

Still another course would be for a firm of publishers to bring out a purely physical paper. The stumbling-block here is the question of advertisements. According to Mr. Thiselton Dyer, scientific men are supposed to be unbusiness-like, no doubt without reason; but it may be well to remind them that most journals live on their advertisements, the reading matter being a necessary evil. It would thus be commercially impossible to run a purely physical paper, as there is no trade, except to a certain extent electrical engineering, which has much to do with physics.

It might be better to abandon the idea of a central organ for physics, and to publish a complete set of abstracts. Abstracts to be useful must be very well made, and they must be complete. It is very difficult to get good abstracts. The work is laborious and costly when efficiently done. Abstracts are only a developed index, and it would still be necessary that separate papers should be obtainable. Incomplete abstracting is a very common vice. It is not enough to have a few papers brought under a reader's notice: that is good when one is reading for general information in an indolent way, but it is useless in the far more common case in which he wants to know either all that has been done on a given subject, or whether some discovery has been hit upon before. A scientifically worked out subject index is also essential, and, as said before, the abstracts must be practically complete.

JAMES SWINBURNE.

4, Hatherley Road, Kew Gardens, June 25.

The Glacier Theory of Alpine Lakes.

I HAVE read with interest the discussion in NATURE on the "Glacier Theory of Alpine Lakes," and I feel constrained to write now, more especially as Mr. Wallace has cited Tasmania as a country, among others, where Alpine lakes are associated with "palpable signs of glaciation." Having recently, with Prof. Spencer, of Melbourne University, made a visit to the central lake district of Tasmania, a few words about the lakes may not be without interest in reference to the subject under discussion.

The lake district of Tasmania is situated about the centre of the island on the great central greenstone plateau, which attains to a height of 4000 ft. above sea level in places. We camped on the shores of Lake St. Clair, and remained there during the whole month of January of this year. Lake St. Clair is about 2500 ft. above the sea, and is about 11 miles long by 2 broad. It occupies a narrow valley between the Olympus Range on the one hand and the Traveller Range on the other. A depth of 590 ft. is recorded. Its basin probably lies in sandstone (carboniferous?), the structure of the adjoining mountains being sandstone capped by greenstone (diabase).

Both Prof. Spencer and myself, being believers in the glacier theory of Alpine lakes, had half expected to find evidences of glaciation, especially as we had heard of well marked signs being found on the west coast, some 50 or 60 miles to the north-west. However, we could not find the slightest trace of glacial action. From the top of Mount Olympus, rising about 2350 ft. above the surface of the lake, we got a magnificent view of the country. The Traveller Range opposite is really the edge of a great greenstone plateau, stretching away with a roughly undulating surface for miles beyond. The surface of this plateau is studded all over with lakes and tarns of various sizes and at different levels. In other directions, too, lakes can be seen here and there nestling in the valleys. In all we counted between thirty and forty lakes and tarns from the top of Mount Olympus. Two small basins of water—the "Olympian Tarns"—rest on the flanks of the mountain itself. On the opposite side of Olympus from St. Clair lies Lake Petrarch, occupying an oval basin and apparently of shallow depth. This lake is about 560 ft. above St. Clair. On the right shore of St. Clair occurs another small lake (Lake Laura) 50 ft. above the former, and separated from it by a ridge about 3400 yards across.

A characteristic feature of this district are the "button-grass" flats. These are open, marshy expanses covered with "button-grass" (*Gymnoschoenus sphaerocephalus*) and other plants. They are traversed by numerous little runlets of water, which usually unite into one or more main streams. Here and there in many of them masses of greenstone protrude. Between these "flats" are generally low ridges of greenstone covered with Eucalyptus and Banksias, &c. Many of these flats or marshes—as, for instance, those in the Cuvier Valley, at the head of which lies Lake Petrarch—reminded me very strongly of the

moorland scenery in the Scottish Highlands, and the plateau, already referred to, with the lakes and tarns scattered over its surface, might be a scene in Sutherlandshire. But in all our wanderings we did not find the slightest sign of glaciation either in the form of moraines or of striated rock-surfaces. We were not able to examine the lakes on the plateau mentioned, but from its configuration I am confident that evidences of glaciation do not exist. On the west coast, notably about the Pieman River, signs of glaciation are, I believe, abundant, and numerous tarns and rock basins are associated with them. Here the neighbouring mountains are not so high as those further inland, and it was probably their proximity to the coast that was the cause, during the last glacial epoch, of glaciers being formed there and not further inland.

So then, though in Tasmania there are instances of rock-basin lakes being associated with undoubted evidences of glaciation, yet, as I have shown, the glacier theory will not account for by far the greater number of the Alpine lakes on the great central greenstone plateau. I do not propose to put forth any theory to account for these lake-basins, but have put down the above facts in the hope that they may prove of some interest in the question at issue, and to show that at least there are some exceptions to Mr. Wallace's statement that Alpine lakes only exist in glaciated regions.

I may add that Lake St. Clair has been accounted for by Gould, who explained it by supposing that a flow of basalt had dammed up the lower end of the valley in which the lake lies. I am, however, much inclined to doubt the existence of this basalt. Though we traversed the end of the lake where it is said to occur, we did not recognise any basalt.

It may also be remarked about the "button grass" flats or swamps, that they really occupy rock-basins, and may perhaps be regarded as the analogues of the peat-bogs of Scotland and Ireland. All those occurring in the same drainage area seem to be directly connected with each other, and I think there can be little doubt that many of them were formerly occupied by lakes.

Melbourne University, May 7.

GRAHAM OFFICER.

THE Editor having given me the opportunity of reading Mr. Graham Officer's interesting letter, I will make a few remarks upon it.

It seems to me that, without further information as to the nature of the search for drift, erratics, or ice-worn surfaces, and judging from the statement that the plateau studded with lakes and tarns was only looked down upon from an adjacent mountain summit, we can hardly give much weight to the positive statements, "I am confident that evidences of glaciation do not exist," and—"as I have shown, the glacier theory will not account for by far the greater number of the Alpine lakes on the great central greenstone plateau." Some light may perhaps be thrown on the matter by the consideration that the undoubted marks of glaciation in many parts of Australia are believed to have been caused by, comparatively, very ancient glaciers, since some of the glaciated surfaces are overlain by pliocene deposits, while others are believed to be of palæozoic age. If the Tasmanian glaciation was also of pliocene age, most of the superficial indications may have been destroyed by denudation, or, if preserved, may be hidden by vegetation or by alluvial deposits. We must therefore wait for a much more thorough examination of the district and of other parts of Alpine Tasmania before it can be positively stated that no evidences of glaciation exist.

ALFRED R. WALLACE.

Vectors and Quaternions.

I WOULD like to ask Prof. Knott whether there would be any fatal objection to defining the scalar product of two vectors as equal to the product of their tensors into the cosine of the angle between them, so that, if the vectors are

$$ix_1 + jy_1 + kz_1,$$

and

$$ix_2 + jy_2 + kz_2,$$

the scalar product would be

$$x_1 x_2 + y_1 y_2 + z_1 z_2,$$

and not

$$ix_1 \cdot ix_2 + jy_1 \cdot jy_2 + kz_1 \cdot kz_2.$$

If this is done, and, for the sake of associativeness of products, z^2 is made equal to -1 , the distributive or quaternionic product of two (or more) vectors would be their vector product

minus their scalar product. The change suggested would enable students to gradually accustom themselves to the notation of the calculus, which would in fact then form an abridged notation for the cartesian expressions and operations which enter into physical investigations.

I would ask Prof. Knott to give this suggestion his careful consideration, as I am sanguine enough to believe that in it, simple as it appears, lies the possible reconciliation of the new school of vector analysts with the quaternionists. Possibly some symbol other than S would have, at any rate at first, to be employed for this new scalar product. Perhaps, with Prof. Macfarlane, it might be called the cos-product, though that notation properly belongs to the scalar product of two vectors only, and loses its significance if applied to the scalar product of three or more vectors. No single letter symbol could be better than S, as it is distinctive and quick to write. However, the first question is whether there is any possibility of the modification being adopted.

The quaternionic product of a vector by itself would be minus its scalar square, but without any mystery attached to the fact. For the product of two vectors = vector product - scalar product, and therefore, if the vector product is zero, the quaternionic product = - the scalar product. Hence, instead of having

$$(\alpha + \beta)^2 = \alpha^2 + 2S\alpha\beta + \beta^2,$$

we should have

$$S(\alpha + \beta)^2 = S(\alpha^2 + 2\alpha\beta + \beta^2).$$

Reciprocal vectors satisfy the equation $\beta^{-1}\beta = 1$, so that $S\beta^{-1}\beta = -1$, i.e. β^{-1} , β are oppositely directed vectors.

The quaternion

$$\alpha\beta^{-1} = \frac{\alpha\beta}{\beta^2} = \frac{Va\beta - Sa\beta}{-S\beta^2} = -\frac{Va\beta}{S\beta^2} + \frac{Sa\beta}{S\beta^2},$$

showing clearly that both the vector and scalar products of $\alpha\beta^{-1}$ are opposite in sign to those of $\alpha\beta$, as must, of course, be the case since β^{-1} and β are oppositely directed vectors. This fact is obscured with the orthodox notation. In fact, so far as I have been able to test the proposed change, I have found no drawbacks, but rather an improvement. ALFRED LODGE.

Sagacity in Horses.

FROM the window opposite, as I write, I have just witnessed an interesting performance on the part of two horses. Bordering the park is a strip of land, doomed to be built upon, but meanwhile lying waste, and used for common pasturage, on which the horses under notice were leisurely grazing. A pony in a cart, having been unwisely left by the owner for a time unattended on the grass, suddenly started off, galloping over the uneven ground at the risk of overturning the cart. The two horses, upon seeing this, immediately joined in pursuit with evident zest. My first supposition, that they were merely joining in the escapade in a frolicsome spirit, was at once disproved by the methodical and business-like manner of their procedure. They soon reached the runaway, by this time on the road, one on one side of the cart, and one the other; then, by regulating their pace, they cleverly contrived to intercept his progress by gradually coming together in advance of him, thus stopping him immediately in the triangular corner they formed. Until the man came up to the pony's head they remained standing thus together quite still; when the two horses, evidently satisfied that all was now right, without any fuss trotted back again together to their grass.

The sagacious conduct of the horses, acting in such perfect cooperation, formed a pretty sight; and it was apparent that, instead of making the pony more excited, they really pacified and calmed him. Why should they not receive "honourable mention" as much as if they were proud human beings?

WILLIAM WHITE.

The Ruskin Museum, Sheffield, June 20.

TERCENTENARY OF THE ADMISSION OF WILLIAM HARVEY TO GONVILLE AND CAIUS COLLEGE, CAMBRIDGE.

BORN at Folkestone, and educated at the King's School, Canterbury, William Harvey was admitted to Gonville and Caius College as a minor scholar in his sixteenth year, on May 31, 1593. The tercentenary of

this event was celebrated by Harvey's College on Wednesday, June 21, this being the earliest day after the date of his admission at which rooms were available for those coming from a distance. The guests were received and welcomed by the Master and Fellows, at five o'clock, in the large Combination Room, where tea was provided. In the smaller adjacent room were exhibited a number of objects of interest connected with Harvey, including his pestle and mortar, from the Museum at Folkestone, a rubbing from his mother's tomb, an autograph letter of Harvey, lent by the Master of Sidney Sussex College, and a coloured drawing of Harvey's coat-of-arms, recently discovered on the walls of the buildings of the University of Padua. The latter was presented to the College by the University of Padua, followed on the day of the festivity by a long congratulatory Latin telegram from the Rector, on behalf of the University, which ran as follows:—"Universitatis Patavinæ quæ cum aliis Britannis discipulis tum Harveio Caioque gloriatur, quorum alterius merita insigne Collegium vestrum i unce recolito nomenque ex altero invenit, festi in Harveii honorem indicti participem se profitetur et in renovanda cum celeberrima Universitate Cantabrigiensi vetere studiorum amicitiaque memoria summpere lætatur, pro Academico Senatu, Ferraris Rector." Also an autotype of the panel portrait of Harvey from Rolls Park, Chigwell, Essex, presented to the College by Sir Andrew Clark, as one of a series of eight, consisting of a central portrait of Harvey's father, surrounded by those of his seven sons. Some early editions of the works of Harvey and of some of his more immediate predecessors and followers were also displayed, together with the admission book of the College, containing the original record of his admission. At seven o'clock the guests assembled once more in the Combination Room, whence they proceeded to dinner in the College Hall, led by the butler, bearing the original "caduceus," as used by Dr. Caius when President of the College of Physicians. The dinner was presided over by the Master of Gonville and Caius College, the Rev. N. M. Ferrers, D.D., F.R.S., above whose chair were displayed a copy of the bust from the Harvey Memorial, crowned with a laurel wreath, and the much-prized portrait of Harvey from the Master's Lodge. After dinner the Grace Anthem of the College, composed by Mr. C. Wood, was sung. The Master then proposed the usual loyal toasts, after which Sir James Paget proposed the toast of the evening, "The Memory of William Harvey."

He remarked that the reason why he had the honour of being asked to propose that toast was his relationship to his brother, who, he believed, made the proposal that there should be that tercentenary of the admission of William Harvey. He desired to remember that, and to speak as he thought his brother would have spoken if he had had the opportunity. He was sure that if he had been present he would have referred to the honour which was due to the college which Caius founded. He would have done that out of the deep sense of gratitude which he had for the College. For it was the Fellowship founded by Caius that led his brother to the study of medicine, and, on the occasion of that Fellowship which he held becoming vacant, to give himself entirely to it. To that he owed a great part of the happiness of his life, and he hoped he (the speaker) would not be deemed wrong if he said that indirectly he himself was also deeply indebted to Caius College, for it was through the large income which was associated with that Fellowship that his brother was enabled, out of his abundant generosity, to help him greatly in the study of his profession at St. Bartholomew's Hospital, of which Harvey was so great an ornament and honour. He wished that they knew more of the time and the work he did in Caius College. Indirectly Harvey owed to Caius himself the opportunity of being a student of the College. It was not, he thought, known whether Harvey