A YEAR OF SCIENCE

APROPOS OF THE BRITISH ASSOCIATION MEETING

[We print below three articles written on the occasion of the Oxford meeting of the British Association for the Advancement of Science, which are in their ensemble a symposium upon the recent progress of scientific thought and its present attitude toward several fundamental questions. The first is by Professor Julian Huxley, and appeared in the *Spectator* of August 14; the second and the third respectively are from the *Saturday Review* and the *Outlook* of the same date.]

I. THE ASSOCIATION MEETING

No reports of outstanding discoveries were made at the British Association meeting this year, but their absence was counterbalanced by the high standard of interest of many of the communications and by the unusually large number of general discussions and summaries of recent advances. Another feature of this year's meeting is the stress laid upon the application of science, not merely to commerce and industry, but to our national and imperial life. This aspect was fittingly symbolized in the Prince of Wales's acceptance of the presidency of the Association, and crystallized in his inaugural address. What is more, not only is thought thus tending toward the social and national application of science, but greater stress is being laid upon the value of scientific method *per se* as well as upon particular products of applied science. In other words, it is at last being realized that there is a real method of science which is of practical value in administrative, social, and political problems, as well as in the realms of physics or chemistry or biology. This method consists in the amassing and publication of evidence, and in the constant verification of opinions by reference to the touchstone of the facts. There will always remain innumerable problems on which decisions must be taken on the balance of competing or incomplete evidence; and in these realms our statesmen and administrators will always need all the intuitive faculties with which they are endowed. The task of science is to relieve the man of intuitive and executive ability of much of his burden by reducing the field in which the intuitive decision is necessary, and making it possible to use the resources of trained skill and scientific certainty. This, of course, has been from the earliest times one of the main practical functions of science. The compass, chronometer, and nautical almanac are far less fallible than any intuitive 'sense of direction.' No possible extension of the personal and incommunicable dexterity of Wilhelm Tell, for instance, would have permitted the successful aiming of a big gun at a target a dozen miles away.

Sir Thomas Holland, in his presidential address to the Education Section, spoke of the value of the history of science as an instrument for bringing vividly before the mind of the average boy or girl the part which scientific thought and scientific method had played in the history of ideas and the

development of modern civilizations. Professor Graham-Kerr's presidential address to the section of Zoölogy was concerned with the rôle which biology could and should play in general education; and Dr. Charles Singer and Professor Desch have stressed similar points of view.

The truth is that the educated public is becoming alive to the fact that science has revolutionized the basis of our thought and altered our whole outlook upon the world, and that we must alter our practice of education accordingly. Broadly speaking, there exist two main competing *Weltausschauungen* in current thought — that which, however modified, is a survival of the religious-philosophical outlook of the later Middle Ages, and another more realist system of which different partial manifestations have been the humanism of the Renaissance, the rationalism of the eighteenth century, and the modern scientific outlook. However, it is only in very recent years that this system could become even approximately complete. Before Darwin it could not take in the realm of living things; before the rise of psychology it could not link up with the study of mind; before the rise of anthropology and sociology, human behavior and human institutions were beyond its grasp. The Renaissance humanism was incomplete because it took little account of science; the eighteenth-century rationalism had not yet understood the limitations of reason; and the scientific philosophy of the late nineteenth century was seeking to compress all phenomena into the categories prescribed by physics and chemistry.

The remedy is what we may call scientific humanism — to base our practice on the facts of science, to advance our knowledge by the methods of science, but to adopt a humanistic scale of values, in which both the limitations and the highest potentialities of the human spirit are taken into account.

But I must have done with these general impressions in order to mention a few of the points of special interest which I have been able to come across in these crowded days. Professor H. F. Osborn, the veteran palæontologist of New York, talked interestingly of evolutionary science to-day and in Darwin's time. He pointed out how quite enormously our knowledge had increased, and emphasized the fact that workers along all lines of approach, fossil-hunters, systematists, and Mendelians, were arriving at the firm conclusion that evolution was a gradual process and that it usually continued for long periods in particular directions.

Physics, as Sir William Bragg confessed, still finds itself unable to effect a reconciliation between the quantum theory and the classical theories of radiation: sometime in the near future we must expect a great new synthesis in this most fundamental of the sciences.

Plant and animal inheritance was much to the fore. Dr. Hislop Harrison exhibited his remarkable specimens of true-breeding dark types of moths, produced as 'induced mutations' by treatment with the salts of heavy metals in their food. It is along these lines that the old-fashioned Lamarckism will develop, to become reconciled with modern genetics. The botanists, in their discussion of the comparatively recent discovery of sex-cromosomes in plants, revealed that the sex-determining machinery of plants with separate sexes is in all essentials the same as that of higher animals and of man.

Sir Jagadis Bose gave an animated lecture to a crowded audience on his experiment on the conduction of impulses in sensitive plants, on the sap-pumping mechanism of plants, and on the effects of poisons and stimulants on

their activities. His instruments of precision and his experimental facts are remarkable; but it is rather a pity that he generalizes so freely. It does not yet seem clear that the mechanism which conducts stimuli in mimosa is really similar in essentials to the animal nervous system; and it is quite certain that, even if every one of Sir Jagadis's experiments concerning sap-ascent is confirmed, the pumping mechanism is something very different from any known animal heart. Yet he has proclaimed the identity of nervous and circulatory mechanisms in the two kingdoms.

Especially interesting were the addresses and discussions concerned with the impact of European civilizations and methods upon primitive peoples. How many stay-at-home folk knew that writing, save for a slight infiltration from the Mohammedan areas to the north, was unknown to the Central African?

The Oxford meeting marks an important epoch in the history of the British Association, by its clear trend away from the detailed and overspecialist character of most recent meetings, and by linking science more firmly with national development in all its aspects.

II. VULGARIZED SCIENCE

ONCE a year the British public becomes scientific. The occasion is the meeting of the British Association; the time of year, that which used, in rude Victorian days, to be known as the silly season. Stimulated by a daily press which knows how to separate the grain from the chaff in verbatim reports of the Association's proceedings, the public becomes passionately interested for a while in questions put at the Association but smacking rather of domestic debate in a family whose members are improving themselves. It sees with enthusiasm the concentration of the most illustrious scientific minds of the age on the problem of why a hen crosses the road, or on that of how man, once 'a blue-behinded ape skipping on the trees of paradise,' got rid of his hairy hide. With ardent eyes it watches the graceful manœuvres by which religion, when purified of the miraculous, is reconciled with science, when doped with the new spiritualism. And so on, and so forth. Till at the end of a week it is left with two main convictions, both very comforting — the conviction that the master minds of science are actuated by much the same curiosities as move the plain man, and the conviction that humanity is on the verge of mastering the final mysteries.

Now the universe may have been brought into existence solely for some ethical purpose, or it may have been created because the divine intelligence had the need so to apprehend itself, or there may be some explanation of it beyond human conception or conjecture, but it is pretty safe to assume that it was not willed in order that the *Tit-Bits* mind might be amused. In so far as the British Association, as interpreted by a large portion of the press, permeates our people to the contrary belief, it does no good service. To be sure, we live in a democratic age, and it may be contended that an exhibition of the commonplace texture and trivial inquisitiveness of the scientific mind, when playing to the gallery and subedited by really bright journalists, helps to bridge over those unfortunate gaps that still persist between a first-rate intellect strenuously developed and a tenth-rate intellect which has seldom been exercised. Performing rats and speculations about prehistoric depilatories may be held to be useful as bringing together on the same level the man in the laboratory and the man at the back of the bus. But there are

several things more desirable than the illusion of community in intellectual interests. It is desirable that science should be kept outside the sphere in which everything is judged by its stunt value, lest the relative importance of scientific inquiries come to be determined by consideration of how far they provide copy for popular papers and topics for conversation. It is desirable also that people should be saved from forming a conception of science according to which it will be starved where it is dependent on public funds, unless it is promising discoveries which the man in the street can appreciate. Further, it is desirable in this age that people should be shaken out of the expectation that science no less than the State has some dole up its sleeve, and can be so applied as to enable the idle and the perverse to enjoy conditions of life which only the sustained efforts of a sane and industrious society can establish.

In some ways it may be good for the public once a year to revel in the sensation of progress, but progress remains to a great extent an illusion. One of the very greatest conservative intellects of the nineteenth century happened to be that of a man devoted to a church which has made higher and wider claims of an earthly character for Christianity than any other. But Coventry Patmore, with that excellent courage of his, argued that on the whole Christianity had not resulted in progress, and in one of his poems he likened progress, with deadly truth, to the heaving and hurrying yet ultimately unprogressive movement of an agitated sea. However much science may have done and may be destined to do for us, humanity, of the British as well as all other varieties, will be limited in progress by that which science cannot touch and which religion itself has on the whole so little and so temporarily affected. The question how man lost his ape's hide is a good deal less urgent than the question how he is to lose his ape's mind and heart. In many respects we are not becoming a more civilized people. We have, for instance, developed a class jealousy on the one hand and an indifference to the less material obligations of social position on the other which are deplorable. We are losing, if we have not already lost, dignity in those discussions which a national life governed by public opinion requires. There is something petty and shrill and common not only in some of our Parliamentary wrangles but, to speak of matters nearer to the heart and more comprehensible by the mind of the people, in argument over the captaincy of a test-match team. And if anyone thinks we are nearer to acquiring the scientific temper, let him look at what the British Association and the popular press between them have provided during the last few days. Not that serious and valuable utterances have been lacking at Oxford. After the admirable presidential address by the Prince of Wales, there have been many truly suggestive discussions. But these have not excited anything like the general comment aroused by the trivial and fantastic contributions made to the proceedings by our scientific entertainers.

III. SCIENCE AND RELIGION

THE Oxford meeting of the British Association naturally recalls the historic controversy of 1860, and rather smug comparisons have been drawn between the Tennysonian England of two generations ago and the Tennesseian America of to-day. This side the Atlantic, no doubt, the lapse of time has helped to clear thought and to break down prejudice. In a sense, however, the conflict between science and religion continues, and will forever continue. Only some fundamental

change in the quality of the human mind can resolve the antinomy between those who hold that there is no knowledge other than that derived by reason from material presented to the senses and those for whom the supreme knowledge consists in a mystic intuition of harmony between mankind and the Power that animates the universe.

The change has been in the terms in which the conflict is stated. Experience has taught both science and religion where their strength lies. Both have somewhat narrowed their field, with the result that their respective spheres no longer overlap, and for the first time, perhaps, since Aquinas accomplished a synthesis of faith and reason it is possible for a man to be both a philosopher and a Christian. To perceive this it is only necessary to recall the actual formulas of the Darwinian controversy. It was claimed by the scientists of the sixties that the evolutionary hypothesis made nonsense of the argument from design which had been evolved in support of the first chapter of Genesis. These marvelous adaptations of organism to environment were the result, not of beneficent special creation, but of the operations of a blind force; and God had been pushed out of the picture. To-day the biologists state their case in very different language. What Darwin called spontaneous variation remains an insoluble mystery into which biology hardly attempts to pry. Its concern is with a process, with the means by which a permanent relation is established between two unstable factors, the living thing and its local setting.

The change of standpoint has been aided by the recent shift of the stream of scientific progress from the channel of biology to the channel of physics. The physicist apprehends his problem in such a way that it never occurs to him, in his scientific capacity, to ask whether he is a materialist or not. He does not only study facts. He studies relations. He knows nothing at all about the nature of the ions and electrons into which he has resolved matter. They may or may not be manifestations of a hypothetical ether. The point is of no great moment to him, because he is concerned to inquire not what they are but how they behave in relation to one another, and to exhibit the laws not of their structure but of their combination. In this respect his work is parallel with that of the biologist, who is interested less in the nature of life than in its relationship with its environment.

There has been a corresponding movement in religious thought. The religious man to-day may, indeed, claim that Scripture gives him a compendious history of the origin of the world. But it is not for its history that he turns to Scripture. The characteristic of modern religious thought is the stress which it lays upon the sacraments — upon the means, that is to say, by which man becomes aware of his relationship with his Maker. In this field, also, there has been a definite shift of interest. Modern scholarship is concerned less with the Bible than with the Church. What matters nowadays is the evidence that faith has grown with the growing needs of mankind, that Christian dogma itself is but a means to an end, and that end the establishment of a sure bond between man and a Power not of this world. Let it be granted that the nature of that bond has been defined in terms which modern thought rejects, or that its existence has been exhibited by appeals to what modern thought regards as the most fallible side of our nature. It matters not. A statement of the relations between man and a Power of necessity beyond the apprehension of our limited intelligences has

at best only a metaphysical value, and any demonstration of it is at best only relatively true and therefore only relatively false.

From this angle the controversies of sixty years ago, which have done their work and permanently influenced thought, shrink into insignificance, and a touch of pity is felt for those who persist not only in asking the wrong questions but in maintaining that their answers to them are of any relevance. Here, in the realm of feeling much more than in the realm of knowledge, is surely the true evidence of progress. Mankind has lost the doctrinaire confidence of nineteenth-century thought. The Church itself has learned to express itself more modestly and less authoritatively, and some at least of its ministers are ready to admit in the study, if not in the pulpit, that there may be more than one road to salvation. Science as well as the sacraments exists for the glory of God; both alike are symbols of the truth that lies behind our mortal perceptions. But what that truth may be we can do little more than wonder, with a sense of awe at its mystery and magnificence. No longer do we stand triumphant over the unveiled secrets of the universe. We feel ourselves to be moving in the outer courts of wisdom, conscious indeed of progressive illumination, but aware that the source and nature of the light to which we are susceptible is hidden from us by the very potency and wonder of its beams. If we so please we may hold with Sir Oliver Lodge that our consciousness of our present limitations is an earnest of advance beyond them, and that our admitted ignorance of ultimate realities is the first step to profounder knowledge. If that step be taken the terms of the conflict of opinion will change again. Meanwhile it is enough to have even our present breathing-space, and to realize that in our Father's house there are indeed many mansions — some at least of which may face the Light.

WHEN THE POWERS MARCHED INTO PEKING [1]

BY W. P. M. RUSSELL

THE cup of the iniquity of the Boxers was full, and the blood of the murdered foreigners cried out for vengeance. All through the sweltering heat of the long summer the Boxers had run riot over the whole of the North of China. They had gloated over the sight of the foreign refugees fleeing before them, half naked and bleeding. They had tortured them with a refinement of cruelty and done them to death, even practising the inhumanly barbarous *ling ch'ih*, or 'death by a thousand cuts.'

The cauldron of the Far East had boiled over and the scum had come to the top. The typical Boxer was possessed of great physical strength combined with brutal stolidity of temperament. *Robore corporis stolide ferox*, — to borrow a Tacitean expression, —

[1] From the *National Review* (London Tory monthly), *July*