

NATURE

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CONTENTS

	Page
Freedom in Science	565
Babbage's Dream Comes True. By Dr. L. J. Comrie	567
Social Paediatrics. By Dr. Stanley Graham	568
Soft Fruits. By Prof. R. H. Stoughton	569
Physics and Chemistry of Swelling and Shrinking. By Geoffrey Gee	571
The Moon and Plant Growth. By Dr. C. F. C. Beeson, C.I.E.	572
The Course of the Controversy on Freedom in Science. By Dr. John R. Baker and Prof. A. G. Tansley, F.R.S.	574
Obituaries:	
Sir Carruthers Beattie. By Sir H. Spencer Jones, F.R.S.	576
Prof. M. Camis. By Dr. R. S. Creed	576
News and Views	577
Letters to the Editors:	
Colour of Heavy Lead Silicate Glass.—Dr. W. M. Hampton	582
Statistical Structure of Ice and of Ammonium Fluoride.—Dr. Kathleen Lonsdale, F.R.S.	582
Spiral Cracks in Glass Tubes.—Dr. John J. Hopfield	583
Electron Accelerator of Synchrotron Type.—A. I. Archer	583
Reaction Velocity at Phase Limits and its Dependence on the Frequency of the Vibration of the Lattice.—Robert Jagitsch	583
An Extension of the Lens-Mirror System of Maksutov.—Charles G. Wynne	584
Effect of Pressure on Crystal Growth.—Dr. M. H. Hey; F. M. L. Bockris	584
Biological Activity of Compounds in Homologous Series.—Dr. G. M. Badger	585
Effect of Electrolytes on Cation-active Detergents.—Dr. John A. Hill and C. L. F. Hunter	585
Reduction by Dissolving Metals.—Arthur J. Birch	585
The Perfect Buffer.—D. Barby and C. A. M. Bowman	586
Reactions of Organic Halides in Solution.—Dr. Alwyn G. Evans	586
Survival of Oyster and Other Littoral Populations.—Prof. J. H. Orton	586
A Revival of Natural Oyster Beds?—Dr. P. Korr'nga	586
Occurrence of Foot Louse of Sheep in the British Isles.—J. E. Webb and H. E. Harbour	587
Control of Wireworm.—E. Dunn, V. E. Henderson and J. H. Stapley	587
Polyploidy and Parthenogenesis in the Genus <i>Saga</i> .—Dr. E. Goldschmidt	587
Diatoms Without Siliceous Frustules.—N. Ingram Hendey	588
Protein of Fruits.—Dr. A. C. Hulme	588
Glycogen Phosphorylysis in Alloxan-diabetic Rats.—Prof. L. Laszt and H. Vogel	588
Alloxan Diabetes and Kidney Function.—C. Jimenez-Diaz, F. Grande-Covian and J. C. De Oya	589
An 'Incomplete' Form of α Agglutinin.—K. E. Boorman and B. E. Dodd	589
Enhancement of Immune Antibodies by Human Serum.—Z. Polishuk and J. Gurevitch	589
The Thyroid and Tuberculosis.—Prof. Roque A. Izzo and Vicente H. Cicardo	590
Uranium in Urine.—H. M. Wilson and A. A. Smales	590
'Conditions of Survival'.—Prof. J. D. Bernal, F.R.S.	590
Infra-Red Recording with the Cathode Ray Oscilloscope.—E. F. Daly and Dr. G. B. M. Sutherland; Dr. H. W. Thompson, F.R.S.	591
Bond-Energies and Isomerization. By Dr. H. A. Skinner	592
Carbon Sources in the Photosynthesis of Aquatic Plants. By Prof. E. Steemann Nielsen	594
Marine Algae of New Zealand. By Prof. V. J. Chapman	596
Forestry in New Zealand	597
Recent Scientific and Technical Books	Supp. ii

FREEDOM IN SCIENCE 60/-

ON p. 574 of the issue we publish an article by Dr. John R. Baker and Prof. A. G. Tansley on "The Course of the Controversy on Freedom in Science" based mainly on the history and development of the Society for Freedom in Science; on p. 590 appears Prof. J. D. Bernal's communication criticising the two editorial articles on "Conditions of Survival" recently published in *Nature*. Though the article and the letter were submitted to the Editors independently, they raise similar issues, though from different points of view, so it was considered desirable that both should be published simultaneously, not with the view of raising an argument, but rather in the hope of clearing up certain misunderstandings.

Baker and Tansley in their article clearly support the conception of freedom in scientific research and exposition, citing science in Soviet Russia as an example of science in chains. Bernal, on the other hand, implies that Communism supports freedom of investigation. It is quite obvious that taken on their face value both contentions cannot be correct; but no useful purpose is being served, we think, by entering the lists of argument before all doubts and misunderstandings are cleared away. It was in this spirit that the Society for Freedom in Science was offered space in *Nature* to state its aims and objectives. While not necessarily agreeing entirely with all the points of view put forward on behalf of the Society, it seems desirable that its aims should be set forth before the world of science, for there is undoubtedly sound *raison d'être* for the Society at the present time, and its main objectives are worth striving for. We would suggest, however, that the Society be wary of attacking a selected target before making quite sure that it deserves attack. For example, though it is clear that the attitude of the powers in Soviet Russia towards science does not conform to the views held and expressed by the Society for Freedom in Science, it is not so certain that the U.S.S.R. initiated "a movement against pure science and against freedom in science". It would be absurd to claim that there is in the U.S.S.R. that freedom in scientific research and in the expression of opinion of things scientific which is still enjoyed in countries such as Britain and the United States; science in the U.S.S.R. is subject to the State and its policy. It seems to us to be unfair to state categorically, therefore, that the Soviet authorities are deliberately planning an attack on pure science and freedom in science. Things are not so tangible as that, and we have much to learn of each other's points of view. Until then, there should be toleration and real attempts to find out the facts and avoid jumping to conclusions.

For example, *Nature* has repeatedly pleaded for conscious planning of scientific research. This does not mean that the individual research worker must essentially be absorbed into a planned team. Neither does it necessarily involve surrendering one's freedom of choice in scientific research. By planning according to what problems reveal themselves and the capabilities and attitude of the personnel available, we

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believe that the best ground and background can be provided for the man of science—individually or in a team—so that he can give of his best. The policy of *laissez-faire* must disappear as the man of science and the layman become more and more aware of science and the impact of science on society. This, we feel sure, is where the pioneers of the Society for Freedom in Science have betrayed the misunderstanding of the points of view of certain other scientific institutions, including *Nature*; for though we claim that the impact of science on society is now achieving such importance as to command constant study which is bound to result in conscious planning, we are equally as convinced that it is the man of science who must be allowed to do the planning in consultation with others. In this way his freedom need not be impaired. We suspect the Society is opposed to political influences being brought to bear in the scientific field—an opposition which receives our support. Provided we are sure of this, then we believe that the five propositions set out as indicating the principles of the Society are of cardinal importance and worthy of full support.

The Society for Freedom in Science is certainly right in insisting that human welfare does not mean only material welfare, and above all the claim that the understanding of Nature is in itself good, apart altogether from the use of that understanding in practical affairs. The Society will do good work by pressing this point of view, for the pursuit of science for its own sake is as important a cultural discipline as the arts and the humanities, and it is therefore of inestimable value in education. Also by pursuing this policy the Society can do much to prevent scientific research becoming degraded to nothing but a search for material developments; for if that happens, fundamental science might well receive a mortal blow and freedom in scientific research disappear entirely from our culture.

The main objectives of the Society for Freedom in Science will best be achieved by constructive opposition. We would not deny the right to criticize opposing views provided it has been made certain that such opposition is real and not merely apparent. Furthermore, as in the case of Bernal's interpretation of the two editorial articles in *Nature*, it is desirable to recognize that there may be other points of view which are not necessarily wrong or, worse still, mischievous. We feel, for example, that Baker and Tansley's charges against the Association of Scientific Workers, the British Association for the Advancement of Science, and the scientific Press for supporting and even taking part in the "new propaganda" are too dogmatic. Their charges imply deliberate action. We do not think such charges are supported either by present-day facts or past history. That there is a threat to freedom in science we would not deny; but we do not consider it is a mutation which appeared in the form of propaganda suddenly in 1931. Civilization is now going through very severe changes, many of them initiated by science itself, and with these changes science, and all that it implies, must move. Never before, therefore, has there been such a need for the Society, provided it

chooses its objectives in the light of up-to-date observations and experiences. Failing this, the Society will succeed only in setting up factions, each of which would in no circumstances see good in the other. But with such principles as the Society is propounding, we think it will successfully go along the right lines. Already two of its officers discern what they claim to be a change of front in those whom they originally suspected of being propagandists against pure science and against freedom in science. It may be that they are right and that such a change of front has occurred; perhaps it is being realized that totalitarianism in science does not work. On the other hand, it is quite conceivable that at any rate the British Association and the Society for Freedom in Science do not differ so much in ideals as in methods of approach. It is clear that the British Association, which stands for the advancement of science, would benefit by collaboration with the Society for Freedom in Science, since in a democratic country it cannot be accepted that advancement is possible in the absence of freedom.

Prof. Bernal's communication reveals keen support for the Soviet political views and attitudes towards science; we are not prepared to discuss these points of view. Readers of *Nature* must be left free to come to their own conclusions. We do not consider it necessary to change or modify the views as set out in the two editorials to which he refers. We feel, however, that supporters of Soviet political and scientific policy should realize that to accuse anyone who attempts to criticize that policy of being a victim of the late Dr. Goebbels's propaganda is now surely outmoded. We do not consider any political doctrine above criticism, and therefore in so far as political doctrines when put into practice frequently affect science, education and research, we must reserve the right to raise our voices. This applies not only to communism but also to democracy. It is quite clear, for example, that the Society for Freedom in Science and *Nature* have not seen eye to eye in the past, but it is equally as clear that since the aims and objectives of both are so similar, in due course misunderstandings can be cleared up.

We agree with Bernal, on the other hand, that "respect for human personality, freedom of worship, freedom of investigation" are far from being an exclusive mark of Christian ethics". So also have we on several occasions expressed similar views to his own that "the cultures of Islam, India and China have contributed their share to the common heritage"; but we are sure that most men of science would support us in the view that science must beware of the incursion of national and party politics into its field. For example, is it really true that "the Soviet Union has assisted and upheld . . . freedom of investigation"; when we think of such as the 'genetics controversy' we feel rather doubtful. When science is utilized to support any political doctrine, then it is not above suspicion of veering from its main (and only true) objective—the search for and exposition of the truth. By jealously guarding its right to freedom in expression of opinion, science makes its strongest and most worthy contribution to

that new international unity which Bernal clearly hopes will be eventually attained. Though this does not imply freedom to defy the laws of one's own country, it does imply freedom to criticize any political doctrine when it is having a tangible effect on science itself (in this respect the Society for Freedom in Science will prove most valuable). We have, therefore, on several occasions criticized certain communist attitudes; there is no question of "ill-considered intrusions into political topics", for it is useless to close one's eyes to the fact that political creeds do affect science and scientific workers, and when we think the effect is a bad one then we reserve the right to say so. Is the only way to prove one's respect for Soviet Russia to refrain entirely from criticism and become communist oneself? No true man of science can deny another the right to a conflicting opinion, but he should denounce those who persist, as Mr. Bernard Baruch recently put it, "in errors as to facts". We are glad that the Scientific Committee to the Atomic Energy Commission has declared that control of atomic energy is possible, though we note that Prof. Bernal does not consider the refusal of the U.S.S.R. to surrender a part of her national sovereignty such an important issue as "the refusal of the United States to accept prohibition of the atomic bomb, and its insistence on attaching to the Lilienthal report the political condition of the abolition of the veto". On October 8, when Mr. Baruch was presented with the annual plaque of Freedom House for his work as United States member of the United Nations Atomic Commission, he referred to the Russian view that international inspection of atomic research would violate national sovereignty, saying: "better that than international disaster. America is willing to accept inspection, and for some time America would be the most inspected". This statement is worth pondering. We consider Mr. Baruch is right, and the Russian point of view wrong, and surely in saying so we are not putting a stumbling block on that trail to international unity which all clear-thinking men and women wish to see blazed.

We cannot agree with Prof. Bernal that inherent in Anglo-American culture there is a "holier than thou" attitude: if there were, it would indeed be a dangerous weakness. Neither does it seem necessary to warn scientific workers in Great Britain against accepting such a flattering ascription to themselves of the monopoly of moral values. But this surely does not imply, therefore, that they become divested of any right to think, and say what they think, of other cultures, political creeds, other hypotheses and other points of view. We think it is Bernal who is allowing politics to intrude upon his scientific views, and this is the type of attitude which we feel must be checked. This can be done best by ensuring that freedom in scientific research which the Society for Freedom in Science stands for, bearing in mind at the same time the duties that scientific workers owe to their fellow men. Men of science can do best by not allowing their political views to colour their scientific work and attitudes, and in refusing to allow political forces to dictate or in any way influence their work.

BABBAGE'S DREAM COMES TRUE

A Manual of Operation for the Automatic Sequence Controlled Calculator.

By the Staff of the Computation Laboratory. (Annals of the Computation Laboratory of Harvard University, Vol. 1.) Pp. xii+561+17 plates. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1946.) 10 dollars.

THE black mark earned by the government of the day more than a hundred years ago for its failure to see Charles Babbage's difference engine brought to a successful conclusion has still to be wiped out. It is not too much to say that it cost Britain the leading place in the art of mechanical computing. Babbage then conceived and worked on his 'analytical engine', designed to store numbers and operate on them according to a sequence of processes conveyed to the machine by cards similar to those used in the Jacquard loom. This, however, was never completed.

The machine now described, "The Automatic Sequence Controlled Calculator", is a realisation of Babbage's project in principle, although its physical form has the benefit of twentieth century engineering and mass-production methods. Prof. Howard H. Aiken (also Commander, U.S.N.R.) of Harvard University inspired the International Business Machines Corporation (I.B.M.) to collaborate with him in constructing a new machine, largely composed of standard Hollerith counters, but with a superimposed and specially designed tape sequence control for directing the operations of the machine. The foremost I.B.M. engineers were assigned to the task; many of their new inventions are incorporated as basic units. When the machine was completed, Thomas J. Watson, on behalf of the Corporation, presented it to Harvard University—yet another token of the interest I.B.M. has shown in science. Would that this example were followed by their opposite numbers in Great Britain! One notes with astonishment, however, the significant omission of "I.B.M." in the title and in Prof. Aiken's preface, although President Conant's foreword carefully refers always to the "I.B.M. Automatic Sequence Controlled Calculator".

The machine contains seventy-two storage counters, each capable of holding twenty-three digits and a sign. For smaller numbers each counter can be split into two, while for larger numbers they can be teamed up. There are also sixty switch-set 24-figure registers, for holding constants; these likewise can be split. There are several special units, two being for multiplying and dividing; these first form nine multiples of the multiplicand or divisor. In multiplication the multiples directed by the multiplier are chosen and added step by step. In division the dividend or remainder is compared with the multiples in succession; that which is just less than the dividend is subtracted, and the appropriate figure of the quotient recorded. When working to the full 23-figure capacity of the machine, multiplication takes about six seconds, and division twice as long; additions and subtractions are done at the rate of three a second, whatever their length.

Three special units (which share many of the machine components) are for calculating logarithms, antilogarithms (or exponentials) and sines (or cosines). The process of calculating a 21-figure logarithm is a combination of the factor method and of the series log $(1+x) = M(x - x^2/2 + x^3/3 - x^4/4 \dots)$. The