



SATURDAY, FEBRUARY 24, 1934

No. 3356

Vol. 133

## CONTENTS

	PAGE
Intellectual Freedom . . . . .	269
Physiology and Behaviour of Primates. By E. S. R.	272
Decompositions into Fifth Powers. By Prof. L. M. Milne-Thomson . . . . .	273
Recent Research in Metallurgy. By L. B. H. . . . .	274
Short Reviews . . . . .	275
Thomas Young. By Sir Joseph Larmor, F.R.S. . . . .	276
Infra-Red Photographs of Racial Types. By Prof. C. G. Seligman, F.R.S. . . . .	279
Heavy Hydrogen. By Sir J. J. Thomson, O.M., F.R.S.	280
Obituary :	
Sir William Hardy, F.R.S. By Sir Frederick Gowland Hopkins, Pres.R.S. . . . .	281
News and Views . . . . .	284
Letters to the Editor :	
International Status and Obligations of Science. —Prof. J. Stark ; Prof. A. V. Hill, O.B.E., F.R.S. . . . .	290
Cytochrome and the Supposed Direct Spectroscopic Observation of Oxidase.—Prof. D. Keilin, F.R.S. . . . .	291
Chemical Separation of the Isotopes of Hydrogen.—Dr. E. D. Hughes, Prof. C. K. Ingold, F.R.S., and C. L. Wilson . . . . .	291
Electrolytic Concentration of the Heavy Hydrogen Isotope.—B. Topley and H. Eyring . . . . .	292
Nature of Antibodies.—John Marrack . . . . .	292
Progesterin in Placental Extract.—A. A. Adler, P. de Fremery and Dr. M. Tausk . . . . .	293
Fine Structure of the <i>K<math>\alpha</math></i> Line of Beryllium.—Dr. F. C. Chalklin . . . . .	293
Dynamics and Mechanism of Aliphatic Substitution.—E. A. Moelwyn-Hughes . . . . .	294
Atmospheric Pressure and the Ionisation of the Kennelly-Heaviside Layer.—Dr. D. F. Martyn . . . . .	294
Small Sand Craters of Seismic Origin.—Dr. J. Coggin Brown . . . . .	295
The Infinite and Eternal Energy.—Donald Murray . . . . .	295
Tidal Bores.—Dr. A. T. Doodson, F.R.S. . . . .	295
Research Items . . . . .	296
The Teaching of History and Prehistory in Germany . . . . .	298
British Industries Fair . . . . .	300
University and Educational Intelligence . . . . .	300
Science News a Century Ago . . . . .	301
Societies and Academies . . . . .	302
Forthcoming Events . . . . .	304
Official Publications Received . . . . .	304
Recent Scientific and Technical Books . . . . .	Supp. iii

*Editorial and Publishing Offices :*

MACMILLAN &amp; CO., LTD.

ST. MARTIN'S STREET, LONDON, W.C.2

Telephone Number : WHITEHALL 8831

Telegraphic Address : PHUSIS, LESQUARE, LONDON

*Advertisements should be addressed to*

T. G. Scott &amp; Son, Ltd., 63 Ludgate Hill, London, E.C.4

Telephone Number : City 4211

## Intellectual Freedom

AS years count, little more than a generation has passed since Huxley died. Prof. A. V. Hill's Huxley Memorial lecture on "The International Status and Obligations of Science" (see NATURE, Dec. 23, pp. 952-954), while stressing the world's debt to Huxley for his vindication of intellectual freedom, reminded us, if any reminder were needed, that since the War, in far less than a generation, indeed in a period of a little more than the last ten years, we have seen the making of a new world, the world of the dictator, in which the spirit is as alien to that of Huxley's day as was the spirit of the Middle Ages.

In retrospect it is easily possible to attach too great significance to the opposition encountered by the scientific ideas propounded by Huxley and the school of thought of which he stands as the representative. The nineteenth century was an age of great expansions. By an almost daily experience its horizons were enlarged. The extension of commerce and industry made possible by the growth of population and new markets opened up by travel, exploration and settlement, the increase of political power among the people, and the spread of education confirmed society in a dynamic attitude towards the problems of life. To this attitude the concepts of an evolutionary philosophy and the scientific ideas of Darwin and Huxley were more nearly akin than the static appeal to authority of those by whom they were opposed. It was an age which believed in the possibility of progress, in the possibility of a continuous and progressive amelioration in the conditions of life and above all in the potentialities of man himself. Backward, barbarous and uncivilised peoples, all, it was thought, might be raised to the status of the most advanced in course of time, given education and training.

To a generation which came to maturity in the latter half of the nineteenth century, freedom of thought was the natural corollary of the complete emancipation of the individual, which had been the prevailing tendency of preceding years, and was, it was then thought, the goal of future progress. The removal of disabilities due to birth, status or religion by movements, such as, for example, Catholic emancipation and the throwing open of the universities, particularly the admission of non-conformists, seemed to be the counterpart of the abrogation of authority and the freeing of inquiry in the sphere of the intellect, which had

been initiated by Bacon, himself a product of the spirit of the Reformation, in the application of scientific method and experimental investigation to the problems of natural science, and of which the final stage, apparently, lay open with the acceptance of evolutionary doctrines and the annihilation of the concept of fixed species as god-created entities. As in the political world the efforts of conservatism were directed towards tempering progressive measures by a compromise with established institutions which would not bar forward movement, so in matters intellectual, when once the complete verbal inspiration of the Bible was recognised to be no longer tenable, the efforts of the keenest minds among the orthodox were directed towards the reconciliation of science and religion, rather than to an endeavour to mark off a forbidden territory by chains of authority, which, it was seen, advanced thought would either pass by or overleap.

This was a world of which Huxley was both a product and a formative influence. He taught a public which was ripe to give hearing to his doctrine. It is unnecessary to labour the point by further analysis of the complex interweave of social and intellectual movement of that day. There are, however, two tendencies, or factors, to which reference may be made for their bearing on present problems. These are the international status of science and the relation of science to politics, and questions of policy in connexion with social problems.

On the general question of the international standing of science little need be added to the references to the position in the past which were made by Prof. Hill in his address. Science and learning and, in a lesser degree, art, as he showed, in the past have transcended national boundaries and have been accorded international status. On the other hand, in recent times, the free interchange of ideas which is the end and justification of the claim of science to be regarded as free of all frontiers, has been, in Great Britain at least, one form of expression of the belief in the ultimate unity and solidarity of mankind as a whole, which underlies the intellectual internationalism of the medieval church, and in the Protestant world of later times has inspired humanitarian movements such as the emancipation of the slaves and intervention on behalf of oppressed peoples on various occasions.

The question of the relation of science to politics and socio-political problems opens up a field

which offers opportunity for wide divergence of opinion, as is shown in the correspondence between Prof. Hill and Prof. J. B. S. Haldane which has appeared in our columns (see *NATURE*, Jan. 13, pp. 65-66). Prof. Hill's contention that science holds a privileged position in consequence, and on the condition of, its detached attitude towards matters which are the subject of political or social controversy and partisanship is unquestionably sound in so far as it affects the objects and conditions of pure scientific research. The object of the research worker is the attainment of truth, of the teacher of science the inculcation of the methods of attaining that object and the demonstration of the progress which has been made towards it. In neither case must there be bias due to extraneous influence or any attempt to sway the judgment of those under instruction, whether it be a class or the wider audience of the general public, a body of opinion of increasing importance in these days of broadcasting.

On the other hand, the scientific worker is a citizen, and as such it is his civic duty to bring his special knowledge to bear on the problems which present themselves to him as a member of the State. Further, as a specialist he may be called in to minister to the ills of the body politic. He alone has the specialised knowledge which can apply the results of research carried out in an academic atmosphere of detachment to the practical problems of life. Moreover, as the State in the performance of its function of ensuring for its members the best possible conditions of life, work and even of amusement, substitutes for regulations framed by rule of thumb, legislation which is in accord with the most recent dicta of science, the aid of the man of science is invoked with greater frequency and over a wider field. He may even be asked to frame a policy, or he may feel called upon of his own initiative to point out the way of future progress. He becomes a propagandist in the better sense. In the earlier days of the Rothamsted Experimental Station, for example, it would on occasion have been difficult to draw the line between agricultural instruction and propaganda.

To a great extent the application of scientific methods and scientific ideas to the problems of government and administration has been an outcome of the theory of State intervention, of which the wide extension is the outstanding contribution of the nineteenth century to political thought and practice. It is true that on occasion science has

found government departments somewhat difficult to persuade that the course of action dictated by scientific considerations was expedient or advisable. Yet on the whole, the fact that State regulation is a necessity which impinges on every side of the life of the community and affects it in multitudinous detail, in the long run has ensured that these regulations should be framed in the light of the results of scientific research. Whatever may be the defects of bureaucratic government, it does afford greater opportunity for the rational application of scientific method to domestic problems, unattainable in a pure democracy, failing the Utopian condition of a scientifically educated public and an executive fully and continuously abreast of the development of science and its practical applications.

The War marked the close of an epoch—a period, in which, it has been attempted to show, the political atmosphere fostered freedom of scientific inquiry, the free interchange of scientific ideas and personnel on an international basis, and an increasing application of scientific methods and results to conditions in every department of the citizen's daily life.

From the welter which followed on the conclusion of peace, we are only now beginning to emerge, and that only in so far as the conditions on which recovery will be attempted are becoming defined. Impressed by the results achieved by national discipline during the War, perhaps remembering how, at first under Bismarck's guidance and then under the Kaiser, the German States were welded into the most powerful national organisation of modern times, the foremost peoples of the world are placing themselves under the control of the organised State, consolidated on a national basis, of which the political and economic segregation is emphasised at every turn, but more particularly by tariffs, exchanges and trade balances, States in which an all-powerful emotional appeal is afforded by devotion to a political theory as in Russia, the call of race or nationality, as in Germany, or of loyalty to a leader who exercises a dictatorial power as in Italy or the United States of America.

With the merits and demerits of a political system, strictly as such, we have no concern in these columns, except in so far as it may become the subject of scientific sociological investigation. But it is of vital interest to science that what may be the relation of political theory and practice under the organised State, founded on a nationalist

basis, to scientific inquiry should be clearly apprehended. The atmosphere of political freedom of Huxley's day, in which scientific inquiry grew to its full stature, has vanished. Is science to go back under a system of State control to swaddling clothes?

To the social reformer and the scientific worker who hates the waste of life, time and energy under rule of thumb and tradition, the organised State under dictatorial power, whether wielded by a cabinet or an individual, presents many attractions. It abrogates government by the Press, and the otherwise uninstructed vote of the mass. In it the man of science rightly sees no more than an extension of the bureaucratic regime of State control which in the past has been instrumental in applying the progressive concepts of science to social amelioration. No doubt future generations will rise up to call General Göring blessed, because he has decreed a reserve for the preservation of the wild animals of northern Europe, yet had his verdict gone the other way, who could now prevail? And those who applaud the work of archaeological exploration and restoration which the Duce has promoted to the glory of the Italian nation may be pardoned if they feel some qualms lest the claims of some period or subject less complimentary to the Italian genius be overlooked. Who or what is to ensure that the organised State in the exercise of its power of control shall not dictate to science what subjects may or may not be matter for inquiry, and the direction that inquiry shall take? The Dayton trial has not yet sunk into oblivion, and to-day in Germany the whole State organisation and the fabric of society rest on a pseudo-scientific theory of Aryan supremacy, once formulated for political reasons and long ago exploded outside her national boundaries, but internally not to be questioned. To conform to that illusion Germany has closed her frontiers; she has evicted some of her greatest scientific investigators, with thousands of the rank and file, content, as it has been put, that her science should lag behind that of the rest of the world, provided that it were German; and finally, in the full spirit of the Hebrew Scriptures, if repudiating them in form, she seeks to evolve a German God, barely refraining from invoking by name Wodan, the God of Battles, who has risen again.

Since the above was written, we have received the circular on the teaching of history in Germany of which a translation appears in this issue (p. 288). It is perhaps worth while to place this on record,



lest it should appear that in directing attention to the danger that authority under the organised State might seek to prescribe for science the line to be taken in teaching and research, NATURE may appear to have issued a warning after the event.

There is much in the political situation of the day, even in Great Britain, which justifies Prof. Hill's fears for the future of intellectual freedom.

### Physiology and Behaviour of Primates

(1) *Functional Affinities of Man, Monkeys and Apes: a Study of the Bearings of Physiology and Behaviour on the Taxonomy and Phylogeny of Lemurs, Monkeys, Apes and Man.* By Dr. S. Zuckerman. Pp. xviii+203+12 plates. (London: Kegan Paul and Co., Ltd., 1933.) 10s. 6d. net.

(2) *Behavior Mechanisms in Monkeys.* By Heinrich Klüver. (Behavior Research Fund Monographs.) Pp. xvii+387+9 plates. (Chicago: University of Chicago Press; London: Cambridge University Press, 1933.) 22s. net.

(1) **D**R. ZUCKERMAN, whose previous volume on the "Social Life of Monkeys and Apes" (1932) was favourably received, has in this new work collected together the somewhat scattered knowledge relating to the 'functional' characteristics of the various types of primates, and considered its bearings upon the classification and phylogeny of the group. He deals among other things with the mechanisms of reproduction, blood reactions, the physiology of the sense-organs, and behaviour in relation to cortical differentiation.

In general, the indications supplied by these functional characters are consistent with the orthodox view of the relationships of the primates, as expressed in the commonly accepted taxonomy of the order. They do not, however, throw any very clear light upon problems of phylogeny. Zuckerman has clearly performed a useful service in bringing together much information which is not easily accessible to the taxonomist and morphologist. The book is well documented and has a good bibliography. It is illustrated by 24 plate figures of apes, monkeys and lemurs, from photographs by F. W. Bond.

It is interesting to note that Zuckerman refers with approval to the work of St. George Mivart in the 'seventies, who in spite of his anti-Darwinian attitude expressed some very sound views on primate relationships. Mivart's contention that

there is little difference in respect of mental powers between monkeys and apes is one which receives some support from recent psychological research. (2) Thus in Dr. Klüver's book on the behaviour of monkeys, we find that some species, particularly of the genus *Cebus*, can utilise tools almost as effectively as Köhler's chimpanzees. This was also the conclusion of Bierens de Haan on the basis of his experiments with *Cebus hypoleucus* (1931). Actually we do not yet know enough about the behaviour of apes and monkeys to be able to rank them in order of 'intelligence', but it is significant that the more carefully and sympathetically they are studied the more complex and adaptable their behaviour appears.

Klüver's book is a contribution of the first importance to this fascinating study. It is admirably characterised by Dr. K. S. Lashley in his introduction as follows:

"Dr. Klüver's monograph sets a new standard for analytic studies of behaviour. He has proposed the question, Just what properties in complex sensory situations are significant for the animal's reactions? and has carried out the investigation with unique thoroughness. As a result, he presents for the first time something approaching a complete picture of the perceptual world of an animal. This perceptual organisation is surprisingly like that of man. Not only are the animals sensitive to the same physical stimuli but for them also the relational properties of the situations are the same. As with man, reactions are but little dependent upon the simple physical properties of the stimulus but rather upon abstract relations which may subsist in physically unlike situations."

These valuable conclusions as to the importance of bare relations in determining responses were obtained by the "method of equivalent stimuli".

The general problem set was to pull in one of two (or more) boxes, which were differentiated from one another by some physical characteristic, as for example weight. The monkey was first trained to pull in, say, the heavier of two boxes of given weights; when training was complete the weights of the boxes were altered throughout a wide range, and it was found that the monkey almost invariably chose the heavier of the pair quite irrespective of the absolute weights. Then the appearance of the boxes was altered in various ways, but the response to the bare relation 'heavier than' was still maintained. This type of experiment, using the pulling-in technique, was extended to many other characteristics, such as shapes and colours, and most interesting results obtained.

The investigations dealt with both New World