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Chemistry As Related to Arts of War and Peace

Prof. Adam Cameron as Faculty Orator Deals With Subject in Address in Praise of Founders at U. N. B. Encoenia—The Methods Followed by Germany Must be Combated—How Lost Scientific Ground was Recovered.

In the absence of Prof. Adam Cameron, his Address in Praise of the Founders was read by Dr. W. C. Keirstead at the University of New Brunswick Encoenia exercises this afternoon.

May I Please Your Honor, Mr. Chancellor, Mr. President, Members of the University Senate and Faculty, Ladies and Gentlemen.

With the shadow of war scarcely lifted from our lives and the realization deepened of the difficulties confronting those of our leaders who have done their utmost to find the most satisfactory solution of the great difficulties and hindrances to a lasting peace, our minds are still freshly interested in the many technical problems that since 1914 have presented themselves in connection with operations in the field and in industrial problems at home in the field of chemistry. This science for many years previous to the war was a general way the preserve of scholastic minds. They saw its possibilities touching national industries but, in spite of repeated warnings, these possibilities did not reach the popular mind, mainly through the want of recognition and financial support of the Government. For the half century previous to 1914, every British chemist of distinction had seized every available opportunity of insisting that the national neglect of chemistry was leading the nation into difficulties.

Cause of Change.

Some attempt should be made to explain the rapid change of public opinion with regard to chemistry which set in with the autumn of 1914. We require to understand clearly how neglect of any scientific subject could so suddenly give place to absolute worship. The reason is one which will be readily appreciated. For the past century, chemistry has been a favorite subject of study in British countries and many of the milestones in the rapid advance of this branch of experimental science have been placed by British chemists. Many of the important chemical industries were established in Britain and flourished until state-aided foreign competition caused their transference abroad. Public interest has never awakened to the national importance of conserving these British industries and they consequently languished as a result of greater administrative astuteness exhibited on the continent of Europe. At the commencement of the war, the sudden stoppage of German chemical imports into Britain led to difficulties in all productive enterprise. For example the stoppage of German coal-tar dyes worth about \$10,000,000 per annum checked a turnover of \$1,000,000,000 per annum in textiles to such an extent that the production of khaki woollens for the troops was endangered. Again, natural and artificial pharmaceutical products such as quinine, salicylic acid and antipyrine mostly controlled or produced by Germany rose to phenomenal prices: alloys necessary in manufacture of steel for high speed tool and armour plate again largely of German origin, were difficult to obtain. Hundreds of other instances might be quoted to show the inhibitive effect produced upon industries representing an annual turnover of ten billion dollars, by the impossibility of obtaining a few million dollars worth per annum of necessary materials. We know now this economic preparation of the enemy was a well-planned and carefully executed scheme of seconding military effort. A nation embarrassed in its industries is necessarily weakened both in defence and offence. The tardy realization of the fact that the Empire had been brought to the verge of ruin by its neglect of applied science has been a great stimulus to public opinion. It is perhaps not yet clearly understood that the neglect of pure science was almost equally responsible for a very precarious position. To quote from Sir Joseph Thomson, "Pure science is the seed of applied science and to neglect pure science in a thing of this kind would be like spending a very large amount on manuring and plowing the land and then to omit the sowing of the seed." The few examples quoted will probably suffice to indicate that the science of chemistry really possesses national aspects and in order to accentuate the point, it will be useful to outline briefly the history of one or two important advances in technical science.

Case of Tungsten.

Let us take the case of Tungsten of which we have a valuable deposit in this province, unfortunately in rather an inaccessible situation. A firm of Sheffield steel manufacturers discovered, about sixty years ago, that the addition of tungsten to steel results in the production of an alloy of great value as a high-speed cutting tool material but the price of the metal tungsten prohibited its use on a large scale. Later German metallurgical chemists succeeded in producing tungsten at such a cost that its use in high-speed steel became practicable and a monopoly of the supply of tungsten to Sheffield was thus established by Germany. It is worthy of note that but little tungsten is mined in Germany and, although half of the world's production of tungsten is mined in the British Empire, its smelting was entirely in German hands. It is also noteworthy that while no German chemist made any strikingly novel contribution to the development of tungsten industry, while no important source of the raw material lay in German territory the major portion of the profits derived from this modern industry fell into German hands. At the outbreak of the

war, the shortage of tungsten led to a Government enquiry and the manufacture of tungsten was installed in Great Britain with such success that the smelted metal is now being supplied to the steel makers in a higher state of purity and at a lower cost than the German product.

German Potash.

One more instance of the important bearing of chemical science upon national concerns may be given. In the neighborhood of Stassfurt in Central Prussia lies the dried-up residue of a vast prehistoric ocean. Each separate material, sodium chloride, potash and magnesium salts, salts of bromine and iodine, which can be obtained by the evaporation of sea-water, is here found in a solid bed and can be easily mined. Of these components the potash salts are the most valuable principally on account of their increasing importance as agricultural manure. Stassfurt potash was first put on the market in 1861, and by its low cost quickly displaced the potassium salts obtained from other sources. It is interesting to note that there is in Alsace a deposit similar to the Stassfurt deposit and about one-tenth of the German potash was mined in Alsace before the war. That total pre-war production of German potassium salts was roughly equivalent to one million tons of potash per annum and of this production, from ninety to ninety-five per cent is used as fertilizer. The shortage of potassium salts outside Germany has been much felt since 1914 and many attempts have been made to provide the missing material; one very promising of these is found in the separation of potash salt from the iron-blast furnace flue gases. It is said that this source of potash salts in England could supply the agricultural needs of that country, which amounts to 23,000 tons per annum, all of which was imported from Germany in pre-war days.

Other valuable constituents of Stassfurt and Alsace deposits are iodine and Bromine; here again no other source of these elements has been allowed to compete.

The German Policy.

The consideration of the manner in which important raw materials, of which tungsten-steel, potash, iodine and bromine are but a few, have been dealt with by Germany, leads us to draw one important conclusion with absolute certainty. There have existed for many years in Germany bodies composed of men of wide expert knowledge concerning the economics of raw materials, whose advice upon chemical production was received and acted upon by the higher political and military authorities. The uniform intelligence with which practically the whole world's production of raw materials has been transferred to German hands, the widespread and far-reaching ramifications of the pre-war German control of the essential mineral and vegetable products, have been exhibited upon so vast a scale that they cannot be attributed to mere commercial enterprise of individual business concerns not unified by government aid. Germany has long had a definite policy for dealing with the raw materials produced within the British Empire; the British Empire has had none.

For illustrative purposes it has been convenient to quote industrial chemical operations as instances which show the intimate relation between chemistry and national prosperity. It is, however, necessary to enquire a little further and to ascertain upon what foundations a flourishing chemical industry is based. All German technological chemical prosperity has been founded upon the conviction that accurate and detailed scientific re-

search is the only sure starting point for any branch of technical production.

The large output of chemical research in Germany for many years has borne a direct relation to the development of the chemical industries in that country. It has been realized not only that some brilliant piece of experimental work is necessary for the initiation of any new technical development, but that incessant scientific work, perhaps of rather a routine and uninteresting character, is at least necessary to the development of the new industry; so soon as the scientific study of a technical process stops, further development ceases, and sooner or later the process itself becomes obsolete, owing to the introduction of some rival method based on more advanced scientific investigation. The neglect of the truth that technical progress can only result from scientific progress has been the undoing of many industries in the British Empire. The proper appreciation of the national aspects of chemistry must bring with it a great increase in the mass of experimental scientific work carried out within the British Empire. In this connection it is pleasing to note the important results already obtained in Canada and other countries of the British Empire, following the example of the mother country, by establishing advisory councils for scientific and industrial research.

British Discoveries.

Great Britain has a record in chemical discovery of which she may well be proud and in consequence many chemical industries may justly be claimed as based directly upon British discoveries. The coal tar color industry was initiated by the discoveries of Sir William Perkin in 1856 and was indeed established by him in England before it was ultimately transferred almost wholly to Germany. The cleverness with which the Germans worked out minutely ideas borrowed from other countries together with the now well-recognized policy of unconscious self-depreciation of the British had much to do with the want of recognition of what success we had with coal tar dyes in pre-war days.

Though the coal tar color industry had languished in Britain, it had never actually become extinct. By enlightened management, by modernizing of works and methods, the competition of British firms was being increasingly felt by the German firms, which, just previous to the war, were subjected the British firms to a severe price-cutting campaign because the British competition in sulphur and direct cotton blacks, was reducing to complete nullity the German conventions in those two classes of colors.

These British firms were a considerable national asset at the outbreak of the war; had these firms with their trained staffs and experience not been available, it would have gone much harder with color consumers in the textile industries. The fact that a private firm like Read, Holliday and Sons, Ltd., of Huddersfield, now merged in British Dyes, Ltd., were in a position to pay a dividend of ten per cent for the five years previous to the war, when they faced unaided the full weight of the German competition, shows that it was possible for a British firm to make a successful fight against the Germans in an industry which they claimed as their own.

Uses of Nitrogen.

Another noted chemical discovery, perhaps less generally known, may be quoted. About a century and a half ago, Cavendish discovered that atmospheric nitrogen and oxygen can be caused to combine at the high temperature of the electric spark. This was an observation of purely scientific interest and has since been used in countless pieces of scientific work. It was applied by Lord Raleigh a few years ago to the separation of the new element, argon, from the air. The shortage of nitric acid, which is so essential to the manufacture of explosives, in Central Europe led to the

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systematic study of the large scale combination of nitrogen and oxygen with a view to the use of the reaction in the manufacture of nitric acid. The process of converting the constituents of the atmosphere into nitric acid is completely successful and was actually in use for the manufacture of most of the huge quantities of nitric acid used in the preparation of explosives for Central Europe. Sooner or later, this or some analogous process must be installed in the British Empire for the purpose of replacing Chili saltpetre as a source of nitric acid. In this as in the working out of so many other British conceptions, Germany has been at a great advantage in that she has always been able to command the assistance of large numbers of competent chemists to do the careful and systematic, although unexciting, work necessary to the determination of all the essential conditions governing a particular chemical reaction. For this reason, the development of great scientific discoveries made in Britain has been too often left in German hands and the practical fruits of these discoveries have been gathered outside Great Britain. It is not enough only to lay down and carry out a definite policy concerning the handling of all the raw products of the Empire; it is essential that the policy should be adopted of systematically directing the youthful intelligence of the Empire toward natural science and that the policy should be carried out strenuously and liberally.

One hundred and twenty years ago our University was established. The founders had courage, hope, and, above all, vision. Let us see to it that we, who are left as trustees, do our share, not only in making the best use of learning that has proved of most value in the light of the past, but also in keeping abreast with the newest developments in the schools of scientific knowledge and hard experience.

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