

cluding a new genus, *Barkerwebbia*, under the *Arecineæ*, and a revision of the order for the Philippines. Prof. U. Martelli describes a number of new species of *Pandanus*. A review of European umbellifers, in which the writer includes the *Araliaceæ*, forms the subject of a lengthy paper by Dr. B. Castellani. Prof. E. Bartoni publishes a short MS. by Parlatore on Linnæus's herbarium which is especially appropriate, as Webb and Parlatore were friends, and held each other in mutual esteem.

A Course in Mathematical Analysis. By Édouard Goursat. Translated by E. R. Hedrick. Vol. i. Pp. viii+548. (London and Boston: Ginn and Co., n.d.) Price 16s.

THIS readable and trustworthy translation will be welcome to those who cannot enjoy the original, the merits of which are by this time well known. The typography is unusually good, and is very creditable to all concerned, such symbols as the square of a_1 , or even of a' , being printed in a satisfactory way, which English printers might imitate with advantage. There are a few terms here and there which are ungrateful to an English ear; "involutionary" or "involutional" would be more agreeable to analogy than "involutory," and "nappe" is retained instead of being rendered by "sheet." But these are trifles, and those of us who have no French can now study a treatise which is eminently lucid and attractive, as well as being up to date and sufficiently rigorous for the purpose it is designed to fulfil.

LETTERS TO THE EDITOR.

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Agriculture and the Empire.

THE article by Sir W. T. Thiselton-Dyer in your issue of March 22 is a fair statement of the position the Home Country should take in the development of agriculture in the Empire at large, and of the necessary training the future experts and researchers in Indian agriculture should receive; and this view requires pressing upon those responsible for the development of agriculture in our colonies, so that the policy of employing as agricultural experts men with a mere smattering of scientific method, combined with a more or less thorough knowledge of British agriculture, may not be followed. Investigation and careful research are wanted, and the only men who can perform this are those whose sense of proportion and scientific methods of attack have been developed by a systematic training in the sciences having a bearing on agriculture. Agriculture is at once a science, an art, and a business, and the successful agriculturist at home must be a man equipped with an adequate knowledge of all these subjects, combined with a special ability for one or more of them.

The agricultural colleges of Great Britain afford a training in the science and art of agriculture, but on the business side of the subject not much can be attempted, as personal experience and responsibility of the individual for his business transactions are necessary conditions. Many agricultural colleges and agricultural departments of our universities possess the necessary scientific equipment and a staff of adequate attainments to give to the future Indian or colonial expert a thorough systematic training in such sciences as chemistry, botany, and zoology, in an agricultural atmosphere. The latter condition must be of immense importance in impressing on the student the relations of the pure science to practice; and although the practical application he will experience abroad will differ essentially from that observed at home, he will at all events be prepared to use his science to solve problems of economical value, and, if his training has been broad and

thorough, to become a most useful factor in developing the agriculture of the country. It is certain that a man trained at an agricultural college or at an institution equipped with the necessary facilities for the study of animal or plant life will be better able to enter upon his duties as investigator of agricultural science in India than a man whose training has been received at the ordinary technical college. From the staff and students of this college during the past few years experts have gone: to South Africa, four, including the director of the Transvaal Agricultural Department; to India, four, including two to Pusa; to British Guiana, the West Indies, and Egypt, two, as well as to other countries, so that it can claim some connection with agriculture in our colonies.

Sir W. Thiselton-Dyer says that notice should be given five years in advance of the requirements for trained men; with this opinion I agree, though I doubt its practicability. What we require is more men of recognised ability to train for such position. Hitherto some branch of technical work other than agriculture has been the object, to a great extent, of the trained student, but now that there is a future for highly trained men who will bring their scientific knowledge and spirit of investigation to bear upon the problems of agriculture at home and abroad, we hope that men of the right stamp will come to be trained partly perhaps in this country, and afterwards under the conditions in which their future work will lie, but in any case to go through a complete course of systematic study in the science to which they intend to devote themselves when they have gained their technical experience. It is a fact, and one to be deplored, that the agricultural students are not always drawn from the best of our rising generation, since farming is looked upon as the profession to be engaged in by those "who are too clever for the Army and not stupid enough for the Church"; but now that we can offer a field for a well trained man to make a name and a living in the domain of agricultural research, we should secure a greater proportion of suitable men. In this country, for the researcher, apart from the teacher, there is little chance for a trained man to earn a livelihood, but abroad, where the resources of the soil have yet to be developed, there is a good prospect of employment for men who are thoroughly equipped with the requisite scientific knowledge and possess the spirit of investigation.

Another point to which Sir W. Thiselton-Dyer has directed attention is the proper teaching of science in our rural elementary schools, and, I would add, our rural secondary schools. How often do we see, especially in the latter class of school, the teacher (who is often selected for his chemical knowledge) teaching by book alone, and without reference to the conditions amid which his scholars live. Chemistry is one of the least suitable of the natural sciences to teach children whose lives will be, or ought to be, spent in the country. Botany or zoology taught by a teacher who has learnt these subjects, and has been trained in their application to outdoor life as it exists in an English farm or country village, would be far preferable, and I venture to think that Kew, the agricultural departments of our universities, and our agricultural colleges could supply such teachers, and so could influence to a considerable extent the value of the teaching in country districts.

The Board of Education has, I understand, the latter matter in hand, and I trust that under the advice of their excellent rural inspector a scheme will be formulated which will in some way check the tendency of modern education to prepare solely for town life.

M. J. R. DUNSTAN.

South-Eastern Agricultural College (University of London), Wye, Kent, March 26.

Sea-sickness and Equilibration of the Eyes.

MANY people have no doubt noticed, when travelling by sea, that the motion of the ship could be seen very distinctly, even when there were no hanging lamps, draperies, or fixed points, such as the horizon or clouds, within range of sight.

Some may think that seeing the motion in this way is due to the imagination receiving its suggestions from the motion of the internal organs, and especially the stomach, for I am here supposing the body to be held perfectly rigid.

From observations which I have recently made it seems evident to me that the cause for seeing the motion is entirely different.

In the first place, you can always see the motion a fraction of a second before you begin to feel it. In the second place, you cannot see a perfectly horizontal motion or a gentle vertical (heaving) motion. In the third place, watching a fixed point close to you, such as a pattern on a carpet, when the ship is pitching and rolling, is far more tiring to the eyesight than when the ship is motionless or running perfectly steadily. All this points to the appearance being due to a true relative motion of the eyes to the ship.

The eyes are suspended in their muscular settings, much in the same way as are ships' compasses in their binnacles. The eyes are, furthermore, perfectly balanced, so as to make their muscular displacements as little tiring as possible. In their normal position, the pull of gravity is exerted vertically through their centres, and the muscular mechanism is compensated for gravity.

Any angular change of position will displace the eyes just as it displaces the stomach, excepting that the eyes, being a great deal more sensitively suspended, will register the displacements more quickly. It is not, however, the motion of the eyes which strains the eyesight, but the act of resisting this motion.

If, with your eyes shut, you attempt to fix the mental representation of a point, which a moment previously you were watching with eyes wide open, you will find that, after one or two motions of the ship, the bodily feeling will precede any visual sensation which your imagination can conjure up. The imaginary point is no longer fixed, but follows the eyes as they let themselves go to the motions of the ship. No strain of the eyesight is caused by a muscular resistance, and the displacements, while felt, can no longer be seen.

ALFRED SANG.

Pittsburg, U.S.A., February 26.

Production of an Electrically Conductive Glass.

EXPERIMENTS have from time to time been made, both in England and abroad, to ascertain what ingredients are best for the purpose of producing glasses of very high electrical resistance.

The utility of a vitreous substance which would conduct electricity comparatively well does not appear, however, to have so far claimed any consideration.

I beg therefore to direct attention to a glass which has recently been made in my laboratory. Its chief feature is that it readily conducts electricity.

For the windows or cases of electroscopes and all high-tension apparatus requiring a transparent cover capable of screening off external electrical fields, this material offers many advantages. A conducting varnish is no longer required for glass which conducts electricity itself. In addition to these practical considerations, there arises the interesting question as to the process by which electricity passes through this substance—whether it is electrolytic. Its resistance varies very markedly with temperature changes. I hope later to give more precise details. The basis of the glass is sodium silicate.

CHARLES E. S. PHILLIPS.

Shooters Hill, Kent, March 12.

Interpretation of Meteorological Records.

IN discussing the records of the meteorological instruments at Canterbury (*NATURE*, March 15), Dr. Aitken suggests that the heavy rain which fell dragged down the higher air, and so caused the fall of 12° indicated on the thermograph curve, and he very clearly and convincingly shows the consequent effect on the barometric pressure and wind velocity. If, however, the air had been in a state of stable equilibrium previous to the thunderstorm, the effect of such a mechanical dragging down of the higher air would have been to heat by compression that air so much that the temperature would have been raised rather than lowered at the ground-level. But if, previous to the storm, the upper air had from any cause become very much colder than the lower air, the atmosphere would be in a state of unstable equilibrium, that is to say, the rate of

change of temperature with height would be greater than the adiabatic rate of change due to heating by compression of descending air. In such a case the changes recorded by the various curves may have been initiated by this heavy cold air suddenly descending and displacing the lower air, which by its sudden uprising would be cooled, the moisture in it condensed, and a heavy fall of rain caused.

The lightning which accompanied this storm introduces an element of uncertainty into any attempted explanation, for we do not know yet the manner in which electric charges are generated in the atmosphere. But it seems probable that a great cooling of the higher air is an accompaniment of a state of electric tension, for it is difficult to see otherwise why a thunderstorm should be followed by a lowering of the temperature near the ground-level.

R. T. OMOND.

Edinburgh.

Oscillation of Flame Cones.

I SHOULD be glad if any of your readers could give an explanation of the cause of the following flame phenomenon, produced while experimenting with a modification of Prof. Smithells's apparatus for the separation of the cones of a Bunsen flame.

A mixture of gas and air is burned at the top of a vertical tube (made preferably of combustion tubing) about 4 feet long and $\frac{3}{8}$ inch to 1 inch in diameter, having a delicate screw adjustment for regulating the proportions of gas and air.

The air supply is carefully and slowly increased, until an almost explosive mixture is reached, and the inner cone is very short and sharp and of a light green colour. On admitting a very slight increase of air after this point, the inner cone (sometimes the two cones) descends the tube to a distance of about 2 feet, and then pauses and goes up again, re-joining the outer cone. The flame then "sharpens" again and repeats the process, and will continue to do so for several hours without further adjustment of the gas or air being made.

There is every appearance of an explosion wave being propagated, as shown by the increasing velocity of the descending flame and by the occasional emission of a note as it reaches the end of the travel.

The length of travel can be regulated by the amount of air admitted, varying from 1 or 2 inches to about 2 feet in the same tube. If it be allowed to exceed a certain limit the inner cone is extinguished at its lowest point, but immediately re-lights at the top of the tube, and then returns as before. The periodicity can be varied from about once in five seconds to once per second.

The gas pressure does not need any special regulation, the ordinary variations from a town supply not affecting the results.

The following are the points requiring explanation:—

- (1) As the proportions of gas and air are constant, what is the cause of the periodic "sharpening" of the cones after meeting at the top of the tube?
- (2) What prevents the explosion wave being completed, and the consequent firing back of the mixture?
- (3) What causes the inner cone to return and travel up the tube, re-joining the outer one at the top?
- (4) The alteration in the character of the flame (in view of the fact that the proportions and pressure of gas and air are constant) points to some form of wave motion bringing the molecules into closer contact. If this be so, what are the conditions which set up this wave motion and what determines its periodicity?

HAROLD E. TEMPLE.

Olton, Warwickshire.

THE phenomenon described in the foregoing letter is in part dealt with in a paper by Dr. Ingle and myself in the *Transactions of the Chemical Society* for 1892 (vol. lxi., p. 204). The continued oscillation of the inner cone is, I think, explained by the fact that the mixture of gas and air in the tube is not uniform. We have, indeed, found it necessary to use elaborate mixing appliances to make it uniform. When a portion of the mixture rich in air reaches