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Editorial and Publishing Offices :

MACMILLAN & CO., LTD.,  
ST. MARTIN'S STREET, LONDON, W.C.2.

Editorial communications should be addressed to the Editor.  
Advertisements and business letters to the Publishers.

Telephone Number : GERRARD 8830.  
Telegraphic Address : PHUSIS, WESTRAND, LONDON.  
No. 3110, VOL. 123]

School Science.

THOSE in touch with educational circles have been aware for some time past of a growing dissatisfaction with the scope and treatment of school science. The Report of the Committee of the British Association upon Science in School Certificate Examinations<sup>1</sup> thus comes at an opportune moment, and will be welcomed by all who realize the difficulties of the present position. It is not an easy matter to probe to the root of the widespread feeling that all is not well with science in the schools, but at bottom there seems to be a conflict between utilitarian and æsthetic ideals. Many teachers, recognizing that the majority of their pupils will have to work hard for a living, feel that they must be given instruction of immediate practical value ; others emphasize the importance of training young people to appreciate to the full the serene joys of the intellectual life. These two aims are not necessarily incompatible, and their reconciliation might be effected with reasonable ease, were not the situation rendered almost hopelessly rigid by the incubus of examinations.

There are in England and Wales eight examining bodies which conduct First and Higher School Certificate examinations, taken by boys and girls at the ages of 16 and 18, or thereabout, respectively. Through the activity of the Secondary School Examinations Council, these several examinations have been closely equated, and there is now little variation among them in syllabus and standard. This uniformity is in many ways a good thing, but the disastrous result of a comprehensive yet stereotyped examination system has been to stifle originality in teaching, and to raise the list of examination successes into a fearful idol, to be at once worshipped and dreaded. The effect upon science has been particularly devastating, owing to the special circumstances. Science is a comparative new-comer to the school curriculum, and a mere half-century's experience has proved insufficient to enable teachers to work out the most suitable and efficient means of teaching it. Yet, while still in this immature state, school science is becoming petrified by examination requirements, and the evil habit of 'cramming' is likely to establish itself firmly unless immediate steps are taken to prevent the catastrophe.

The Committee not only points out the danger, but makes valuable suggestions for avoiding it. It favours a scheme whereby schools may arrange

<sup>1</sup> British Association Reprints. No. 23 : Report on Science in School Certificate Examinations. Pp. 443-532. (London : British Association, 1928.) 1s.



their own plan of work, and examine their own pupils in association with independent boards of assessors. Such a scheme is already in operation in certain technical schools, where a national certificate is awarded under the joint supervision of the Board of Education and the Institution of Mechanical Engineers; and a similar scheme has been adopted by the University of London for the examination of the twenty-two training colleges allotted to it. If a system of this kind were generally adopted, with adequate safeguards, teachers would have far more freedom to elaborate methods and courses of work suited to particular needs, and school science would have the opportunity of advancing on the lines of true culture.

Present conditions are responsible for a further regrettable tendency in elementary science teaching, namely, a concentration upon formal chemistry, physics, and, to a less extent—principally in girls' schools—botany. Although something may be said for such a study at the stage of the Higher Certificate, it is very doubtful whether boys and girls of 14 to 16 really derive any great permanent benefit from a diluted form of academic science. The 'theory' of chemistry and physics, and even of botany, is in fact not appropriate to the general education of the middle school. A few bright pupils may benefit, but teachers and examiners alike realize that most of the candidates are drowned in a boundless sea of definitions, laws, and hypotheses, of a depth to them unfathomable.

Still another conspicuous defect in school science is the infrequency with which biology forms a part of the regular routine. Whatever we may regard as the primary aims of teaching science to boys and girls, we must certainly include among them that of imparting an elementary knowledge of the phenomena of life. It is therefore extremely disconcerting to find that many, if not most, of our children may pass through the schools without receiving any instruction whatever in biology. There are, of course, explanations of this remarkable state of affairs. In the first place, the majority of science teachers have specialized in chemistry or physics, or both, at the universities, and are thus content, in general, to teach those subjects only; at any rate, no active demand for biological work is likely to proceed from teachers of the exact sciences unless a stimulus is applied from without. Secondly, it has been—and is—maintained that biology has too recently emerged from the purely descriptive stage to lend itself to the inculcation of scientific method, whereas chemistry and physics may be very easily adapted to this end. Lastly,

we are reminded that biology is based largely upon chemistry and physics, and that logic consequently demands a study of at least the elements of the two latter sciences as a necessary preliminary to biological work. It is clearly an urgent matter for the biologists to show how these difficulties can be removed.

Such are the principal facts relating to the present condition of science in schools. It remains to consider them in relation to the strife between æsthetic and utilitarian ideals which we believe to be the real cause of the prevailing controversy. Since modern civilization depends for its very existence upon the application of scientific knowledge, no one will deny the importance of teaching young citizens a modicum of scientific facts. Moreover, technical occupations absorb increasingly large numbers of workers, and must continue to do so as long as civilization persists: it may thus be of direct practical and financial value to a boy or girl to get elementary technical instruction at as early an age as possible. These two points are, in brief, the arguments of the utilitarian school, and they undoubtedly have much weight. If they carry the day, they will tend to preserve the existing scheme of formal chemistry and physics, and to exclude biology until biological callings have increased to such an extent as to offer wide and immediate prospects.

Even those teachers, however, who most strongly urge the utilitarian aims agree that science, as part of a general education, should do more than impart useful information. There is, in fact, an almost universal feeling that the æsthetic side of science is ultimately the most vital, but opinions differ as to the degree and manner in which this aspect is to be emphasized. Stern disciplinarians, who themselves experience an austerity of pleasure in fundamental scientific philosophy, make superhuman efforts to transmit some shadow of this pleasure to restive school certificate sets; the rare occasions on which their labour gets the full appreciation it deserves are a sufficient recompense for many failures. It is a commonplace that such teachers are usually regarded with no little reverence by their pupils in after years, but the reverence is rather for the man than for his teaching.

There are, again, those teachers who strive 'to make science easy', and in doing so run dangerously near the borderline of insipidity: scientific facts, as such, are of no greater educational worth than the date of Waterloo or the names of Henry VIII.'s wives. To know how an electric bell works is not necessarily to be educated. It is seductively



attractive to make one's science course a series of superficial explanations of devices and phenomena, and to imagine that one is revealing the beauties of science.

This has been the chief criticism levelled at 'everyday science', 'science for all', or 'general science'; but it is a criticism easily disposed of, since it rests upon a misunderstanding. The advocates of 'general science' have been envisaged as those who would replace the very real (if limited) benefits of formal science by the illusory returns of a shallow smattering. Nothing could be farther from the truth. 'General science', as properly interpreted by the Committee, is an attempt to make children see science steadily and to see it whole; to enable them to assimilate scientific principles and scientific method by a consideration of phenomena from the point of view of every relevant branch of science; and to increase their capacity for intellectual pleasure by opening to them the inexhaustible treasures which science discovers in the world of everyday life. The 'general scientists', in fact, are thorough-going supporters of the æsthetic aim, though sometimes they disguise their real sentiments by pointing out the immediate practical value which the course they suggest may possess. It is true that a scheme of 'general science' may include lessons on severely practical topics, but the whole spirit of the course is to relegate the purely utilitarian aim to a definitely lower place.

Unfortunately, 'general science' has to fear two extremely serious perils. The first is that it can so easily be transformed into a grotesque caricature, becoming, indeed, the smattering which it strives to avoid. The second is that it is incomparably more difficult to teach than the formal chemistry or physics or botany at present in vogue. If it is to achieve its purpose, the first essential is to dispel the notion that 'general science' is a soft option, to be welcomed for the sake of weaker candidates, but otherwise to be disparaged. This difficulty in teaching will, we fear, be very troublesome to overcome, but examining bodies may do something by encouraging schools to take general science, and by allowing a wide choice of questions in the papers.

Specialization at the later stage, that of the Higher Certificate, is probably inevitable. Yet we admit surprise at the qualified blessing which the Committee gives to the Higher Certificate Examination, for we cannot bring ourselves to believe that it is good for boys and girls of 16-18 to devote three-quarters of their school time to the study of only two or three special subjects. We should like to see a broader basis for the examination,

with a less intensive treatment. Similar remarks apply to the university scholarship examinations, which demand what is practically degree knowledge from the candidates, and do more to sophisticate adolescent education than any other single factor.

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### The Place of Science in our View of History.

*The History of British Civilization.* By Dr. Esmè Wingfield-Stratford. Vol. 1. Pp. xv + 574. Vol. 2. Pp. viii + 575-1332. (London: George Routledge and Sons, Ltd.; New York: Harcourt, Brace and Co., Inc., 1928.) 42s. net.

ON several occasions the pages of NATURE have afforded evidence of the growing importance taken by science in the writing and teaching of history. It is, in fact, at the root of the difficulty which was dealt with recently in one of the leading articles. How to secure that our political leaders—and one might well add leaders of all other kinds—should approach their business in a scientific spirit? There are, of course, many ways by which the change will come, and is coming, but it may be doubted whether any way will affect a larger number of persons than that of infusing the ordinary teaching and view of history with some notion of the part that science has played in the process. For we all learn some history. Not only at school but also in after life, so far as we do any serious reading at all, it is of a historical kind; floods of memoirs and biographies are being constantly poured out by the press.

Here is the main source of intellectual influence which is playing upon the more thoughtful sections of the public; it is here that science must make its way. It is therefore an interesting study—more interesting every time—to measure the space which science occupies in works of general scope, especially when they purport to talk of civilisation as a whole, and, most of all, of modern civilisation. Such a book has just appeared in Mr. Wingfield-Stratford's "History of Civilization", which has had a remarkably good press and promises, if he can induce his publishers to produce a cheaper edition, to have a powerful influence in forming British opinion about its own past. It has all the elements of sound popularity for an English public, a vigorous full-blooded style, a freedom of personal judgment, an absence of pedantry or the apparatus of learning, a readiness to admit national crimes and defects, and a glorious ending on the right side, with the British Commonwealth of