

ably in indicating the nature and value of the contribution which each of them made to biological science. He is especially happy in his treatment of the three representatives of ancient research; but the essays on Vesalius and Harvey are also clear, well-arranged, and suggestive. Mr. McRae is not content with second-hand information. He has evidently studied the original sources with care; and the result is that his method of exposition is invariably fresh and interesting. He knows, too, how to connect the results attained in former times with those at which later anatomists and physiologists have arrived. He does not, of course, claim to have exhausted the interest of his subject. But the work he has done, so far as it goes, is sound, and should be of service to many of his readers in helping them to understand the various stages in the development of the scientific conceptions with which he deals.

Through Magic Mirrors. By Arabella B. Buckley. (London: Edward Stanford, 1890.)

THIS volume is intended to form a sequel to the "Fair-Land of Science," and is written with the clearness and brightness which make that book so attractive. The power that Miss Buckley has of interesting young people in the more popular parts of the various sciences cannot be doubted, and is well shown in the present book. A magician is supposed to teach young lads; and the author is thus enabled to bring in different parts of the sciences, and to preserve a continuity throughout.

There are ten chapters, and the following are some of the headings: "The Moon," "Life-History of Lichens and Mosses," "History of a Lava Stream," "An Hour with the Sun," "An Evening with the Stars," "Little Beings from a Miniature Ocean, &c." In the chapters with these headings the uses of the telescope, spectroscope, camera, microscope, &c., are all mentioned and well explained, and their principles clearly brought out.

The information throughout is up to date, and is taken from the best sources; and the illustrations form a most important addition to the text. The frontispiece is a reproduction of Mr. Isaac Roberts's most exquisite photograph of the great nebula of Orion, taken on February 4, 1889.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Proposed South Kensington and Paddington Subway.

ALTHOUGH there can be no question but that any facilities of access to the group of buildings on the ground of the Commissioners of the Exhibition of 1851 will be greatly to the advantage of the public, the objections to the proposed railway raised in your recent article on "Shaking the Foundations of Science" are worthy of most serious consideration, if they are not altogether fatal to the scheme. The alternative route for the line which you suggest, along Queen's Gate, would meet with equal difficulties, much greater expense, and certain opposition in several quarters. There is, however, another solution of the question free from most of the objections to both the others.

Let the existing subway be continued as originally projected as a walking road to a station at the Albert Hall; and let the tramway or railway line be brought across Kensington Gardens from Paddington to meet it there. This will have the desired effect of giving easy access to the Albert Hall and neighbourhood from the north-west of London, as well as a convenient dry covered approach from the South Kensington Station. The cost of this scheme to the promoters of the railway will be far less than if they have to enlarge the present subway so as to make it available for carriages. The convenience to the public will be nearly as great. In the proposed scheme anyone coming by the District

Railway must change carriages at the South Kensington Station; and there are few who, having once alighted, would not as soon take a short walk to the Museums or the Albert Hall through the subway (as was originally designed when this was made) as mount into another carriage. It will be a totally different thing from having (as now) to emerge to the upper surface, and either take a cab or trudge along a wet, dirty, and cold road. It would, in fact, be scarcely a longer walk than is often necessitated along the platforms of some of our existing railway stations.

The walking subway, instead of opposition, may well receive the cordial support of all interested in the "foundations of science," as it will lessen the number of wheels which rattle along the streets above. The marvellous improvement that it made in the state of the streets during its brief period of usefulness, the summer of the Indian and Colonial Exhibition, was apparent to all dwellers in the neighbourhood.

W. H. FLOWER.

Natural History Museum, January 12.

WOULD it not be desirable to prepare a petition to the House of Commons, to be signed exclusively by scientific men, against the proposed South Kensington and Paddington Subway Railway? A copy might lie for signature at the rooms of each of the learned Societies.

ALFRED W. BENNETT.

Chemical Action and the Conservation of Energy.

IN NATURE of December 18, 1890 (p. 165), there appears a paper by Mr. Pickering under the above heading, in which some of the errors of thermo-chemists are exposed. As, on account of the well-known experimental skill of Mr. Pickering in thermo-chemistry, there may be some risk that all the positive statements in this paper may be accepted by students as facts, it is, I think, worth pointing out that some of these statements, although given positively as if they were obvious physical laws, are, to say the least, matters of controversy, whilst others are absolutely erroneous. It would seem as though prolonged calorimetric studies lead the experimenter to regard heat changes as the only factors to be considered in cases of chemical equilibrium, since the same erroneous view of the subject has been taken by Berthelot in his "Law of Maximum Work," by J. Thomsen in a similar "Law," and now by Mr. Pickering in this paper. He concludes:—

"As a consequence of this, it follows that, in any complex system of atoms, where two or more different arrangements are independently possible, and where the various products remain within the sphere of action, and are capable of further interaction, then those products, the formation of which is attended with the greater evolution of heat, will be formed to the exclusion of the others."

It is somewhat curious that by way of clearing the ground for his own views Mr. Pickering demolishes one of the chief arguments of the older school—namely, that an endothermic reaction may occur if it forms part of a cycle of which the final result is an evolution of heat. His illustration of the impossibility of this, by comparison with a stone rolling a short way up a hill by itself in order to have a long roll down on the opposite side, is exceedingly apt. But immediately following this is a statement which must be regarded as incorrect: "No amount of heating can make an endothermic reaction possible so long as it remains endothermic."

I have characterized two statements as erroneous; perhaps I may be allowed to mention the evidence usually accepted as proving this, premising that, since it partially depends on the second law of thermodynamics, and this in its turn depends upon experiment (see J. J. Thomson, "Application of Dynamics to Physics and Chemistry," pp. 4 and 5), no argument against it is valid which deals only with single molecules. The researches of J. W. Gibbs (Trans. Conn. Acad., iii. 108, 343), of Lord Rayleigh (Proc. Roy. Inst., vii. p. 386), of Massieu (*Journ. de Phys.*, vi. p. 216, and of Helmholtz (*Sitz. Akad. Berl.*, February 2, 1882, July 27, 1883, and *Monats. der Berl. Akad.*, May 31, 1883, p. 647; also, Physical Society, Translated Memoirs, vol. i., Part 1), prove conclusively the general principle that the evolution of heat alone is not conclusive as to the possibility of a chemical change taking place in a given direction. The magnitude which does condition this change having been arrived at by different methods, in some cases independently, has received different names; thus it is the "free energy" of Helmholtz, the