

discussed here, but I would make one suggestion. When the objects in a given visual field are moving in different directions, or some of them not moving, the eye usually fixes on one of the objects, regarding it as stationary and treating the others as moving. This requires both a muscular and a nervous effort, involving the co-ordinating mechanism of the higher nerve-centres; and when the stimulus ceases or changes, the reciprocal after-effects in these centres are apparently interpreted as opposite motion; a change of nerve-muscle co-ordination is necessary to accommodate the eye to a changed stimulus. Even very simple sensations may involve complex nerve-muscle co-ordination.

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Cambridge, December 16.

A TRAVELLER IN LAPLAND.¹

MR. HEDGES BUTLER is a specialist in unusual modes of travel, and may well be proud of his pioneer work in systematic journeys through the air. Most visitors to Lapland would select the long days of summer, when the heat may prove excessive and the mosquitoes are "a veritable plague." Mr. Butler points out that the best time to start is about the end of March, and he gives pictures of Kiruna railway station, and the romantic little platform at Polcirkel, piled about with snow. When he gets as far north as he can by the steamer or

the Narvik railway, he casts aside all British prejudices as to hours of meals and clothing; he dines and dresses like his Lapp companions, sleeps with them in a skin tent when there is no rest-house, and occasionally passes the night in a burrow in the snow. His friendliness with the people smooths away the difficulties of journeys by the boat-like sledges or on skis, and he is always ready to emphasise his happiness rather than his discomfort. In reading his book, we seem admitted to the pleasure of his companionship.

¹ "Through Lapland with Skis and Reindeer, with Some Account of Ancient Lapland and the Murman Coast." By Frank Hedges Butler. Pp. xii+286. (London: T. Fisher Unwin, Ltd., 1917.) Price 12s. 6d. net.

Mr. Butler gives useful details of equipment, which remind us of the delightful "Provision to catch the Whale fish in Russia," published by Hakluyt under the date 1575. He sketches the history of the Lapps, and gives, in chap. vi., a valuable description of the Murman coast and its conditions down to the arrival of the railway at Alexandrovsk. We might reasonably expect, however, some reference to the political and commercial importance of this line, and to the singular revival for London, Hull, and Moscow of the sixteenth-century trading routes. The bibliography of Lapland in Appendix v. begins with Stephanus in 1629; but Englishmen would like some reminder of Willoughby's last journals, and of the tragedy of "the *Speranza*, which wintred in Lappia" in 1553. "Kegor, Pechingo, and Cola" are, moreover, discussed by William Burrough in 1576, and their names were then better



FIG. 1.—Bossekop on the Altenfjord, Norwegian Lapland. From "Through Lapland."

[Photo B. Mesch.]

known to our merchants than they are at the present day. Mr. Butler will do much to introduce this region again to general readers, and we can only regret that they must turn elsewhere for the romance of our early Russian trade. Burrough uses the pleasant terms "Lappians" and "Lappies" for the people, and we commend these to Mr. Butler, who in one place gives us the odd plural "fjeldlappers" as a Norwegian term.

A certain indifference to language, characteristic alike of British travellers and of soldiers at the front, shows itself in Mr. Butler's work. The Finnish spellings in the vocabulary on p. 48 are

not those usually accepted, nor will Fru Wiig of Bossekop feel happy in appearing as "Mrs. Wiggs." "Gastivare" (p. 125) is neither Finnish nor Swedish, and "kestikievari" would seem to be the word intended. Mr. Butler, however, can drive reindeer, just as he can follow game in Africa, and the main thing is that he accommodates himself so skilfully to his surroundings. Even if we cannot hope to follow him, and may be content to view the wilds of Lapland from Abisko or the top of Kiirunavaara, we feel

statistical mechanics and their applications to the problems of stellar dynamics. Since the positions and motions of individual stars are known only in a few instances, it is impossible to treat the motions of stars by the ordinary methods of classical mechanics, so that statistical methods have to be adopted. Important investigations in stellar dynamics have been made recently on this basis by several investigators, more particularly by Eddington and Jeans. There are two fundamentally different methods of treatment: (a) The



FIG. 2.—Lapp tent and sledge at Jukasjärvi. From "Through Lapland."

[Photo F. H. Butler.]

something, as we turn his pages, of the dry, healthy air and the crispness of the arctic snow.

GRENVILLE A. J. COLE.

STELLAR DYNAMICS AND STATISTICAL MECHANICS.¹

THE five papers referred to below do not form a logical sequence of discussion, but are related to one another in that they are all more or less directly concerned with the methods of

¹ (1) "Statistical Mechanics, based on the Law of Newton," *Lund Meddelande*, Ser. ii., No. 16. (2) "Ueber den Satz von den Gleichen Verteilung der Energie," *Lund Medd.*, Ser. i., No. 79; *Arkiv för Mat. Astr. och Fysik*, Bd. xii., No. 18. (3) "Ueber hydrodynamisches Gleichgewicht in Sternsystemen," *Lund Medd.*, Ser. i., No. 82; *Arkiv för Mat.*, etc., Bd. xii., No. 21. (4) "Conceptions Monistique et Dualistique de l'Univers Stellaire," *Lund Medd.*, Ser. i., No. 81; *Scientia*, vol. xxii., p. 77 (1917). (5) "Eine Studie über die Analyse der Sternbewegungen," *Lund Medd.*, Ser. i., No. 78; *Arkiv för Mat.*, etc., Bd. xii., No. 10. All by Prof. C. V. L. Charlier.

stars may be compared with the molecules of a gas, and the effect of the various encounters considered, the discussion proceeding along the lines of gas theory. (b) It may be supposed that the encounters of stars have but small effect, so that the stars may be regarded as describing orbits under the general attraction of the stellar system as a whole, the discussion then proceeding along the lines of hydrodynamics. Both methods may be expected to give results of value for the general theory.

Prof. Charlier has adopted the first of these two methods in (i), and has worked out a kinetic theory for the stars based upon Newton's inverse square law of attraction; in gas theory the treatment has usually supposed either that the molecules are elastic spheres or that they repel each other inversely as the fifth power of the distance.