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THE END OF THE SECOND WORLD WAR

THE dramatic collapse of Japan under the pressure of unprecedented air bombardment accompanied by the threat of invasion by overwhelming forces marks the end of the War of 1939–45 —the Second World War. More than that, it marks the end of a period extending over some thirty-five years which has witnessed increasing social unrest and suffering, culminating in warfare of an intensity never before witnessed, and physical destruction on an appalling scale. War has now become so terrible, so swift in its march and so indisc iminate in its cutting off of old and young alike, that the greater nations of the world must recoil with horror from the possibility of another major war, lest they court annihilation of whole populations. This is not to say that armed forces will be unnecessary; for so long as man falls short of the ideal in his ethical outlook and practice, there will be differences and disputes, some of which may lead to wars. But it should not be beyond the power of the nations, imperfect as man is, to limit the conflict and promote a swift settlement. Towards this end the United Nations Charter is a first instrument, based on a mixture of idealism and worldly practicability, which can be of prime importance for the future of humanity.

Two events of the immediate past will always be associated with the surrender of Japan to the will of the United Nations. These are the use of atomic energy in the form of a bomb of stupendous destructive power, and the declaration of war on Japan by the U.S.S.R. It is idle to speculate on their relative significance, in that both are the result of carefully prepared plans carried out over a long period; and the fact that they came to fruition almost simultaneously may have been a coincidence. In any event, we are more concerned for the moment with the significance of the release of atomic energy in manageable fashion. This, as we have already pointed out (*Nature*, August 11, p. 153), is a landmark in the history of mankind—it marks the beginning of a new era, an era in which the quality of the work of men of science of the world will not only be of immense importance, but will also be acknowledged as such. It is not suggested that men of science should become, as it were, a ruling caste, to whom all others would defer; they themselves would be the first to dispute any such intention, for their training does not of necessity develop the qualities needed for administration. Rather we would anticipate that they will be expected to take a share in the tasks of government, as they have done during the War, at the direct request of the ruling authority and with a conspicuous success which has been generally acknowledged and acclaimed. Gone, it is hoped, are the days when men of science were regarded as useful standbys, to be called in when things go wrong and speedily relegated to the background after use has been made of their knowledge. But scientific workers must also play their part; they must not allow their preoccupation with their particular interests to make them oblivious to their responsibilities as citizens of a world which is becoming increasingly dependent on their efforts, and they must maintain their high standard of integrity.

So far as the general outlook is concerned, the present position as regards scientific and industrial research is very little different from that at the close of hostilities in Europe (see *Nature*, May 12, p. 553). Everywhere throughout the world there are shortages due to sheer destruction, to lack of raw materials, to transport difficulties and so on. There are innumerable problems for men of science to tackle, arising out of war-time conditions; and in addition, there has been a space of six years during which scientific investigation has been very largely diverted from its normal course. Scientific workers will also be called upon in the immediate future in connexion with the control of Japanese scientific and industrial development.

This task will be much the same as in Germany; for Japan is highly industrialized, and the guidance of her industries on to peaceful lines will require equivalent measures. Nor need the difficulty of a language so different in form and structure from those of Western Europe be regarded as an insuperable barrier. Many educated Japanese are familiar with Western languages, and also there is a small number of European scholars who have studied Japanese history and culture and whose guidance will no doubt be sought; further, steps have already been taken to train students who show an aptitude for Oriental languages in readiness for such duties as may devolve upon an occupying body. So far as scientific and industrial processes are concerned, there will be little difficulty; the chemical equation has the same significance, both qualitative and quantitative, in the Far East as in the West, and there is no possibility of shades of meaning; mathematical symbols are equally definitive throughout the world, whether they are used in purely mathematical work or in connexion with aerodynamics, hydraulics, electrical engineering and other applied studies. Scientific research and industrial practices in Japan have come mainly from European and North American sources and employ the same terms and even the same symbols. Thus it is quite common to find a scientific paper written in Japanese but liberally sprinkled with chemical equations printed in Latin characters with Arabic numerals just as in European practice. Even in biology and geology, scientific terms are usually employed directly without translation, and the binomial system of nomenclature of living organisms is as apparent in papers in Japanese on biological topics as are the chemical equations referred to above. Indeed, the language of science, as it is written in Europe and America, is truly international in form and significance.

In devising means of controlling scientific research and industrial and engineering development in Japan, there seems no reason, as has been suggested above, why it should not follow the main lines laid down for the control of Germany, but with the important proviso that policy will be influenced by the counsel of those who are familiar with the Japanese mode of life and cultural tradition. It would be absurd to attempt control of a country like Japan, which, in spite of the veneer of twentieth century industrialization presented to the casual observer, is steeped in a tradition wholly alien to the outlook of Western Europe and North America, without adequate consideration of these factors.

So much for one specific problem posed by the control of Japan. The distance separating that country from Western centres will present difficulties for the maintenance of even a token occupation force, both as regards supplies and the morale of the men; and numerous other points for anxious decision must arise.

Many such matters must be regarded as involving what has been termed the tactics of science. We must now revert to the broader question of the grand strategy of scientific and technical development. The controlled release of atomic energy applied in the development of the atomic bomb emphasizes once more the importance of scientific research, and its significance for the progress of knowledge and for the material welfare of mankind. Scientific and technical research has made possible this appalling weapon of destruction, and it will not let the matter rest there. As was pointed out in *Nature* of August 11, the discovery is the culmination of many years of patient and sometimes dangerous investigations, and the fact that it has been developed for the purpose of war is no fault or desire of scientific men as a body. They will therefore wish to push on vigorously with investigations of the mechanism of the reactions involved, and with their adaptation to the peace-time needs of man. This may mean many years of labour —perhaps as many as have passed since the idea of atomic disintegration became more than the philosopher's dream. But they will not be deterred.

Nevertheless, means must be found of financing such investigations, which from their very nature can claim the interest only of those concerned with long-range developments; and present indications are that much elaborate and costly equipment on an engineering scale will be necessary. Only Governments or national institutions are likely to be in a position to respond to the requirements of research of this character in atomic physics. All this points towards the same conclusion as was reached in considering the moral aspects of the discovery of the regulated release of atomic energy, namely, it is a responsibility of Governments. The possibilities for good or evil are of such magnitude that individuals cannot fairly be entrusted with their exploration; similarly, none but Governments are likely to be able to provide the continuous expenditure necessary for development. Moreover, there must not be parsimony in the matter, as so often occurs when results do not immediately accrue; there must be faith in the outcome even when times are difficult and retrenchment seems inevitable. President Truman's request to Congress for provision for such research, and the British Government's announcement of its desire for collaboration, are therefore welcome moves; the Canadian Government is also to push on with investigations. The keynote in this matter, as in other affairs, is research, and yet more research. Research can be speeded up in time of national emergency, as we have recently seen, and now it is a matter of world emergency. Coupled with research there must be education, in the broadest sense, as has often been emphasized in these columns, so that nations may appreciate their responsibilities to their neighbours, who are now all the peoples of the world.

But we would conclude on a note of hope for the future. The end of the war with Japan marks the total defeat of aggression in the East and the West. To achieve it the freedom-loving nations have combined their forces, and incidentally voluntarily surrendered much of their freedom as sovereign States, while individual men and women have submitted to government largely by order from higher authority. It is not desirable or possible that such loss of democratic rights and privileges should continue; but it should be quite clear that the active association of the Great Powers must go on, in order that the world may recover from the disaster which has overtaken it. The United Nations Charter is a first step in this direction, on which it must be hoped that the nations of the world will build a structure enabling mankind to go forward in peace and prosperity to a new world order.

JOHN TYNDALL

Life and Work of John Tyndall

By A. S. Eve and C. H. Creasey. Pp. xxxii+404+25 plates. (London: Macmillan and Co., Ltd., 1945.) 21*s*. net.

JOHN TYNDALL was among the greatest masters of experimental demonstration that the world has seen. Davy, Faraday, Dewar and Bragg stood high in this category, and it is noteworthy that all these prepared and produced many of their demonstrations at the Royal Institution. In this particular direction Tyndall stood as high as any of them. It is not easy to realize how much of what is now the commonplace of lecture illustration in the physical sciences became so through him. He gave much thought and study to producing dramatic effects; indeed, stories were current which caricatured this aspect of his lectures, though it is difficult at this distance of time to judge whether any credence should be given to them. However that may be, there can be no doubt about the eagerness with which he was listened to, both in Great Britain and in the United States, nor about his great skill in carrying a popular audience with him.

The picture has, of course, another side. Some scientific men, among whom P. G. Tait was conspicuous, seem to have been much irritated by Tyndall's popular reputation, and hinted more clearly than good manners should have permitted that he verged on being a charlatan. I have looked over several of his books to try and judge for myself whether there was any real justification for this, but I cannot find that there was any.

Though I can remember Tyndall in the flesh, I was too young at the time to form any judgment of my own. The late Lord Rayleigh, however, who knew him well, thought highly of Tyndall's scientific work, and expressed himself more emphatically than was usual with him in the sense that Tyndall's critics were entirely mistaken in their estimate. He thought, however, that they had had their effect on Tyndall by putting him on the defensive.

The controversy about the doctrine of energy was one of the points on which Tait was most emphatic. It is not doubtful, I believe, that J. B. Mayer was the first to give a numerical value for the mechanical equivalent of heat, and that his value was substantially correct. If these facts are admitted (and I have not seen them denied), the plain man will not easily be convinced that Mayer's contribution was worthless. Yet Tait and also Kelvin were inclined to take this line. There was no doubt a serious flaw in Mayer's argument; but it may well be held that those who enunciate new and important results *which prove to be right in substance* should not be judged by the criteria which would be appropriate in marking an elementary examination paper a generation later. Tyndall, moved by a sense of justice, argued strongly in Mayer's favour, and I believe that the view which he took has been generally adopted in Germany; Helmholtz at least seems to favour it. Tait was probably right in assuming that Tyndall knew little of the more abstruse questions of mathematical physics: but it is not apparent that he ever professed to do so, and, after all, one cannot do everything. Tyndall, in spite of ill-health, and with no initial advantages, achieved a great deal for science in many directions. We should be grateful for what he was, rather than critical of what he was not. This book fills, at long last, a gap in the history of British science in general, and of the Royal Institution in particular.

The reviewer has read again, after an interval of more than fifty years, several of the essays contained in Tyndall's "Fragments of Science", and comes away with the impression that they have stood the test of time remarkably well. Phrases are occasionally met with which grate unpleasantly on the modern scientific ear, particularly where Tyndall deals with the electric arc, and the design of the dynamo; but if it is remembered that at the time the ampere and the volt had scarcely been defined, still less were any direct-reading instruments available for measuring currents and electromotive forces, this must in fairness be put down to the contemporary state of electrical science rather than to any shortcomings on the part of their author. By reading rather out-of-date accounts of scientific advances, one gets an insight into where the difficulty lay which is of great historical interest, and which fills a gap which can scarcely be filled otherwise. It is not at all easy for any student of scientific history to appreciate a difficulty which is no longer felt. In this matter of the efficiency of the dynamo, Tyndall's generation certainly felt at the back of their minds that there was some inherent obstacle to its working at a high efficiency. There is, of course, in fact no such obstacle, and it is very hard now to trace why they thought that there was. It is not suggested that Tyndall particularly countenanced this idea, though in some passages he seems to attach a theoretical importance to the internal resistance of the machine which reads oddly to-day.

It is difficult, coming to another aspect of Tyndall's writings, at this distance of time and in the intellectual atmosphere of the present day, to understand the storm which was aroused by his Belfast address to the British Association in 1874. A profound effect was provoked by that address, and the passage which was most resented has often been quoted—it runs thus: "The impregnable position of science may be described in a few words. We claim, and shall wrest from theology the entire domain of cosmological