In 1901 both general chemistry and qualitative analysis, with some quantitative work, to illustrate laws.

The object and aim of chemical study in the two periods may be illustrated by excerpts from the prefaces of two books. The one in 1876 says that the author "has sought to make a pleasant study which the pupil can master in a single term, so that all its truths may become to him household words. This work is designed for the instruction of youth and for their sake clearness and simplicity have been preferred to recondite accuracy."

The 1901 author says: "The tendency of the present day is to make the student, from the very beginning, an *investigator;* to train and develop his faculties for observation; to make him find out facts and discover truths for himself; in other words, to make him *think* instead of merely committing to memory what others have thought."

What will be the next progressive movement in secondary-school chemistry? Already a few dim shadows are being cast which may materialize. In schools of the larger cities there is a growing demand for elective courses and elective studies in every department of learning. Elective *courses* are not a new idea, but should high-school pupils be allowed to choose *all their studies* throughout a three or four years' course, it would profoundly affect the scope of teaching and indirectly the methods. Another coming event is the reaching down of chemistry into the grammar grades. This has been successfully done in some few cities and towns. Should the grammar grades teach chemistry and the high-schools have elective studies, the higher grades of quantitative, volumetric, organic and theoretical chemistry may be forced into the high-school, and a minimized university result.

Another indication is that of cooperation. Chemistry teachers are beginning to form associations for discussion of methods and aims. There is at present a wide diversity in methods of chemistry instruction. While these can never be wholly unified, nor is it desirable that they should be, owing to varied environments, yet discussions of methods, aims and results are most stimulating, and secondary schools may, in this respect, take a step in advance of colleges and universities. Magazines and periodicals for the discussion of what is latest and best in science-teaching mark also the new era, and are an indication in the same direction. The *Journal of the American Chemical Society*, whose 25th anniversary we celebrate to-day, may join hands with its infant sister, *School Science*, the youngest representative of scientific education.

From the twentieth century aspect of chemistry study, is it too much to say that it realizes more fully than perhaps any other single subject the ideal for combined manual, observational and intellectual training?

Rufus P. Williams.

SCIENTIFIC BOOKS.

Public Water Supplies: Requirements, Resources, and the Construction of Works. By F. E. Turneaure and F. H. Russell, professors in the University of Wisconsin. New York, John Wiley & Sons. 1901. Octavo. Pp. xiv + 746.

This volume has been prepared with particular reference to the needs of teachers and students in engineering colleges, and it is from this point of view that the following remarks are made: The field covered is a large one and in no other branch of engineering has there been a greater growth during the past twenty-five years. In particular the methods of purification of water have, by the aid of the sciences of chemistry and bacteriology, become so thoroughly understood that they are now of equal importance with the operations for storage and distribution.

Part I. of the volume, covering 197 pages, relates to the sources of supply, rainfall, flow of

streams, chemical and bacterial examinations, and the diseases caused by impure water. Part II., consisting of 549 pages, treats of hydraulics, works for the collection and storage of water, purification systems, and the methods of distribution by tanks, pipes and pumps. The space devoted to the different topics appears well proportioned to their relative importance, the subjects themselves are usually thoroughly treated and descriptions of the most modern practice are freely given.

The question of economy in engineering construction is a controlling one in all comparative designs, and this book is one of the few to bring it prominently to the notice of the student. The annual interest on the first cost, plus the annual cost of operation and maintenance, is to be made a minimum, and the general method of doing this is set forth clearly and satisfactorily. Even in cases where the general method is not of direct application, the economic arrangement of details is often discussed. Thus, the economic size of one sand filter bed is shown to depend upon the number of beds, and upon the cost of walls and bottom filling as compared with the cost of piping, valves and other appurtenances. Such discussions are a characteristic of modern engineering and their introduction into text-books should be welcomed, for economic construction is the corner stone of sound engineering practice.

The general subject of hydraulics is set forth only to a limited extent, as a full treatment could scarcely be given in a single chapter. The laws of flow of ground water are, however, fully presented and useful formulas developed, while the subject of water hammer is discussed in a novel manner. Reservoirs, dams, filtration systems, conduits and pipes, pumping machinery, and the distribution of water, are well and thoroughly treated, with numerous examples of constructed works. In short, it may safely be said that the book constitutes one of the very best treatises on water-supply engineering now before the American public.

At the end of each chapter, with the exception of the brief one on hydraulics, there is given a useful list of literature. Periodicals are cited in italics, while transactions and books are in Roman type. Few engineering students will know what is meant by *Hyg. Rund.*, *Cent. f. Bakt.*, and other similar abbreviations which should properly have been written out in full. The book seems, however, remarkably free from errors that are apt to occur in a first edition. The most serious ones noted are on page 213, where it is said that one U. S. gallon is 0.1605 cubic feet, and on page 216 where the word 'longitudinally' should have been 'transversely.' The book is well printed with the exception of the cuts, many of which properly deserve severe criticism.

The chapter on chemical and bacterial examinations of water appears to be the only one that is likely to prove unsatisfactory to engineering students. Bacteria are not defined and described in respect to size, form, color and functions, and the impression is given that all are specific germs of disease, while there is no hint as to the useful work performed by many species in transforming injurious decaying matter into harmless constituents. At the foot of page 123 a statement is made implying that bacteria in water are found in the suspended matter and not in solution. On page 125 it is said that a water rich in bacteria is not necessarily poor in quality. On the whole this discussion lacks that definiteness and logical method which is demanded by engineers. The chemical part of the chapter is better, but it is also lacking in definiteness, as no records of analyses are given and little is said which will enable a student or engineer to interpret the results of a water analysis.

The field of water supply on both the sanitary and construction side has become so vast that special treatises on the chemistry and bacteriology of water, filtration, reservoirs, standpipes and distribution plants are demanded by practicing engineers. For the student, however, such differentiation is neither feasible nor desirable, and this volume, with the exception above noted, presents such a satisfactory review of the theory and practice of the entire subject that it will undoubtedly prove of great service in technical education, and at the same time take high rank as a manual for young engineers.

MANSFIELD MERRIMAN.

LEHIGH UNIVERSITY.