



SATURDAY, JULY 27, 1929.

CONTENTS.

	PAGE
The Advancement of Science in South Africa	117
A Classic of Physics	119
The Hellenic Society, 1879-1929	121
The Subject Index to Periodicals. By Dr. S. C. Bradford	122
Our Bookshelf	123
Letters to the Editor :	
Diffraction of X-rays by Two-Dimensional	
Crystal Lattice.—Prof. W. L. Bragg, F.R.S.	125
Asymmetry in the Radiation from the Hydrogen	
Atom in the Electric Field.—Prof. J. Stark	125
The 'Absolute' and 'Relative'.—W. W. L.	126
New Fixatives for Plant Cytology.—L. La-Cour	127
An Isotope of Carbon, Mass 13.—Dr. Arthur S.	
King and Prof. Raymond T. Birge	127
A Spinning Target X-ray Generator.—Dr. Alex.	
Müller	128
The Origin of Variations.—Dr. E. J. Allen, F.R.S. ;	
A. G. Lowndes	128
Production of High Lo Surdo Fields.—Prof.	
Yoshio Ishida and Shigeru Hiyama	129
New Bands in the Spectrum of Oxide of Lan-	
thanum.—Giorgio Piccardi	129
Recent Progress in Canadian Hydro-Electric Power	
Development. By Dr. Brysson Cunningham	130
The Original Home and Mode of Dispersal of the	
Coconut. By Dr. Arthur W. Hill, C.M.G., F.R.S.	133
Obituary :	
Prof. L. T. Hobhouse. By Dr. Morris Ginsberg	153
News and Views	154
Our Astronomical Column	158
Research Items	159
The London School of Hygiene and Tropical Medicine	
History of Science Exhibition at Florence. By Miss	
S. D. Wingate	163
Long Delayed Radio Echoes	164
University and Educational Intelligence	164
Calendar of Patent Records	165
Societies and Academies	166
Official Publications Received	168
Diary of Societies	168
SUPPLEMENT.	
Africa and Science: INAUGURAL ADDRESS TO THE	
BRITISH AND SOUTH AFRICAN ASSOCIATIONS.	
By Jan H. Hofmeyr	135
Summaries of Addresses of Presidents of Sections	146

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The Advancement of Science in South Africa.

TWENTY-FOUR years ago the British Association visited South Africa for the first time, and now, by invitation of the South African Association for the Advancement of Science, the parent body is again in Cape Town. Mr. Jan H. Hofmeyr's inaugural address, which is printed in the supplement to this issue of NATURE, indicates the remarkable advances made since 1905 in South Africa in almost every branch of science. Mr. Hofmeyr very properly recognises the great service of the late Sir David Gill to science in South Africa in the early part of this century. Without him there would have been no body in South Africa corresponding to the British Association, for to him, and to a lesser extent Sir Charles Metcalfe, the existence of the South African Association is largely due. Sir David was not only a great astronomer, but also a very inspiring and attractive personality.

In 1905 there were four separate States, each enjoying, under the Crown, a very large measure of independence. Two of them, the Transvaal and the Orange Free State, as a result of the war, were still under Imperial tutelage, but in 1907 they were given full responsible government. It cannot be truthfully stated, however, that these four States formed a very happy family; indeed, the exact converse was the case, but in 1910 all came together and formed what is now known as the Union of South Africa. It was then that the real advances in scientific work started, for, thanks largely to a bulging Transvaal treasury, government departments were properly staffed with scientific workers. When it obtained responsible government in 1907 the Transvaal showed the way, possibly because it had the necessary money, and the world-renowned Veterinary Station at Onderstepoort to which Mr. Hofmeyr refers was actually planned before union took place.

Twenty-four years is not a long period, but possibly no other country has experienced such changes within a similar time. Governmental changes have already been indicated, but the whole country's physical aspect has altered almost beyond recognition. Vineyards, orchards, plantations, and trim homesteads now abound where formerly there was nothing but bare veldt. The flocks of sheep and cattle have increased beyond the wildest dreams of those who can recall the conditions of 1905. It is true that ostriches, thanks to fickle fashion, have decreased for the moment, as have also Angora

goats, but the nuclei of potentially important industries still remain. Great stretches of country which were deadly to man and beast are now being successfully farmed and healthy children are being reared. The fight against animal and plant diseases has been waged without ceasing and, thanks to the vigilance of an alert staff of scientific workers attached to the agricultural department, great victories have been won. In this connexion the work of Lord Milner must never be forgotten, for it was he, and no other, who laid the foundations of a scientific agricultural policy the results of which are so apparent to-day. This fight has been waged in the laboratories as well as in the veldt. Twenty-four years ago South Africa was importing many of its everyday food requirements, such as butter, cheese, and bacon. To-day she is exporting all these and many others, but she has still to import a considerable proportion of her wheat.

Sir Thomas Holland, the new president of the British Association, will find much to interest him in his own line of work, for in spite of the triumphs of agricultural science, South Africa is still in the minds of the public mainly a producer of gold, diamonds, and, to a minor extent, of platinum. The Geological Survey, from the merely material point of view, has brought much wealth to the country as a whole through its discoveries and surveys, and in Northern Rhodesia a most ambitious scheme of geophysical survey is now being undertaken. Two years ago, at the Empire Mining and Metallurgical Congress held in Canada, Sir Thomas delivered an epoch-making address in which he advocated the necessity of making a review of the mineral resources of the Empire, and though nothing tangible has resulted, his views have not been forgotten; and South Africa, which is probably as well known geologically and mineralogically as any other country in the world, is still capable of springing mineralogical surprises which increase her potential wealth. It is true that many, indeed most, of the discoveries have been made by the old-time prospector, but it looks as if the new geophysical methods were likely to oust that picturesque character from his most interesting occupation.

Then, although the Rand and Kimberley are still the most important mining centres, they have ceased to be the only ones. Indeed, it looks as if Northern Rhodesia will at no distant date rival the Rand with regard to the value of its output of copper and other metals and minerals. But throughout the Union itself there are many centres of mining activity concerned with the actual mining

and subsequent treatment of coal, platinum, chrome, asbestos, mica, tin, manganese, magnesite, beryl, and other minerals of minor importance.

Not many years ago, the exports from South Africa were made up almost entirely of gold and diamonds, but to-day the agricultural products, as Mr. Hofmeyr points out, very nearly equal in value the mineral exports, and it is anticipated that at no distant date they will even exceed them. These great advances are undoubtedly due to the application of scientific principles, and although the amount of research work carried out in the laboratories of the four teaching universities of the country is comparatively small at the moment, that work is undoubtedly of paramount importance to South Africa itself.

Mr. Hofmeyr refers with justifiable pride to the great advances which have been made in university teaching—advances in which he himself took no mean part. There is, however, just a doubt as to whether they have not been too rapid for a country which, after all, has a white population of only a million and a half. Probably they were inevitable, as the distances between populous centres are very great, and there has always existed a healthy provincial patriotism which has made for duplication of services generally. There are, for example, two well-equipped medical schools when probably one is quite sufficient for the country's requirements. There is also overlapping in certain specific subjects. If, in the fullness of time, one of the existing universities could be developed for research and post-graduate teaching, the country would undoubtedly be the gainer. At present there is too much teaching and too little research, and yet, as has already been indicated, the output is quite considerable. South Africa is fortunately very rich in historical archives, and thanks to Mr. Graham Botha, Sir George Cory, Prof. Eric Walker, and many other earnest workers, these are being rescued from comparative oblivion and made public.

Then, again, thanks to a few ardent workers inside and outside the universities, the origins of the native races, their languages, their folk-lore, and their customs, are being studied to-day as never before. The natives are being rapidly civilised, their old tribal customs are gradually dying out, and the authority of the chiefs, except in the native reserves, has practically disappeared. Nothing quite satisfactory has yet taken its place. The black man is South Africa's greatest problem to-day. All others fade into relative insignificance, and it will take the combined wisdom of both the

dominant races to reach a solution. The members of the British Association cannot be expected to grasp all the ethnological, economic, and political aspects of this great and most difficult problem in the short time at their disposal, but they can at least regard it from an entirely detached point of view.

Those who were living in South Africa at the time of the last meeting there of the British Association wondered very naturally what would be the effect of that very inspiring experience. They felt that they were on the eve of great happenings, but no one could predict what these would be.

Looking back, we find it difficult even to-day to assess the benefits which accrued to the country as a whole. Both visitors and hosts were undoubtedly inspired by the interchange of thought and experience, and it was surely no coincidence that, immediately after the visit, South Africa as a whole set out to wage scientific warfare on its all too numerous pests and parasites, to discover the possibilities of new forms of agriculture, and to inaugurate a more extensive geological survey campaign. The people as a whole, and those who were responsible for the government of the country, had their thoughts very definitely directed to the application of scientific endeavour.

Those who live in South Africa, and those outside it who endeavour through sheer love of that great country to keep in touch with its many problems, again feel that they are on the eve of great happenings. What they will be no one can say, but the members of the British Association will find a better educated community, a more receptive public, and a greater appreciation of the benefits of science among all classes than on the last occasion. They will also find a very healthy spirit of nationalism, developed largely since the War, but finding expression in all walks of life. Nevertheless, they are assured in advance of a hearty welcome from all sections of the community, and we have no doubt that not only will the present visit be as inspiring as the last, but also that its results will be infinitely more beneficial, not to South Africa alone, but to the whole of the British Empire and to the world at large.

The British Association when it visits an outpost of the Empire acts as a catalyst; little is known about the methods whereby these mysterious bodies exercise their equally mysterious effects, but they are nevertheless perfectly definite. South Africa is a splendid field for this catalyst, and we are sure that the stimulus afforded by the present meeting will be felt for many years.

A Classic of Physics.

The Collected Works of J. Willard Gibbs. In 2 vols. Vol. 1: *Thermodynamics.* Pp. xxviii + 434. 15s. net. Vol. 2: Part i., *Elementary Principles in Statistical Mechanics*; Part ii., *Dynamics, Vector Analysis, and Multiple Algebra, Electromagnetic Theory of Light, etc.* Pp. xviii + 207 + vi + 284. 15s. net. (New York, London and Toronto: Longmans, Green and Co., Ltd., 1928.) 2 vols., 25s. net.

THE writings of Gibbs on thermodynamics and statistical theory were far and away the most complete of the early presentations of those subjects, but there must be many with a good knowledge of the theories who have never consulted the originals. As his works have long been out-of-print, the editors have performed a most valuable service in bringing out the present two volumes. They are beautifully printed, and the editors are to be congratulated on having adopted the right method for the re-issue of a classic; a commentary will certainly be useful, and one is to be composed by a number of authorities, but the present books are not disfigured by footnotes in the manner so often practised by energetic but injudicious editors.

It is well known that Gibbs's work did not meet with great appreciation for many years, and after reading his papers it is interesting to consider why. We can imagine some elder of the Connecticut Academy after one of their meetings telling him as delicately as possible that he could not understand what the "Heterogeneous Equilibria" was about; and then Gibbs would go home and amplify it, expecting thereby to make it as clear to others as to himself. The result is that, once the chief idea is grasped, the whole is discussed in such great detail that it could scarcely be improved in ease or clearness. The whole trouble is at the beginning, and depends on the reader being able to *feel* the meaning of $d\epsilon \geq td\eta - pdv - \mu_1 dm_1 - \mu_2 dm_2 - \dots$ (Gibbs always considers the case of inequality with care), and for most of us it is unfortunately a considerable step from admitting the logic of the equation to the intuitive understanding of it. It is hard to see how amplifying his introduction would have helped; what is needed is habit of thought, and this can only grow with the lapse of time. His first paper on thermodynamics was published in 1873, two years before the great paper, and the right answer to anyone who complains about the "Heterogeneous Equilibria" is to advise him to spend, like Gibbs, two years over its preliminaries.