ever. One of the most interesting results so far announced is the great depth of the Arctic Sea over a very large area. This accentuates the physical contrast between the Arctic and the Antarctic regions; and will probably make it necessary to adopt a greater mean depth for the ocean, and a deeper position for the line of mean-sphere level (*cf.* NATURE, vol. liv. p. 112). The general course of the *Fram*, as sketched from the provisional data, shows an altogether remarkable parallelism with Dr. Nansen's hypothetical track of the *Jeannette* relics, and fully bears out his theory of the circulation of the Arctic Sea. A "palæocrystic sea" would appear to be possible only in conditions which give rise to eddies, or otherwise impede the normal circulation. The temperature has not been found so low as that frequently experienced in northern Siberia, so that unendurable cold can no longer be viewed as an obstacle in the way of making high latitudes.

So far as high latitudes go, Admiral Markham, in 1874, succeeded in passing Parry's position of 1827 by only 35′, or about forty miles; Lockwood, in 1882, did not get more than four miles further north than Markham; but Nansen has taken the unexampled stride of 2° 50′, or almost two hundred miles beyond the previous "record," in consequence of his simple plan of not opposing, but siding with the workings of nature. The result is a triumph of science, and a proof—if proof were needed—that scientific training, no less than courage, perseverance, and physical endurance, is necessary in a great explorer.

Apart from the voyage of the *Fram*, this summer has yielded a rich harvest of arctic exploration. The *Windward*, which left Vardö on June 29, under the command of Captain Brown, an experienced whaler, and with the aid of Mr. Crowther as ice-master, has made a remarkably quick voyage to and from Franz Josef Land. She took out Mr. W. S. Bruce and another member of Mr. Jackson's party, and brought back several whose time with the expedition had expired. The telegrams which have been received show that Mr. Jackson's party have passed the winter comfortably, and have had excellent sport; they have devoted themselves to the mapping of the region around their winter quarters, and dispatches are promised by the *Windward*, which will doubtless give particulars as to points visited and positions attained. Dr. Nansen's journey on the ice north of Franz Josef Land will be a powerful stimulus which should result in great achievements.

Mr. Andrée's balloon expedition has had to be postponed on account of delay in getting the balloon-house erected and the balloon filled, but it will certainly be renewed next year. Spitzbergen, with weekly mail-steamers, a comfortable hotel, and even a set of postage-stamps, has been largely visited by tourists during the summer; but amongst the sight-seers and sportsmen there have been several scientific men bent on serious exploration. Sir Martin Conway, with Dr. Gregory, Mr. Garwood, and Mr. Trevor Battye, have been over a large amount of new ground, and made several interesting discoveries. The geology of the islands in particular has been carefully worked up, and the results will be looked forward to with confidence. The whole party has safely returned to Norway.

Mr. Peary's expedition to the north-west coast of Greenland has been much hampered by the ice, and it is uncertain whether it will yield any scientific results. The application of the name *Peary-land* to the extreme north of Greenland, proposed by the Geographical Club of Philadelphia, has been generally approved as a tribute due to an explorer of great power and perseverance.

Prospects of Antarctic exploration are no brighter. The Belgian expedition has been postponed, and the English expedition to Cape Adare does not seem likely to start this year. There is, however, a possibility that the wave of enthusiasm in polar research, which is sure to pass over Europe during the coming winter, may float some of the existing schemes, or even move high quarters, and lead to the dispatch of a properly equipped Government expedition. However glad we should be to see a British party regaining the national prestige in the polar regions, the need for scientific research in those quarters would lead us to welcome the first who comes forward with a sane plan and a sound party, be their nationality what it may. The drift of the *Fram* has shown that the new explorer may succeed, even though he may contravene every law laid down by the old, provided he respects the law of nature of moving in the direction of least resistance, and not trying to hurry through in a season what should be the deliberate progress of years. May it not be possible that we have somewhat overestimated the necessity for naval discipline, and undervalued the power of scientific enthusiasm in polar exploration? HUGH ROBERT MILL.

SIR WILLIAM ROBERT GROVE.

"I HAVE long held an opinion almost amounting to conviction, in common I believe with many other lovers of natural knowledge, that the various forms under which the forces of matter are made manifest have one common origin; or in other words are so directly related and mutually dependent that they are convertible, as it were, into one another, and possess equivalents of power in their action. In modern times the proofs of their convertibility have been accumulated to a very considerable extent, and a commencement made of the determination of their equivalent forces."

Thus wrote Faraday in 1845, beginning his paper "On the Magnetization of a Ray of Light and the Illumination of Magnetic Lines of Force," and the words describe admirably the subject of William Grove's great work "On the Correlation of the Physical Forces" which appeared in the following year. But as a matter of fact this famous essay had been brought into existence three years before as a course of lectures delivered at the London Institution, in which Grove then held the post of Professor of Experimental Philosophy. It was the first systematic statement of the connections between the different departments of physical phenomena, and as such was of great scientific (that is *science-making*) value. Helmholtz's magnificent exposition of the principle of conservation of energy appeared the year after, and contained as completely as was then possible that quantitative discussion referred to in the last words of the above quotation from Faraday, as being when they were written, at various points begun. These two remarkable essays may be said to form the starting-point of the modern science of energetics, of which the experimental foundation was even then being overhauled and laid still more deeply and stably by Joule. If we reflect how much has come from the principle of constancy of energy with the necessary aid of other dynamical principles (for the theory of conservation is by itself insufficient for the determination of the mode of action of physical forces), we are better able to form an idea of the value of the work done by these pioneers in exploring and mapping out the paths which appeared to lead from one province of science to another.

At the time of the publication of his essay Grove was about thirty-five years of age, having been born at Swansea in 1811. He had already accomplished a considerable amount of original work of great value. His voltaic cell, known now to all who have even the slightest knowledge of electricity, was one of several voltaic combinations which he devised, and was described first at the British Association meeting at Birmingham in 1839, and again in a paper in the *Philosophical Magazine* for October of the same year. Though the Grove battery is now superseded in most of our laboratories by dynamos, it was in

its day a discovery of no slight scientific importance. It solved in a very satisfactory way for practical purposes of experimenting the problem of how to obtain a voltaic battery of high electromotive force and moderate resistance, free from the paralysing effects of polarization when used to generate large currents for fairly long intervals of time. The battery soon became a great favourite for experiments involving heavy currents, such as the production of the electric light by means of an arc between carbon points; and it was that used by Faraday in his electro-optic experiments.

From the age of twenty-five to fifty Mr. Grove, though pursuing the profession of the Law, was actively engaged in scientific work, and at a comparatively early age was elected a Fellow of the Royal Society. Just fifty years ago he was awarded a Royal medal for his paper "On Certain Phenomena of Voltaic Ignition and the Decomposition of Water into its Constituent Gases by Heat," which formed the Bakerian Lecture for 1846. His papers are numerous and deal mainly with the phenomena of the voltaic cell, and of electrolytic decomposition generally. The subject of the polarization of gases in particular occupied much of his attention, and he discovered the well-known gas-cell, so interesting from a theoretical point of view, and especially now as being the forerunner of the modern secondary battery. Besides these Mr. Grove studied electrical discharge, the effect of light on polarised electrodes, and other subjects which, investigated with the aid of modern appliances and instruments, have yielded a rich harvest of valuable results.

The most active part of Mr. Grove's scientific career may be said to have ended about the time of his presidency of the British Association at the Nottingham meeting in 1866. His presidential address was on his favourite subject "The Continuity of Natural Phenomena," and he had then the satisfaction of finding the views he so early held now shared by all scientific workers, and illustrated by a great mass of recent scientific discovery. In 1871 he was made a Judge, and shortly afterwards received the dignity of knighthood. In 1875 the honorary degree of D.C.L. was conferred on him by the University of Oxford, and was followed in 1879 by that of LL.D. from the University of Cambridge. For sixteen years he devoted himself unremittingly to his legal duties, but in 1887, when he retired from the Bench, his former scientific interests and activity, never extinct by any means, in great measure returned. But at his now very advanced age arduous scientific work was impossible, and his contributions to scientific literature were limited to such lectures and addresses as his strength enabled him to deliver.

In the preface of his essay on the Correlation of Physical Forces, Sir William Grove represented himself as standing on the vantage ground obtained by the labours of others, and therefore as able perhaps to see somewhat further than those who had gone before. It is ever thus: the men of to-day work more surely and swiftly because such men as he have lived and worked before them. It has been given to few to witness, as did Sir William Grove, almost all the scientific progress of the nineteenth century, and it must have well rewarded his scientific spirit to see the younger generation enter into the labours of the founders of the theory of energy with so much eagerness and so great a promise of fruitful achievement.

A. GRAY.

PROFESSOR HUBERT A. NEWTON.

AT the time when the attention of astronomers is again directed to the return of the nucleus of the November meteors, the sad intelligence reaches us of the death of Prof. Newton, of Yale College, whose reputation is largely connected with the history of this shower, and who, perhaps more than any other, has advanced the position of meteoric astronomy to that it now holds. He thus rendered a great service to astronomy, and had he no other claims to remembrance this would ensure a grateful recollection. Prior to his historical researches the observation of meteors possessed but a languid and feeble interest, lacking that coherence and purpose which method, founded on a suggestive hypothesis, alone can give. The collection and discussion of the original accounts of thirteen meteoric displays, all of a similar description, and distributed over a period of more than nine hundred years, demonstrated the permanent character of the phenomenon, rendered prediction possible, and invited hopeful inquiry. The fact that he left the inquiry incomplete scarcely diminishes the extent of his service, since he showed that the problem came within the range of celestial dynamics, and he at once indicated the method and supplied the means which it was certain would be effective in the hands of a master of profound and subtle analysis. It is not necessary to pursue the subject further, or to more than mention the interest subsequently added to meteoric inquiry by the discovery of Schiaparelli and others working in this fruitful field; the impulse had been given, and the subject of shooting-stars became vividly and permanently a subject of astronomical notice.

Prof. Newton's connection with the observatory of Yale University has been long and honourable. Perhaps one is not quite justified in calling him the Director of the Yale Observatory, but his position seems rather difficult to define as the Secretary to the Board of Managers, who annually present a report to the President and Fellows of Yale College. For two years, 1882–4, he certainly held the position of Director; but he seems to have preferred his old position of Secretary, leaving the head of each department to make a separate report. There can be no doubt, however, but that his was the directing mind, and determined the character of the observatory. It was while he held the position of titular chief that the heliometer, which in the trained hands of Dr. Elkin has proved itself of such value, was mounted, and probably it was his suggestion that the observatory should possess an instrument of exact measurement rather than one of those gigantic equatorials, which elsewhere in America have appealed to the fancy, and satisfied the ambition of the millionaire. Certainly he subscribed liberally to the guarantee fund which ensured its use by a skilled astronomer, and the work that has issued from the observatory under his management, whether it be parallactic inquiry or stellar triangulation, has amply justified the expenditure, and placed the institution in the front rank of those devoted to extra-meridianal work. Not but that the utilitarian side of astronomy has also been ardently pursued at Yale. The distribution of time signals, the testing of chronometers and philosophic apparatus have long been a part of the routine work, and the observatory has worthily striven to maintain a high standard of workmanship.

Prof. Newton's services to science are by no means exhausted by the fulfilment of the duties of his chair or of the direction of the observatory. He has held the post of President of the American Association for the Advancement of Science, and been the author of many papers, generally connected with meteoric or cometary astronomy. More particularly may be mentioned his inquiry into the capture of comets by Jupiter or other planets, in which he has shown that the perturbing action of the planets on parabolic orbits of every possible inclination to the ecliptic tends to produce elliptic orbits of short period, moderately inclined to the ecliptic and with direct motion.

The Royal Society recognised the eminent services Prof. Newton had rendered to astronomy by placing his name on the roll of foreign members in 1892.

W. E. P