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## SCIENCE AND INDUSTRY.

WHATEVER the political changes resulting from the present European struggle may be, it is certain that the industrial and economic changes will be of an equally striking and revolutionary character. Those of us who can remember Europe as it was before the war of 1870 and now look back upon the forty-five years which have elapsed since that fateful conflict, cannot fail to realise that the transfer of Alsace and Lorraine from France to Germany was an event of vanishing importance compared with the gigantic disturbance which has been brought about in Europe and throughout the world by the unprecedented industrial expansion of Germany which has taken place during the same period. Some idea of the stupendous magnitude of this rapid development in the matter of chemical industries may be gathered from the figures cited by Prof. Percy Frankland in a lecture recently delivered before the Society of Chemical Industry, and of which an abstract was published in our last issue. The magnitude and variety of the German chemical industries are surpassed in wonder only by the rapidity with which they have developed from the very small dimensions which they possessed prior to the war of 1870. Still more remarkable, however, is the fact that a similar investigation of many other activities, such as the textile, mining, metallurgical, electrical, agricultural, and shipping industries, would reveal developments almost equally startling.

It is this great industrial prosperity which has rendered possible the vast and amazing effort to secure German supremacy in Europe of which we are the spectators to-day. The older ruling class in Germany had but little interest in commerce and industry as such but it had the sagacity to see that its dreams of empire could only be realised by fostering industrial and commercial enterprise in every possible way. The ruling class, at bottom despising the tradesman in every shape and form, has had the wisdom to recognise that its prejudices must be concealed, and that everything must be done to put the wealth-producing classes into the most favourable position for competing with the similar classes of rival countries. The rulers of Germany had the discernment to apprehend that one of the most important weapons in that competition was education, and that education must not be of a uniform, stereotyped, and antiquated pattern, but must be elastic and carefully adapted to the needs of each particular class of the community. Education of every kind has been promoted, not only by pecuniary endowment but by the granting of exceptional privileges, both material and social, to those possessing attainments of a higher order, *e.g.*, by the reduction of military service to a period of one year only in the case of all boys who have passed beyond a certain school standard. Research of every description, not only in science but in every other branch of learning, has been fostered to an extent quite unknown in any other country.

This has resulted in Germany becoming beyond all other countries the land of the expert, "a country of damned professors," as Lord Palmerston once called it in the language of a bygone day. It is the country in which every man is proud of knowing his own particular business, nor will he be listened to on any other subject. In England, if a man succeeds in catching the public ear, his utterances on every conceivable subject will be accepted by thousands. Nothing is more astounding than the faith which large sections of people put in the omniscience of our prominent men. We can well remember how Mr. Gladstone, who had adopted the plan of replying by post-card to his innumerable inquirers, was once not only asked for his opinion on the efficacy of vaccination, but actually thought fit to express it. Other and much more recent examples of the faith reposed in self-constituted oracles amongst us will occur to most of the readers of NATURE. In Germany knowledge is so widely diffused, and it is so generally understood that real knowledge can only be attained by years devoted to some kind of research, using the word in its widest sense, that most educated Germans are aware that any given individual, however brilliant, can only be an authority in a comparatively limited field of knowledge. In Germany, therefore, it is only the opinion of the accepted expert that counts. If Germany is the land of experts, England is undoubtedly the land of amateurs, and, owing to the extraordinary genius of our countrymen, it is quite true that in the past most striking achievements must be credited to amateurs. Priestley and Cavendish were amateurs, as were Darwin and many others of high distinction that could be mentioned, but they assuredly became experts also in fact, if not in name.

Science is the dynamic and creative force in

industry, and it is only through scientific discovery that industry can rapidly advance. It is this fact which has been freely recognised in Germany, whereas it is from this fact that the great majority of Englishmen instinctively shrink. The German believes in shaping his practice on theory, whilst the Englishman moulds his practice on tradition and instinct, and avoids all theoretical considerations as far as he can. In the earlier stages of chemical industry, and whilst chemical science was in a rudimentary state, much was accomplished by the eminently practical instincts of Englishmen, but with the increasing complexity and refinement of the problems involved, progress has only become possible through profound knowledge gained by unceasing investigation directed by theoretical considerations, and it has been during this later phase that such rapid strides have been made by the chemical manufacturers of Germany.

Of all the chemical industries, the one which depends most entirely on a far-reaching knowledge of chemical theory is that of Synthetic Organic Products (Artificial Dyes, Drugs, Perfumes, etc.), for it would certainly require instincts of even a super-British order to be capable of devising methods for the economic manufacture of such commodities as indigo, adrenalin, and ionone! It is not surprising, therefore, that this branch of chemical industry is almost entirely in German hands, whilst the other branches are, for the most part, gravitating in the same direction.

It is not the unexpected which has happened, for that the neglect of science by our manufacturers would inevitably lead to this result has been consistently preached by British chemists during the past forty years. The irony of the situation lies in the fact that this relative failure of our chemical industries to expand has gone on *pari passu* with a great increase in our output of chemical research, the quality of some of which has been of a particularly brilliant kind. That this capacity for research has remained almost wholly divorced from industry is due to the British manufacturer, who has almost entirely failed to attract into his works the more brilliant chemists trained in this country. The remuneration and prospects offered are in general of such a disadvantageous character that they cannot be entertained excepting as a last resort. It is, moreover. the absence of any prospect of reasonable remuneration in industrial chemistry that greatly limits the study of chemistry as a profession in this country. The Government and the municipal corporations, in their capacity as employers of chemists, are no better than the manufacturers.

That the British manufacturer is himself in general entirely ignorant of chemistry is the result of our antiquated system of education. Whatever school he may have attended will almost certainly have been presided over by a headmaster reared in traditions of medievalism, with the result that he probably imbibed the idea that the study of science would relegate him to an inferior position in the school; at the university, unless he were reading either classics or mathematics, he would not, even at the present day, be in the swim, and would find little or no favour with the head of his college, whilst until recently he would have been of no account at all. He would then pass into his hereditary position in the factory knowing nothing of the science upon which the business is based, and incapable of understanding even the alphabet of the language of the chemical officers it may possess. What wonder, then, that he distrusts and fears these chemists, who are the brain of his business, and that he prefers to confide in the engineers, who are but little less ignorant of chemistry than himself.

That this is the typical situation in the chemical industries of this country was revealed in a particularly significant manner in the House of Commons only a few nights ago, when the Government scheme of "British Dyes, Limited," was under discussion. At the conclusion of the debate, the Parliamentary Secretary of the Board of Trade said that the man who was conversant with the science and practice of dye manufacture was unfit to go on the directorate, because, as he would know something of the business, the whole of the other directors, being but business men, would be in his hands. We are thus authoritatively informed, from his seat in Parliament, by the Secretary of the very Board which is entrusted with the duty to look after the commercial and industrial interests of the country, that the first qualification of a director of a public company subsidised by the Government is that he must know nothing of the business in which that company proposes to engage. Surely the report of this speech must have escaped the astigmatic eye of the official censor, or he would have passed his pencil over a piece of information so gratifying and useful to the enemy! As Prof. Armstrong, in commenting on this utterance in a letter to the *Morning Post* on Saturday last, very truly remarks: "Our fate as makers of dyes is sealed. We, the taxpayers, can do nothing but

look on while our million and a half is squandered by directors who now confessedly are to be men without business knowledge of the industry they control."

If we would take advantage of the great opportunity which this war affords for industrial and economic rearrangements, it is imperative that the ruling classes in this country should no longer continue in their present state of semi-education which passes as culture, and which permits them to go through life with little or no understanding of the vital importance of science to the State. If after the war we are to recover some of the chemical industries which we have lost, and even maintain those which we still possess, it is essential that the individual undertakings should be controlled by men who have a real and expert knowledge of the business in which they are engaged, and that our legislators should have had sufficient scientific education to enable them to understand such problems connected with these industries as may be brought before them. The experience of the past thirty years points unmistakably to the conclusion that industrial success is becoming more and more dependent upon the co-ordination of industrial effort, and the embarrassing position in which we find ourselves at the present moment, in respect of the supply of a number of chemical products, is largely attributable to the almost entire absence of any such organisation. In both France and Germany we understand that councils of experts have been appointed to inquire into the effects of the war on the chemical industries of these countries, and to report to their respective Governments as to what legislative measures are desirable for promoting their welfare. As the present crisis is on a scale which we trust may never recur in the history of the world, so the opportunity for discarding mischievous traditions, effete ideas, and clumsy methods of procedure is of such an altogether exceptional character that it is to be hoped we shall not allow it to pass unutilised through ignorance, lethargy, or divided counsels.

## *THE CHEMISTRY OF FOOD PRODUCTS.*

*Food Products.* By Prof. H. C. Sherman. Pp. ix + 594. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1914.) Price 10*s.* net.

APART from the analytical side, chemistry in its application to food products is a neglected science in this country in comparison with the activity which exists in America. The neglect, however, has been, in the main, in official and public circles, as several of the British food manufacturers of repute have availed themselves of scientific help for some years past, and it may be claimed that the high—not to say world-wide—repute of the products of some of these firms is to some extent due to the resource of, as well as the control exercised by, their scientific staff. In the United States, legislation has been very largely the cause of the awakening of the public interest in its food, and in this connection the name of Dr. H. W. Wiley will be remembered with gratitude by present and future generations. Whatever the cause, the development of the investigation of the composition and value of food products has been exceptionally rapid during the past few years: it is manifested by such outward signs as the foundation of university chairs in food chemistry in America, and the publication of informative text-books.

As the moment is ripe for reform, the wisdom of founding such a chair at our own Imperial College of Technology may be urged: there is much to be done, for example, in educating the public as to the food value of many low-priced products from our Colonial Empire, which are at present neglected, and in showing manfacturers how to make better use of the available raw material.

Dr. H. C. Sherman, who occupies the chair of food chemistry at Columbia University, has produced an exceptionally informative book, in which he combines an account of the production and preparation of the various food products for the market, with statistical data, details as to their chemistry and physiology, and an outline of the latest scientific research and opinions.

The book also contains a large number of up-to-date tables giving the food values, protein content, and mineral constituents of all sorts of foods, and is, indeed, replete with information of every kind, so that it will be indispensable to every food chemist and manufacturer. All the principal food products are dealt with in turn, each chapter being concluded with a list of references to the literature. Though much of the information given is outside the ordinary scope of the college trained chemist, it corresponds exactly with the practical details which the actual worker requires, and we do not remember to have seen this given so succinctly anywhere else. The more advanced scientific sections are equally satisfactory, so that current views are expressed without undue dogmatism: this is especially the case in the more physiological sections.

A good deal of space is devoted both in an appendix and elsewhere to the rules and regulations for the enforcement of the Foods and Drugs