a result. This removal of microbes by sedimentation during the flow of a river is unquestionably of great hygienic importance, and of much greater hygienic importance than the alleged oxidation of dissolved organic matter, which in itself can have no power of communicating zymotic disease. It is, however, a process which cannot be relied upon as furnishing any guarantee that harmful microbes, turned into a stream at a given point, will no longer be present in the water at any point lower down. From the numerous experiments which have been made on the vitality of pathogenic microbes in water, there can be no doubt that many forms which might have subsided, would remain alive for long periods of time, and be carried down uninjured when the river was next in flood. Dr. Frankland concludes his paper by saying that we must not allow sedimentation of microbes to cause us to relax our protective measures to exclude contamination from our streams, but on the contrary, bacteriological research clearly indicates, on the one hand, the value and importance of purifying by the very best available means all dangerous liquids, such as sewage, before admission into rivers; and, on the other hand, to submit the water drawn from streams for town supply to the most careful subsidence and filtration through sand before delivery.

[1] Abstract of a paper by Dr. Frankland, read before the Health Congress, London, Aug. 17 (reported in Engineering).

THE Summer School of Ethics and Sociology at Plymouth, Mass., the first session of which has just been held, is described in a brief illustrated article in the *Review of Reviews* for September. The article is illustrated with portraits of Professor Felix Adler of New York, Professor Toy of Harvard, and Professor Henry C. Adams of Ann Arbor.