CHEMISTRY LARGE FIELD

Study Has Developed Rapidly ---Is Still Progressing

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Not so very long ago the chemist confined his efforts to the direct transmutation of baser metals into gold. Later, the more practical and indirect methods were discovered, and still later there became evident a higher goal than gold. Parallel with this advance has been the gradual evolution of the chemist from the stage of necromancer through that of servitor to the pharmacist, and of analyser limited, to that of servant plenipotentiary. Evidently the development is still under way.

A young man considering this vocation has such a broad field before him that he may be sure of making himself useful in some, to him, interesting part of it. Within the boundaries of biological chemistry there are all the reactions of life to be studied, from parthenogenesis to immunity. Many well trained chemists will find most interesting, exciting and remunerative service in that territory in the near future. One need only to refer to the chemical work now being done in connection with such histological plagues as tuberculosis and cancer to indicate boundless utility. We may now see also the unlimited tracts of synthetic organic chemistry. It looks as though any desired physiological properties in matter could sometime be produced by the suitable study of complex organic substitution products. The architect, with his limited building materials and the relatively narrow requirements of his constructive design, must be considered cramped, in comparison with the synthetic organic chemist.

But there are many parts to the field. A thousand trained chemists in this country are now devoting their lives to the foods of animals and plants. Fully a thousand more are continually determining the composition of industrial products, to aid in keeping these materials within specifications, expressed or not, of maximum utility. Hundreds of chemists are at work in all conceivable branches of new usefulness. They are the pioneers who, possibly ahead of the instant demand, are attempting to increase the pleasure of living by new devices and inventions. I include in this group those explorers who, for the pure love of research and its otherwise unpurchasable pleasure, are advancing the science as a whole and fashioning tools for the use of later generations. We often hear of pure and applied chemistry, as though they were different kinds. It is rather the individual exponents who differ only at times.

I assume that this letter is directed to a narrow group of readers. It has a purpose. This is confined to the calling of the chemist. The aim, however poorly sighted, is at the immediate future for chemists in America. Exterpolating on the chemistry-time curve of the past, it is very evident that the rate of rise of chemistry, whether applied as an art or a science, is in both going to be very great. The demands upon the chemist are being increased more rapidly all the time.

The velocity of advance which a few years ago was greatest in Germany seems to be greatest now in America. The advanced science of chemistry or physical chemistry which in 1890 was only taught in Germany, is now taught in most of our American colleges. A few years ago a student of chemistry looked forward almost entirely to the profession of analyst, or teacher. Now he may be an engineer in any one of a score of industries, a specialist in any one of a dozen different lines of Government or municipal work, a research investigator in any one of a large number of widely different industrial laboratories, a consulting chemist, a patent specialist, an electrochemist, a metallographist, etc., etc., etc.

There are a number of research laboratories now at work in connection with manufacturing plants and others are being established. In the one of which I am the Director there are about thirty trained chemists confined to experimental work. A separate analytical laboratory at this plant employs a dozen or more chemists.

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CHEMISTRY IN INDUSTRIES

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ately be called, chemical engineering, must be constructed. First the chemical principles underlying the process and the conditions of reactions and equilibrium must be considered; and second, the design of the necessary apparatus, the choice of the materials of construction to withstand the chemical reagents employed, and the other factors which determine the final economy of the process must be fully appreciated.

The necessary supplies for every manufacturing enterprise may be considered under two heads: energy and raw materials. The raw material will differ more or less for each industry and must be considered separately; but the supply of energy is the same in all. Hence the course in industrial chemistry considers first the available sources of energy, the methods of economically using the same, whether it be as chemical, electrical, or mechanical, and the relative cost of energy in its different forms. Again many processes largely mechanical in nature are common to a number of chemical industries. In many cases the completeness of the chemical process or the perfection of the product is dependent on the preparatory mechanical treatment. Thus the chemical reaction on which the properties of Portland cement depend are largely controlled by the fineness to which the raw materials are ground and the completeness with which they are mixed. The principles of such operations as grinding and pulverizing, calcining, drying, evaporation and distillation are treated in a fundamental way without reference to any particular industry in which they may later be employed.

In considering the various manufacturing industries which depend essentially on chemical reaction, attention is given to the factors already mentioned, namely the chemistry involved, the plant necessary and the supplies called for. But of great interest and importance also is a consideration of the influence which important advances in industrial chemistry have had on civilization as a whole. The invention of gun powder revolutionized the history of the world and gave a serf with a gun an advantage over a knight in armor on horseback. Modern high explosives make it possible to remove mountains without the abnormal expenditure of faith called for by holy writ. The wonderful influence which chemistry has had upon history has been through its application to every-day life of the people, and this has been through industrial chemistry. A consideration of these broader phases should not be omitted.

The transition from a chemical preparation carried on in a laboratory to the same preparation as made on a commercial manufacturing basis, is often beset with difficulties. In order to determine some of the more important factors which must be considered in passing from a laboratory to a factory, a laboratory course in industrial chemistry has been provided. In this course no atempt is made to ape factory methods, or to do anything on a factory scale; but rather the time is devoted to the solution on a laboratory scale of that class of problems which are incident to factory work. In other words, the course attempts to teach method in attacking the problems which are inherent in factory practice from a broad chemical engineering point of view. Much attention is paid to the preparation of technical reports; in putting into concise, readable English the results of experimental work, so that the important facts may be brought before the busy man in a form that will insure his continued reading, rather than be laid aside for the leisure moment which never comes.