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. xlvi. 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-

stances of erratic blocks. The erratic blocks from the higher Alps, which are found on the flanks of the Jura Mountains, are also shown to point conclusively to the former existence of glaciers stretching down the Rhone Valley as far as the Jura. The distribution of erratics in North America are next considered, and the crowning example of boulder transportation is said to be afforded by "the blocks of light grey gneiss discovered by Prof. Hitchcock on the summit of Mount Washington, over 6000 feet above sea-level, and identified with Bethlehem gneiss, whose nearest outcrop is at Jefferson, several miles to the north-west, and 3000 or 4000 feet lower than Mount Washington." After giving instances in Great Britain and Scandinavia of boulders carried above their source, Dr. Wallace says :—

We thus find clear and absolute demonstration of glacier ice moving up-hill and dragging with it rocks from lower levels to elevations varying from 200 to 2700 feet above their origin. In Switzerland we have proof of the same general fact in the terminal moraine of the northern branch of the Rhone glacier being about 200 feet higher than the Lake of Geneva, with very much higher intervening ground. As it is universally admitted that the glacier of the Rhone did extend to beyond Soleure, all the *à priori* objections to the various cases of rocks carried much higher than their origin, in America, the British Isles, and Scandinavia, fall to the ground. We must either deny the existence of the ice-sheet in the great Swiss valley, and find some other means of accounting for the travelled blocks on the Jura between Geneva and Soleure, or admit that the lower strata of a great glacier *can* travel up-hill and over hill and valley, and that the ice-sheets of the British Isles, of Scandinavia, and of North America merely exhibit the very same characteristics as those of Switzerland, but sometimes on a larger scale. We may not be yet able to explain fully how it thus moves, or what slope of the upper surface is required in order that the bottom of the ice may move up a given ascent, but the fact of such motion cannot any longer be denied.

Prof. T. E. Thorpe contributes a chatty paper on "Carl Wilhelm Scheele," whose life's work is summed up as follows :—

We owe to Scheele our first knowledge of chlorine and of the individuality of manganese and baryta. He was an independent discoverer of oxygen, ammonia, and hydrochloric acid gas. He discovered also hydrofluoric, nitrosulphonic, molybdic, tungstic, and arsenic acids among the inorganic acids ; and lactic, gallic, pyrogallic, oxalic, citric, tartaric, malic, mucic, and uric among the organic acids. He isolated glycerin and milk-sugar ; determined the nature of microcosmic salt, borax, and Prussian blue, and prepared hydrocyanic acid. He demonstrated that plumbago is nothing but carbon associated with more or less iron, and that the black powder left on solution of cast iron in mineral acids is essentially the same substance. He ascertained the chemical nature of sulphuretted hydrogen, discovered arsenetted hydrogen and the green arsenical pigment which is associated with his name. He invented new processes for preparing ether, powder of algaroth, phosphorus, calomel, and *magnesia alba*. His services to quantitative chemistry included the discovery of ferrous ammonium sulphate, and of the methods still in use for the analytical separation of iron and manganese and for the decomposition of mineral silicates by fusion with alkaline carbonates.

To this long list of successful labours must be added the memoir on "Air and Fire," which appeared in 1777, and the experimental material for which was partly collected in Malmö and Stockholm before 1770, and partly during Scheele's stay at Upsala, that is, prior to 1776. These dates, Prof. Thorpe reminds us, are important in view of Scheele's relations as a discoverer to Priestley and Lavoisier.

"The Geographical Evolution of the North Sea" forms the subject of an article by Mr. A. J. Jukes-Browne in the *Contemporary*. In the course of the paper the following conclusion is arrived at :—

The North Sea—that is to say, a sea lying east of Britain and opening northward—had no existence until after the formation of our Coralline Crag. The great change which submerged the northern land-barrier and permanently lowered the temperature of eastern England by letting in the waters of the Arctic Ocean took place during the formation of the newer "Crags" which overlie the Coralline Crag in Suffolk, and extend northward through Norfolk.

In proof of this statement, two salient facts may be mentioned : (1) the incoming and gradual increase in the number of northern species among the mollusca of the newer Crags ; (2) the occurrence of Crag shells in the glacial sands of Aberdeen, showing that marine Pliocene deposits once existed at no great distance from the Scottish coast and were destroyed by the ice of the Glacial Period.

According to Mr. Jukes-Browne, towards the close of the Pliocene period the whole area between East Anglia and the Netherlands appears to have become dry land. The estuary of the Rhine then lay off the coast of Norfolk, and the Thames was one of its tributaries. During the glacial epoch, the whole bed of the North Sea was dry land. The subsidence that afterwards submerged the North Sea floor and filled the valley of the English Channel with water, led to the silting up of the English river-valleys, and to the formation of the modern delta of the Rhine. Mr. Jukes-Browne believes that by it England was separated from the Continent ; for there is no proof that a continuous sea separated England and France at any earlier Pleistocene epoch.

The *Forum* (October) contains a contribution by Prof. E. S. Holden, the object of which is "to detail the history of the remarkable 'new star' of 1892, in the constellation Auriga." On this side of the Atlantic, a detailed account is understood to mean a more or less minute narration of particulars ; but Prof. Holden's paper shows us that in writing the history of a new star in detail, reference to some of the most important communications on the matter may be omitted. "The *Nova* was, no doubt, a star like our sun . . . ," says Prof. Holden. ". . . Let us imagine what fate ours would be, if our sun should suddenly increase in light and heat some hundreds of times, and then fall off some thousands," and so on. The learned Director of the Lick Observatory will find that there is very little, if any, evidence that Nova Aurigæ "resembles our sun" in physical constitution, which is the inference naturally put upon his remarks. We read that, "Nothing can be clearer than the identity of the 1893 spectrum of the *Nova* and that of the nebulæ"—a pill which some spectroscopists have had great difficulty in swallowing. Prof. Holden describes Prof. Seeliger's hypothesis of the genesis of the Nova, but inclines to Prof. Vogel's modification of it ; for he remarks, "We can at least say that up to the present time the new star has behaved as if it had entered a system of distant planets, rather than a swarm of cosmical meteorites." This, however, is simply an expression of opinion, and the statements that might justify it are not discussed, for the reason that "they relate to the minutiæ of observation."

The *Quarterly Review* (October) contains an excellent account of Vedic mythology, which should be of interest to astronomers, since it deals chiefly with the relation of the sun and moon to mythological thought and language.

An article on "Waves," in *Good Words*, and one on "Electricity and Health," in the *Humanitarian*, deserve mention, though neither contain much of scientific importance.

The *Medical Magazine* contains Part I. of an article on "Heredity and Disease."

ON A METEORITE WHICH FELL NEAR JAFFERABAD IN INDIA ON APRIL 28, 1893.[1]

PARTICULARS have recently reached this country concerning the fall of a meteorite near Jafferabad in the south-east of Kathiawar, a native State adjoining the

[1] Note read at the meeting of the Mineralogical Society, October 24, 1893.