

further allowed to give some reasons for the opinion expressed. That there exists a relation between sun-spots and magnetism is undoubted. And although those who are able to study the variations of sun-spots side by side with the variations of magnetism can very well see to what extent the relation definitely holds, it is difficult adequately to convey to others a due impression of all the circumstances of the case. Periods of maximum sun-spots are periods of great magnetic activity and energy, whilst periods of minimum sun-spots are periods of magnetic quiet. But it has not yet been found possible to trace direct correspondence in details. Thus, when a large spot is present there may occur one or more considerable magnetic disturbances or storms, some enduring it may be for a few hours only, others it may be for several days, but, assuming direct solar influence, what it is that precisely determines when such disturbances shall arise is unknown. Further, at times of sun-spots being numerous, there is also considerable general magnetic irregularity. Now, in these magnetic disturbances and irregularities there will be innumerable individual motions far exceeding in magnitude that accompanying the Carrington sun outburst, and yet during all the many years that have elapsed since 1859, through which period the solar surface has been continuously scrutinised by hundreds of observers in different lands, no second occurrence similar to that of 1859 has come to light. But if there be so close a connection between solar and magnetic phenomena as the occurrence in question would seem to indicate, the fact that we have no corroboration of the solitary observation of 1859 is surely remarkable, considering that, of late years, it is very much to correspondence in details that attention has been to a great extent directed. If irregular magnetic movements were comparatively few, the observation of 1859 might possess some significance, but they are, on the contrary, multitudinous, many at times occurring during the course of a single day, and often of considerable magnitude, but yet without any recorded accompanying solar manifestation.

To sum up, the points of the matter may be thus stated:—

- (1) The solar outburst in 1859 was seen independently by two observers: the fact of its occurrence seems therefore undoubted.
- (2) The corresponding magnetic movement was small.
- (3) Many greater magnetic movements have since occurred.
- (4) No corresponding solar manifestation has been again seen, although the sun has since been so closely watched.

The solar outburst of 1859 would thus appear to have been a rare phenomenon, and its observed occurrence at the time of a recorded magnetic movement quite an accidental coincidence.

This conclusion in no way invalidates the question of general relation between sun-spots and magnetism, whatever may be the true explanation of that relation.

Greenwich, November 6.

WILLIAM ELLIS.

The Recent Earthquake.

AFTER the Pembroke earthquakes of August 1892, you were good enough to insert a letter from me (vol. xlv. p. 401) asking for observations from different places. In reply to this letter, I received so many and such valuable records, that I should be greatly obliged if you would allow me to make a similar request for accounts of the recent earthquake of November 2, in Wales and the West of England. I should be very grateful for descriptions from any place whatever. The questions printed below indicate the points on which information is chiefly desired, but if any observers are able and willing to give further details, I shall be pleased to send them my fuller list of questions, which I may remark are somewhat different from those given in the letter referred to above.

- (1) Name of the place where the earthquake was observed.
- (2) Time at which it was felt, if possible to the nearest minute.
- (3) Nature of the shock. (a) Were two or more distinct shocks felt, separated by an interval of a few seconds? (b) If so, which was the stronger? (c) What was the duration (in seconds) of each, and of the interval between them? (d) During this interval was any tremulous motion felt or rumbling sound heard?
- (4) Duration in seconds of the whole shock, not including the accompanying sound.
- (5) Was the shock strong enough (a) to make doors, windows, fire-irons, &c., rattle; (b) to cause the chair, &c., on which the observer was resting to be perceptibly raised or moved; (c) to make chandeliers, pictures, &c. swing, or to stop clocks?
- (6) (a) Was the shock accompanied by any unusual rumbling sound, and, if so, what did it resemble? (b) Did the beginning of the sound precede, coincide with, or follow the beginning of

the shock, and by how many seconds? (c) Did the end of the sound precede, coincide with, or follow the end of the shock, and by how many seconds? (d) Were the strongest vibrations felt before, at, or after the instant when the sound was loudest, and by how many seconds?

CHARLES DAVISON.

373 Gillott Road, Birmingham, November 6.

"An Ornithological Retrospect."

I HAVE been interested in reading "An Ornithological Retrospect," by your correspondent, Dr. Sharpe. His reference to myself by name in the concluding paragraph is partly my excuse for troubling you with a few remarks upon this article. Dr. Sharpe, in one long breath, deplores (pleonastically) the fact that "very little anatomical work has scarcely been done" recently in ornithology, and exults over a reviewer in a "leading London paper," who apparently took the same view—tomahawking him with the remark that "in every branch of the subject considerable progress has been made." I think that the opinion of the minority in this case is correct, and that our knowledge of bird anatomy is progressing. But those of us who are occupied with this study have frequently to regret the ignoring of anatomical facts by systematists; this is particularly discouraging, since by far the larger proportion of papers upon bird anatomy are purely of systematic interest, dealing with the resemblances between bird and bird. Dr. Sharpe evidently feels that the British Museum Catalogues of Birds are not beyond criticism from this point of view. In one or two volumes there is a conspicuous absence of any arrangement in accordance with anatomical fact. Dr. Sharpe, therefore, is rather imprudently candid in saying that to understand these catalogues a man must be an ornithologist.

Zoological Society's Gardens.

FRANK E. BEDDARD.

The Foam Theory of Protoplasm.

IN your issue of October 19 there appeared, under the title "Bütschli's Artificial Amœbæ," a review, by Dr. John Berry Haycraft, of Prof. Bütschli's work upon protoplasm. I venture to think that in many places Dr. Haycraft has misrepresented entirely Prof. Bütschli's researches, while other objections or criticisms which he brings forward are answered in the book itself. Since I have been engaged for some time upon a translation of Prof. Bütschli's work, which is now in the press, I must ask your readers to suspend their judgment until they have a better opportunity of forming an opinion for themselves.

2 Blackhall Road, Oxford.

E. A. MINCHIN.

SCIENCE IN THE MAGAZINES.

AMONG the magazines received by us, the *Fortnightly* is well to the front as regards articles having a scientific interest. Dr. Alfred R. Wallace writes on "The Ice Age and its Work," with the object of explaining "the nature and amount of the converging evidence demonstrating the existence of enormous ice-sheets in the northern hemisphere, to serve as a basis for the discussion of the glacial origin of lake-basins, which will form the subject of another article." After briefly describing the foundation of the science dealing with glaciers and their action, and the early school of glacialists, Dr. Wallace states the phenomena which points to the former existence of glaciers in regions where the mountain-tops are at present below the snow-line. These are classified as follows:—(1) Moraines and drifts; (2) Rounded, smoothed or planed rocks; (3) Striæ, grooves, and furrows on rock-surfaces; (4) Erratic and perched blocks. As a good example of a moraine, that in Cwm Glas, on the north side of Snowdon, is mentioned, together with those in Glen Isla (Forfarshire), and the Troutbeck alley near Windermere. In Cwm Glas, also, smoothed and rounded rocks are to be seen above the moraine. Striated, grooved, and fluted rocks are exemplified by those near the lakes of Llanberis, and by the remarkable effects exhibited at Kelly's Island, at the western end of Lake Erie. The enormous block near St. Petersburg, and the mass of Swedish red granite found at Fürstenwalde, south-east of Berlin, are given as in-