greatly improve the condition of the water. Much of the water from the upper Hudson and the northern tributaries of the Mohawk shows the effect of this sort of pollution, but the dilution from comparatively unpolluted sources is great enough to reduce it far below the objectionable point.

After this study, which usually is not very important, comes the study of the pollution by the population on the watershed. In investigating the purity of an established supply or in selecting a new one this is the most important study of all. We have approached the subject in three ways, keeping the results obtained by the three processes in juxtaposition so that they can be used as mutually explanatory. The first and, after sufficient experience in judging effects, the best method is by actual inspection of the polluting matters discharged into the stream. These matters consist of sewage, garbage, drainage from fertilized fields and other sources of animal matter, and the discharges from manufacturing establishments, some of which are chemicals and some putrescible organic refuse. In connection with this inspection goes a determination of the amount of water flowing in the stream at the point of entrance of the polluting matter. A careful study of the relative amounts of polluted liquid and river water with the proper consideration of the amount of pollution the water already contains and the character of the new supply will give a very clear idea of the condition of the resulting mixture. Detailed study by chemical and biological methods of typical conditions will bring one to the ability to determine by the inspection the probable condition of new streams in approximately the same circumstances. In our own case, having but little material obtained under the conditions existing in this country, it was necessary to make this detailed examination.

The second process applied to the river was, therefore, the chemical analysis of numerous samples from various places. It is usually considered that the elements determined in water analysis which denote the amounts of organic matter in different forms and the amount of salt are the important ones. The list included, therefore, albuminoid and free ammonia, nitrogen as nitrates and as nitrites, chlorine, oxygen absorbed, as well as the total solids, loss on ignition, color, appearance, and odor at 100° F.

The third process applied was the biological analysis of samples of water taken from the same places as those for chemical analysis and from many more. The biological analysis may be made with reference to the number and kinds of algæ, infusoria, and other microscopic animal and vegetable life, with reference to the numbers of bacteria, and with reference to the numbers of such species of bacteria as can be recognized as coming from sources which are dangerous or suspicious. All of these determinations will be valuable in deriving a basis for a definite opinion as to the character of the water. A few experiments were made under the first head, and it was found that as regards flowing water in rivers this determination was not as necessary as others, moreover, the methods of such analysis have been well elaborated by others, therefore it was left until a more convenient season. It is advisable to make this analysis on some samples, however, to secure the fullest knowledge possible.

As regards the determination of numbers of bacteria, it was soon discovered that in order to determine the relative amounts of pollution in the rivers at different places, it is necessary to reduce the possible sources of addition to the numbers of bacteria to a minimum. This is done by waiting until a rainless period, or nearly so, has intervened of sufficient duration to reduce the river to its low stage and then give time for the collection of the samples. It is possible by taking this precaution to show the increase in pollution by showing the increase in numbers of bacteria below the source of pollution. Rains, sharp and heavy or long continued, will wash into the stream much matter from the soil, abounding in bacteria, so that the indications of pollution from the constant flow of sewers and the like will be greatly obscured. It is probable, also, that it would be difficult to compare the purity of two streams in widely different parts of the country or in different conditions as to soil, slopes, area of watershed, etc., on account of the consequent variations in numbers from what may be called outside sources. Our work has shown the possibility of determining the relative increase in pollution in the flow of a single river when proper precautions are taken. One point to be mentioned is that where sewage is discharged into still water much of it will settle at once and samples taken near the surface will not show the full effect of its presence.

The numbers of bacteria, at least unless determined without the greatest care to eliminate all disturbing conditions, are not therefore so important an indication as is desired. It is well known that there are species of bacteria which exist under their most favorable conditions in the intestines of men and the higher animals, but will live for a greater or less length of time in other places. If the numbers of such bacteria could be ascertained the relative amount of pollution from such suspicious sources would be best determined. On the recommendation of Dr. Theobald Smith of Washington we tried the method of determining the numbers of *Bacillus coli communis*, by the fermentation-tube method. This bacillus was selected because it is the most common in fecal matter and its growth in such media as ordinary river water at ordinary temperatures is believed to be very slow, if there is any. The method suggested by Dr. Smith was found to be easily applicable in practice, and some very valuable results have been secured. It promises to be a most valuable aid in determining the pollution of water, and is especially valuable because it gives the statement of the serious part of the pollution, while all the other methods mentioned are open to the objection that they may reject a water which has a large amount of pollution not from dangerous sources, the water being, therefore, comparatively clean; while they may, on the other hand, pass as good water which shows but little actual amount, that amount being of a very suspicious nature.

Many of the results of the investigation whose programme is presented above, are given in the last four reports (tenth to thirteenth) of the N. Y. State Board of Health. A paper by Dr. Smith, giving the argument for the selection of *B. coli communis* as the index of pollution, is given in the thirteenth report. The investigation is not yet finished, and other reports will follow until sufficient data have been obtained to warrant a definite statement as to the condition of the water at the intakes of the various waterworks which draw from the lower parts of the rivers under investigation. It is believed that the work done shows that the programme given above is the proper one to follow, and this statement of it is therefore made with the hope that it will be found useful in other cases. Considerable experience in selecting conditions and in collecting samples and data will be necessary to make one expert in drawing definite conclusions from the results obtained.

NOTES AND NEWS.

THE museums and laboratories of the University of Pennsylvania are represented by a very considerable exhibit at the Columbian Exposition. The University has erected an inclosure on the space assigned to it in the gallery of the Liberal Arts Building, for which the design was contributed by the University School of Architecture. This forms the exhibit of that school. Within this space are contained various collections from the different departments. Notably the Veterinary and Biological. The latter contributes a psychological laboratory, which will be in operation during the summer. The Department of Archæology has sent collections from three of its sections, American, Babylonian, and Egyptian, which are now installed in the gallery. The large collection of games and religious objects contained in the Oriental Section of the Museum will be shown in the Anthropological Building.

— The present interest in subjects connected with the study of sociology has led Professor Charles R. Henderson of the University of Chicago to prepare "An Introduction to the Study of the Dependent, Defective, and Delinquent Classes," which will be published about June 1 by D. C. Heath & Co., Boston and Chicago.