fishes, and a mandible of a primitive Mastodont (*Tetrabelodon dinotherioides*). He is still in the field, now accompanied by his sons, whom he has trained to follow him.

A. S. W.

The Book of Nature-Study. Edited by Prof. J. B. Farmer, F.R.S. Vol. IV. Pp. viii+210. (London: The Caxton Publishing Company, n.d.) Price 7s. 6d. net.

The fourth volume of this attractive publication is devoted entirely to botany. The descriptions by Dr. W. H. Lang of some common plants flowering in the spring and summer appeared in the previous volume; the continuation refers to plants that flower later in the year and others of special morphological interest, such as the honeysuckle, dodder, sundew, and types of trees. The Scots pine serves as a representative gymnosperm, while a brief account of pollination and seed dispersal closes Dr. Lang's contributions. His precise and orderly descriptions provide excellent models for a student to emulate.

To Dr. W. Cavers has been entrusted the somewhat difficult task of preparing an interesting account of the cryptogams, and in this he is very successful. He adopts a less formal method of description than Dr. Lang, and by confining himself merely to the more important characters, he is enabled to direct attention to a large number of species. Most of the indigenous ferns and fern allies are noted, and the more striking mosses and liverworts. Lichens form the subject of a separate chapter, but algæ are omitted, and only outlines of the fungal groups are indicated. This section and the former one are confined to morphology as distinct from ecology, which provides the bulk of the third section contributed by Miss C. L. Laurie, although the heading, "Woodland Vegetation," appears in the contents. The ecological section suffers from a want of definition of the main objective. The descriptions of the moors, commons, and heaths are quite definite, perhaps somewhat brief, but the interpolation of parasites and saprophytes in the middle of plant associations presents an unnecessary confusion of ideas. The chapter on woodland vegetation is very instructive, albeit the paragraphs are somewhat disjointed, and no definite tree formations are fully described as such.

The illustrations are numerous and excellent; the coloured plates of single plants, notably of the honeysuckle, are admirable specimens of reproduction, and the plain photographs are practically as effective for their purpose. Two photographs of lichens, the woodland photographs by Miss Tidman, and the illustrations of the mistletoe and goat-willow are perhaps the choicest: but it is somewhat invidious to draw distinctions, as the contributors include Dr. O. V. Darbishire, Mr. H. Irving, and Mr. Chalkley Gould.

Éléments de la Théorie des Probabilités. By Émile Borel. Pp. viii+190. (Paris: A. Hermann et Fils, 1909.) Price 6 francs.

Like all Prof. Borel's works, this is a very pleasant book to read. It is in three parts, dealing respectively with discontinuous problems, continuous problems, and those in which *a priori* probabilities are involved. The second part contains, among other things, a useful sketch of Gauss's theory of errors; and the third gives some applications to statistics and biology. Some of the problems are quite amusing; for instance, "Pierre plays écarté with a stranger, who turns up a king the first time he deals. What is the probability of his being a professional cardsharper?"

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.*]

Magnetic Storms.

The last English mail which arrived in India brought the newspapers containing the account of the magnetic storm of September 25, and in the *Times* Sir Oliver Lodge's opinion on the cause of such storms is given. It appears, however, that three of the statements contained in that account are not entirely supported by experimental and observational evidence, and would not be subscribed to by those who have recently been working at the problems of atmospheric electricity.

(1) Sir Oliver Lodge remarks:—"Some of them" (electrons from the sun), "especially at the times of the equinox, may come down near the equator. Those which journey to the Poles are accompanied by an opposite current in the crust of the earth from the equator to the Poles, and this it is which disturbs the telegraphs, being picked up or tapped by them *en route*." Now if a large quantity of negative electricity were suddenly added to the upper atmosphere, and this induced a corresponding charge of positive electricity on the earth's surface, it would of necessity disturb the existing potential gradient in the atmosphere.

The extent of the disturbance can be roughly calculated by treating the earth's surface as an infinite plane. Suppose that the electrons moving in the upper atmosphere and adjacent space are uniformly distributed; their electrostatic and horizontal magnetic effect at the earth's surface will then be the same as if they were confined to a plane parallel to the surface of the earth. Let the surface density on the plane be σ and the velocity of the ions in the plane v; H will then be changed by $2\pi\sigma v$. Now Dr. Chree states (Nature, September 30) that during the magnetic storm H varied by more than 740 γ; for convenience let us take the change in H to be only 700 γ, *i.e.* 0·007 electromagnetic unit. Hence $2\pi\sigma v = 0{\cdot}007$, or $\sigma = 0{\cdot}007/2\pi v$. If σ is measured in electrostatic units this becomes $0{\cdot}007\text{V}/2\pi v$, where V is the velocity of light. The electrostatic field between the charged plane and the earth would be $4\pi\sigma$, *i.e.* $4\pi \times 0{\cdot}007\text{V}/2\pi v$ or $0{\cdot}014\text{V}/v$. Expressing this field in volts per metre, we have $0{\cdot}014 \times 300 \times 100\text{V}/v$, *i.e.* $420\text{V}/v$. Now v cannot be greater than V, hence the smallest value of the field would be 420 volts per metre. This value is more than four times greater than the normal value of the potential gradient in the atmosphere, and it is of the opposite sign. This calculation is not supposed to be quantitatively accurate, but it gives in a simple way the order of magnitude of the effect. Hence it is seen that the large electrical charges which would be required to produce the magnetic effects observed, even if they moved with the velocity of light, would be easily recognised by their effect on the potential gradient. For many years instruments have been in use in different parts of the earth giving continuous records of the potential gradient in the atmosphere, but, so far as I am aware, no effect of a magnetic storm has ever been reported. Such an instrument is in use in Simla. On the day of the storm the weather here was perfect, so that if any effect of the kind had taken place it would have been clearly seen; but, as a matter of fact, there is absolutely nothing on the record to distinguish the period of the magnetic storm from the periods on either side of it: the potential gradient was entirely normal throughout September 25 and 26. It would therefore appear that the great earth currents associated with magnetic storms are not, as Sir Oliver Lodge suggests, due to induced charges.

(2) Sir Oliver Lodge further says, regarding the electrons:—"Those which enter the atmosphere elsewhere act as nuclei for condensation of moisture, and by screening the sun's rays are probably responsible for some of the dull and overcast weather." This statement is apparently based on a misconception of Mr. C. T. R. Wilson's experiments on the condensation of water vapour on ions, for these experiments do not afford any real support to