of stars of which the latitude of one star only was observed, while that of the other was obtained by means of Ptolemy's difference of latitude. Therefore, the longitudes of only about 900 stars were actually observed, and the latitudes of about 878 stars. But there is a strong suspicion that the original observations should be still further reduced, as there are some forty or fifty stars the errors of the places of which resemble the errors of Ptolemy, and thus suggest a derivation from the Almagest. These very interesting results of Mr. Knobel's examination of the catalogue have escaped the attention of all previous historians of astronomy.

The comparison with modern star-places shows that the accuracy of Ulugh Beg's observations was not much superior to that of Ptolemy's. Mr. Knobel reproduces a drawing of an altazimuth from a Persian MS. in the British Museum (a treatise on astronomical instruments), which shows the use of diagonal scales for subdividing graduations. As the MS. dates from A.D. 1700, the influence of knowledge derived from Western sources is not excluded. But as diagonal scales were known to Levi ben Gerson, a Spanish Jew who died at Avignon in 1344, it is very possible that some later Arabian observers may have employed them. Judging from his star-places, Ulugh Beg scarcely did so. We congratulate Mr. Knobel on this completion of the long labours of Prof. Peters and himself on ancient star-catalogues. J. L. E. D.

OUR BOOKSHELF.

A Chemical Sign of Life. By Shiro Tashiro. (The University of Chicago Science Series.) Pp. ix+142. (Chicago: University of Chicago Press; London: Cambridge University Press, 1917.) Price 1 dollar or 4*s*. net.

DR. TASHIRO gives a useful and readable summary of the results which he has obtained on the production of carbonic acid in nerve and in seeds by the employment of an ingenious microchemical method. He regards the evolution of this gas as a sign of life analogous to the "blaze currents" described by Dr. Waller. The magnitude of the CO_2 production which he observes in nerve fibres has raised doubts as to the exact significance to be ascribed to the results obtained. The author deals with some of the criticisms which his work has evoked.

Morphology of Gymnosperms. By Profs. J. M. Coulter and C. J. Chamberlain. Revised edition. Pp. xi+466. (The University of Chicago Press.) Price 5 dollars net.

THIS important work was reviewed at length in the issue of NATURE for August 10, 1911 (vol. lxxxvii., p. 171). The revised edition is in no sense rewritten, but important changes and additions occur, the more important of which are in the chapter on Cycadales and in the bibliography. A supplementary list to the latter adds 150 titles to the 484 of the first edition.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Tidal Energy Dissipation.

MR. STREET is in error in attributing to me (NATURE, October 25, p. 145) the "contention that viscous action in a solid earth cannot be an appreciable cause of the slowing of its rotation." I have never made any such assertion, it is opposed to my personal opinion, and in the present state of knowledge it is quite impossible either to affirm or to deny a statement of such definiteness. His criticisms of the law of viscosity used by me (M.N., R.A.S., vol. lxxvii., pp. 449–56) are confined to its precise mathematical form, to which I attach little importance, and do not touch the physical conceptions underlying it, which are fundamental. The mathematical argument was only a numerical illustration of the order of magnitude of the effects to be expected from these.

The theory that viscosity in the solid earth is the cause of the lunar secular acceleration requires its effect to be considerable for variable stresses with periods of the order of a day. If, then, the viscosity is of such a character as to permit an indefinite flow when a constant stress is applied for a long enough time, then for stresses with a period of a year or more the substance will have time to flow like a liquid, keeping approximately the hydrostatic form throughout the changes. Hence the Eulerian nutation, a long-period vibration depending for its existence entirely on solid rigidity, could not persist. Similarly, annual variations in the distribution of mass over the surface would be compensated by internal flow, and there could therefore be no annual variation of latitude.

If, on the other hand, the viscosity is not of a type that permits indefinite flow, the strain when a constant stress is applied must tend to a finite value, and afterwards remain approximately constant. The effect of viscosity must then be limited to the initial stage. In the case of a periodic stress the period of which is long compared with this initial stage, the rigidity will be of much more importance than viscosity, and the substance will behave nearly as if perfectly elastic. On the other hand, if the period is short in comparison, viscosity will be of greater importance. This is supported by the fact that if the viscous forces are directly proportional to the rate of straining, as is inherently probable on account of the analogy to electric resistance and fluid viscosity, the same is found to hold. On such ideas the law I called that of "firmo-viscosity" is based. If, then, the effect of such viscosity is considerable when the period is twelve hours, it must be more important than elasticity when the period is only a few seconds, as in the case of earthquake waves. Thus the transmission of these waves would be prevented. It follows that firmo-viscosity is absent from the earth so far down as seismic waves travel; it may, however, be important at still greater depths.

If on the application of a constant stress to a body the strain at once assumed a finite value, then slowly increased for a few days, and afterwards remained constant, the viscous properties of such a body would bear a close resemblance to those of the earth as a whole. In this case, however, the rigidity found from the Eulerian nutation should be much less than that found from earthquakes, which does not appear to be the case. This suggestion, therefore, alters the difficulty without removing it.