

sure reward in its advancement wherever this method might be applied. So much for these objections.

New notations in the calculus of quaternions must needs be invented from time to time. But since they are becoming complex (though far simpler than in cartesian coordinates) as the problems are getting more complicated, it is highly desirable already at this stage of development, to exchange opinions on the selection or adoption of new symbols.

By these and other considerations we have been led to believe that the time has come for those who are interested in vector analysis to come to the fore and join hands. In order to further this purpose, we venture to suggest the establishing of something like an "International Association for Promoting the Calculus of Quaternions." The following would be amongst its principal objects:—

(1) That the members should be informed of the publications of all important papers and works respecting either the theory of quaternions or its applications; and if possible to have these made accessible to them.

(2) That the members should be afforded the means of exchanging opinions on the introduction and adoption of new notations.

In these few lines we have tried to point out the important task of the Association, but shall be obliged for any suggestion or improvement. All we desire is to assure to the calculus the place it deserves, and consequently to see it fully developed in its various aspects by the combined efforts of able mathematicians and physicists. It is almost needless to say that we are only preparing the way; and once the Association has been started, we shall be ready to place it in the hands of persons much more competent than ourselves to further its best interests.

We earnestly hope that all friends will appreciate our endeavours and show us at once some token of approval. We would ask those who are in Europe to communicate with the first of the names below, and those in America with the second.

P. MOLENBROEK, The Hague, Holland.

SHUNKICHI KIMURA, Yale University, U.S.A.

August 7.

P.S.—It has been suggested by friends interested in this matter to enlarge the scope of the proposed Association so as to include all systems allied to quaternions and to Grassmann's "Ausdehnungslehre." This suggestion we are in full sympathy with. The name of the Association might then be "The International Association for Promoting the Study of Quaternions and Allied Systems of Mathematics."

P. M.

September 17.

S. K.

#### Artificial Human Milk.

It is stated in NATURE of September 19, that "so far, according to Dr. Backhaus, no satisfactory substitute has been produced in the place of human milk"; and a method is then described by which he has "quite recently" succeeded in supplying the deficiency. It appears to differ little from the process first employed and made known by me in 1854, and afterwards published in my "Experimental Researches" in 1877; except that, in omitting to add the necessary amount of milk-sugar to make up for the deficiency in the cow's milk, Dr. Backhaus fails to obtain an artificial milk closely resembling the human in chemical composition.

My recipe has, since its first publication, been advantageously used in private and hospital practice by the late Prof. W. C. Williamson, by Dr. W. Playfair, and others, but it has probably not come under the notice of Dr. Backhaus.

My process is based on the fact that by the removal of one-third of the casein from cow's milk, and the addition of one-third more milk-sugar, a liquid is obtained which closely approaches human milk in composition. The following is the mode of preparing the milk, and it is so simple that any intelligent mother or nurse can easily carry it out.

"Allow one-third of a pint of new milk to stand for about twelve hours, remove the cream, and add it to two-thirds of a pint of new milk, as fresh from the cow as possible. Into the one-third of a pint of blue milk left after the abstraction of the cream, put a piece of rennet about one inch square. Set the vessel in warm water until the milk is fully curdled, an operation requiring from five to fifteen minutes, according to the activity of the rennet, which should be removed as soon as the curdling commences and put into an egg-cup for use on subsequent occasions, as it may be employed daily for a week or

two. Break up the curd repeatedly and carefully separate the whole of the whey, which should then be rapidly heated to boiling in a small tin pan placed over a spirit- or gas-lamp. During the heating, a further quantity of casein separates, and must be removed by straining through muslin. Now dissolve 110 grains of powdered milk-sugar in the hot whey, and mix it with two-thirds of a pint of new milk to which the cream from the other third of a pint was added, as already described. The artificial milk should be used within twelve hours of its preparation; and it is almost needless to add, that all the vessels employed in its manufacture and administration should be kept scrupulously clean."

In this process only one-third of the milk was sterilised; but, in the light of modern bacteriology, it is desirable to sterilise the whole by finally heating it to boiling.

The Yews, Reigate, September 29.

E. FRANKLAND.

#### The Elements of Architecture.

HAVING been for some weeks out of the way of seeing papers, I have only just seen the review of "Architecture for General Readers" in NATURE of August 15. I ought to thank you for devoting so much space to a book which deals rather with art than "nature," and there are one or two criticisms on special points which I think are just, and which will have attention in the second edition of the book. But there are three remarks of the reviewer's on which I should like to have a word.

(1) He refers the reader to Perrot and Chipiez' work on "The Arts of Primitive Greece" for proof of the derivation of the Greek entablature from a wooden origin. In my opinion, Messrs. Perrot and Chipiez prove nothing whatever but their own ingenuity. They argue in a circle. Assuming the probability of a wooden origin for the Greek entablature, they proceed to construct out of their own inner consciousness a series of wooden structures, quite possible but entirely imaginary, in which the origin of all the features of the stone entablature is carefully provided for, and then produce an engraving of the stone (or, rather, marble) entablature to show triumphantly the result which they have been consciously leading up to all the way. You may prove anything on that kind of principle. I do not deny that the Greek entablature appears to be of timber origin. I only say it has not been proved to be so, and I am sure Messrs. Perrot and Chipiez have not proved it.

(2) The reviewer thinks I am captious in objecting to Wren's double cupola at St. Paul's as a sham, and that I might as well object to the vault which hides the interior of the tower over the crossing in a mediæval cathedral. But he misses the main point of my objection, which is that the exterior timber dome of St. Paul's is made to appear, to the eye, to carry a ponderous stone lantern which would, in fact, crush it at once, and which is really the termination of a concealed masonic construction thrusting itself through the timber dome. At Florence and St. Peter's the stone lantern is really carried by the visible dome which appears to carry it; at St. Paul's it is not, and could not be. I consider St. Paul's by far the more beautiful design of the three, but it cannot be denied that it is a constructional falsehood in that respect. (See the block section of it given on p. 99 of the book.)

(3) The reviewer objects that I have denied to Italy any specimen of true Gothic, and yet that Milan is one of the most impressive Gothic interiors in existence. This may be true as to general effect; but the detail of Milan is wretched; and it is by detail that purity of architectural style is chiefly to be judged.

H. HEATHCOTE STATHAM.

(1) MR. STATHAM objects to Perrot and Chipiez' work, on primitive Greece being cited for proof of the derivation of the Greek entablature from a wooden origin.

It seems to me that in this matter possibly the main difference between Mr. Statham and the reviewer lies in the meaning to be attached to the word *proof*. Absolute mathematical proof is seldom to be looked for in archaeological or historical descriptions, and we must be often contented with a sufficiently high probability. Taking the word in that sense, it seems to me that the circle in which Perrot and Chipiez are said to argue, cannot be made to re-enter into itself.

Mr. Statham allows that the Greek entablature "appears to be of timber origin." Vitruvius (iv. cap. 2) says distinctly that it