tunity to increase until they once more inhabit their ancient haunts up and down the coasts of the two Californias.

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ROGER FREDERIC BRUNEL[1]

IT has been my good fortune to come in close contact with the scientific work of Dr. Brunel from a number of points of view, and I consider it a privilege to have the opportunity to endeavor to make clear in a non-technical way the value and significance of his contributions to the science of chemistry.

My interest in Brunel's work was aroused by his first publication because I was working in the same general field of chemistry and because of the fact that we were graduates of the same university. The thesis presented by him in connection with his work for the doctorate gave a clear indication of his skill in experimentation, and an insight into the kind of a problem that aroused his interest. In contrast to many researches in organic chemistry which have as their aim the preparation of a series of new compounds lacking theoretical interest, the problem under study had to do with the more fundamental properties of molecules. Chemistry is concerned primarily with the study of the transformation of one kind of molecules into another kind. Only recently has attention been paid to what may be called the mechanism of such transformations—that is, the manner in which reaction takes place between the chemical units. Research of this kind involves the development of new methods and a high order of scientific imagination. It is more difficult and less likely to yield a wealth of new facts suitable for publication. It requires quantitative measurement and the point of view of the physicist.

The fact that Brunel began his research work in this special field of organic chemistry, no doubt, was the determining factor in his subsequent activities. All his published work has to do with the study of the most fundamental things of the science. The reputations of many chemists are based upon the fact that they have added perhaps hundreds of new substances to the long list of known organic compounds—Brunel was attracted by the more profoundly important problems of how molecules interact and the nature of chemical affinity itself.

His association with Professor Arthur Michael, immediately upon graduation, was most fortunate, because he came in the closest contact with the leading investigator in organic chemistry in America, and a man of international reputation on account of his leadership in what I may call the philosophy of the science. Michael was studying chemical affinity from the standpoint of energy, and the work of the two investigators led to results of great value.

When I was asked to review Brunel's work I wrote to Profesor Michael to tell him of the action taken by the authorities of Bryn Mawr, as I knew he would be pleased at this recognition of the services of his former co-worker. I have just received a reply to my letter from Professor Michael from Bermuda. He writes:

> The sudden death of Dr. Brunel was a shock to me, as it must have been to his other friends, who, like myself, know his fine personal character. He worked two years with me, so I had ample opportunity to appreciate his acute, rare mentality, and his unusual skill in experimentation. I have always considered Dr. Brunel one of our ablest investigators in organic chemistry, who already had made notable contributions to the science and of whom much might have been expected.

The work done with Michael had for its object the study of variations in chemical affinity brought about as the result of the change in the arrangement of the atoms in molecules of the same composition. In these researches the quantitative point of view, which is not considered in so much work in organic chemistry, was stressed as before—the results obtained were of great scientific value. It may be interesting to point out here that these results have been found useful in connection with certain industrial developments based upon the compounds studied.

One of the outstanding contributions of Brunel was the paper published in collaboration with Marguerite Willcox. This investigation centered around the study of the relative chemical affinities of certain important groups of atoms. The concept of chemical affinity was that derived from modern physics and physical chemistry, and quantitative measurements were made. The mode of attack of the problem and the detailed plan were both most ingenious. The research is a model that could well be followed in investigating further chemical affinity, and this study is, to my mind, the most important problem before chemists to-day.

Another paper published by Brunel, in collaboration with Crenshaw and Elsie Tobin, illustrates a second type of research in which he was a master. In this paper are recorded the properties of certain alcohols. The materials upon which measurements were made with a high degree of accuracy were first obtained in an unusually pure condition. The work showed great attention to details, and the results are taken as standards by organic chemists.

A short time ago one of my own students was preparing a sample of an alcohol and I questioned him as to the purity of his product. He replied with a

[1] Address at the meeting in memory of Dr. Brunel held at Bryn Mawr College on February 5, 1925.

sense of conviction as to the success of his work, that the properties of his material were identical with those published by Brunel. He was satisfied and so was I.

During the war Brunel interrupted his work to take up certain investigations on war gases suggested by the authorities in Washington. He studied with his customary care certain gases which were used to induce a copious flow of tears. Such gases served an important purpose in interfering with the preparations which are necessary before an attack is made. Lines of communication are shelled and, as a result, all work must be done by soldiers who are protected by masks. These cut down markedly efficiency and, consequently, slow up military operations. I had the pleasure of communicating to English chemists, who were working on the same substances, the results obtained by Brunel. As a result their efforts were turned to other problems.

JAMES F. NORRIS

SCIENTIFIC EVENTS

WORLD WHEAT PRODUCTION[1]

DURING the past ten years it has been realized that all the countries in the world have a common bond in the international trade in wheat. Various adjustments in relationships have perforce been necessary, but the six years which have elapsed since the war have given wheat-growing countries time to stabilize their positions and in some degree to accommodate themselves, on one hand, to the cessation of export from Russia, and, on the other hand, to the discontinuance of the artificially enhanced production prevalent during the war years. For this reason the agricultural statistics for 1923 published by the International Institute of Agriculture at Rome, with their comparisons with pre-war years, are of special interest, since they do at this stage indicate the trend which agriculture in general and wheat production in particular is taking throughout the world.

The situation as revealed by the year-book is, on the whole, reassuring. Except in Europe, both area and production in wheat show an increase over the corresponding figures for the period 1909–1913. In North America the increases in area and production are approximately 40 per cent. The year 1923 was admittedly a favorable one for wheat growing, but an examination of the annual returns shows that this increase is not an isolated instance. Europe is still 7.3 per cent. below its pre-war average in production of wheat, and 9.5 per cent. below its average area in that crop over the same period; but the area has increased steadily since 1920, and the production, notwithstanding fluctuations, has never fallen lower than it was then.

Russia is omitted from these returns, but the decrease in wheat production in that country during 1922, when famine conditions were at their worst, is now authoritatively stated as fifty-five and a half million quarters, or 65 per cent. of the pre-war average. In 1923 Russia had a small export trade. It will be remembered that, before the war, Russia was one of the chief sources of the world's wheat supply.

A good deal of attention has recently been directed towards the wheat production and crop balance-sheets of Canada and the United States. No appreciable decrease in area under cultivation in either country is recorded in the data published, but wheat production in both is less in 1923 than in 1922. Almost the whole of this loss can be apportioned to the United States, where increases in the more important crops of cotton and maize more than counterbalance it. Four million acres went out of wheat in 1923 and 5.4 million were added to the maize and cotton crops. Further, the excess of exports over imports of wheat has fallen from 32 million quarters in 1921 to 9.6 millions in 1923. Taken together, these figures would seem to afford a striking confirmation of the forecast made by the Bureau of Agricultural Economics in the U. S. Department of Agriculture Year-book for 1921. In a paper on "Wheat Production and Marketing," O. E. Baker says, "Wheat production, however, has been increasing less rapidly than population in this country, and it is very probable that this will continue to be true, at least until we reach the point where we consume practically all we produce." Such a state of affairs is obviously of very serious import.

The International Year-book has grown during its brief career, and this issue gives many more details than its predecessors. It is to be regretted that in so doing it has been thought necessary to discontinue some of the summary tables. That relating to the percentage of each crop, based on total area under cultivation in each country, is a noticeable omission. The book contains sections dealing with crops, live stock, trade returns, prices, freight charges, fertilizer consumption and rates of exchange, and will repay perusal not only by the agriculturist and economist but also by the interested layman.

THE TRANSMUTATION OF MERCURY

THE department of chemistry of the University of Chicago has authorized publication of the following statement:

Recent reports in the press indicate that Miethe, in

[1] From *Nature*.