the various countries included in the British Empire has the great merit of being natural, simple, and clear. The position and extent of each country are first noted; next he explains the form of surface, describes the climate, and traces the coast-line. Details as to population, industries, and commerce come afterwards, and these are followed by "such facts concerning the social and political condition of the people as are usually included in a course of geography for children: the form of government, and descriptions of the political divisions and chief towns." Mr. Baker has selected his facts with much discretion, and presents them in a way which is likely to interest young readers and to exercise the intelligence as well as the memory. There are many very good illustrations and several coloured maps.

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 Rôle of Quaternions in the Algebra of Vectors.

PROF. GIBBS seems to forget that his pamphlet was specially announced as *Arranged for the use of Students in Physics*. When I wrote the remark which has called forth his recent letter, I was discussing the reasons for the comparatively slow progress of Quaternion Analysis in recent times. And, as it is precisely to students of Physics that I think we must look for such progress, anything which is calculated to divert their attention from Quaternions, or to confuse them in their use of Quaternion symbols, must be regarded as tending to retard the progress of the method. The Vector-Analysis supported by Prof. Gibbs involves a serious departure from the usage of ordinary Algebra, inasmuch as $\alpha\beta$ is not regarded as a product, but merely as a "kind of product." This is specially likely to confuse an ordinary student, and is undoubtedly artificial in the highest degree:—while one of the chief recommendations of Quaternions is their naturalness, *i.e.* the utter absence of artifice in their fundamental rules.

Some of Prof. Gibbs' suggested notations are very ingenious, and well calculated to furnish short cuts to various classes of results *already obtained*. But they do not seem to have led to any important extensions of such results; and must therefore be regarded as having claims to consideration very much inferior to those of the novelties of notation suggested by Mr. M'Aulay; for these have undoubtedly shown their value as instruments of research, while they do not depart from algebraic usage in a matter so fundamental as is the notation for ordinary multiplication.

It is singular that one of Prof. Gibbs' objections to Quaternions should be precisely what I have always considered (after perfect inartificiality) their chief merit:—*viz.* that they are "*uniquely adapted to Euclidian space*," and therefore specially useful in some of the most important branches of physical science." What have students of physics, as such, to do with space of more than three dimensions?

I do not agree with Prof. Gibbs in his statements as to the superiority of his notation over that of Quaternions, so far at least as can be judged from the examples he cites. Surely the simple equality

$$\sigma\phi\rho = S\rho\phi'\sigma = \Sigma(S\sigma S\lambda\rho)$$

shows, at least as plainly as does

$$\sigma.(\alpha\lambda + \beta\mu + \gamma\nu). \rho = \rho.(\lambda\alpha + \mu\beta + \nu\gamma). \sigma,$$

that the common value is "exactly the same kind of function of σ that it is of ρ ." As to $S\sigma\phi$, it is simply meaningless, and I cannot imagine anyone writing such an expression.

But I have a positive objection of another kind to Prof. Gibbs' proposed notation. To save complexity a great number of *indispensable* brackets, or their equivalents, are omitted. If all the really necessary signs of this kind were inserted, the translations of moderately complex quaternion formulæ into his

language would be frightful even to look at. To take a very simple case:—so far as I understand him Prof. Gibbs would write

$$(\alpha \times \beta) \times (\gamma \times \delta) \times (\epsilon \times \zeta)$$

as the equivalent of

$$VV(V\alpha\beta V\gamma\delta)V\epsilon\zeta.$$

But, if so, how would he write, without additional parentheses,

$$VV\alpha\beta VV\gamma\delta V\epsilon\zeta, V.\alpha\beta VV\gamma\delta V\epsilon\zeta, V.V\alpha\beta V\gamma\delta V\epsilon\zeta, \&c.?$$

Even the first of the four just written has but *one* pair of brackets, besides the five Vs; while Prof. Gibbs' equivalent has *three* pairs of brackets, besides the five $\times$ s. And, so far as I can see, Prof. Gibbs must invent a new notation entirely for the last two formulæ written above, since the product of three vectors is nowhere provided for in his system, important as it is and of constant recurrence in physical problems.

St. Andrews, April 25.

P. G. TAIT.

P.S.—As I see that the correspondence in the *Athenæum* regarding the notice of Hamilton in the *Dictionary of National Biography*, has just been summarily closed, I would remark that the patent error of that notice is the confusion of Hamilton's *Varying Action* with his *Quaternions*. The consequence is that Hamilton gets no credit whatever for his absolutely invaluable contribution to Theoretical Dynamics!

The Influenza.

THE influenza—or the peculiar fever we know by that name—seems to be again making its appearance amongst us; at present in scattered cases in the towns, villages, and country districts of the west of England, and with some severity in Yorkshire. How is it that having had the disease once does not give immunity against future attacks, as is more or less generally the case with diseases of this kind, *i.e.* those caused by microbes, as this is now held to be? It would be interesting if some statistics could be arrived at with regard to the present outbreak, showing the proportion of cases of those who had already had influenza, and of those who, having escaped before, have now taken the disease.

E. ARMITAGE.

April 22.

Antipathy [?] of Birds for Colour.

YOUR correspondent "M. H. M." asks the question in your issue of April 16 (p. 558), "Has the sparrow an aversion to yellow?" because of its habit of destroying, as if in wantonness, the petals of crocuses of that particular colour. From some observations I made on the subject, when it was broached about four years ago, an account of which appeared in your columns (vol. xxxvi. p. 174), it is evident that the birds show a decided *fondness* for the colour, instead of an aversion to it. In the case I described, the birds used laburnum sprays only for their nests. It may interest your correspondent to know of such an incident, and to refer to the other correspondence on the subject alluded to on the occasion.

WILLIAM WHITE.

The Ruskin Museum, Sheffield, April 22.

A Meteor.

SEEING the note in your issue of the 16th inst. (p. 566) as to a meteor observed by a lady correspondent at Ruanlanihorn, Cornwall, on March 26 last, I send you the following extract from my note-book in reference to a meteor observed by me at Martock, Somerset, on the same evening, and which there would seem to be little doubt was the same as that referred to in your note:—

"March 26.—At Martock, Somerset, saw a very fine meteor in the southern sky; time 7.16 p.m. It was travelling from west to east at a comparatively slow speed; the meteor was of a white hue, and left a visible train, in length about equal to the apparent diameter of the moon; the train was a deeper yellow tint and was broken up towards its end. The meteor was visible fully 5 seconds."

Martock is about 110 miles from Ruanlanihorn.

Addiscombe Road, Croydon, April 20.

W. BUDGEN.