

paths ending in North Africa. The fourth (D), fifth (E), and sixth (F) main routes depart from the extreme north of Siberia. The fourth (D) ascending the river Ob, branches out near Tobolsk—one track, diverging to the Volga, descends that river and so passes to the Sea of Azov, the Black Sea, and thence by the Bosphorus and Ægean, to Egypt; another track makes for the Caspian by way of the Ural River and so leads to the Persian Gulf, while two more are lost sight of on the steppes. The fifth (E) mounts the Jennesei to Lake Baikal and so passes into Mongolia. The sixth (F) ascends the Lena and striking the Upper Amoor reaches the Sea of Japan, where it coalesces with the seventh (G) and eighth (O) which run from the eastern portion of Siberia and Kamchätka. Besides these the ninth (X) starting from Greenland and Iceland, passes by the Færoes to the British Islands and so joining the second (B) and third (C), runs down the French coast."

All these routes are plainly laid down on the map which accompanies the work, and in the absence of more precise information, it will hardly be in the power of any British ornithologist to dispute them, though, as before stated, we must hold them to be in a great measure conjectural. In the following chapters the author shows how necessary it is to know the principal routes taken by birds in their migrations before we can understand or reason intelligibly on their movements, and of very great interest are his remarks on the Genetic Import of Regular and Irregular Lines of Travel, and on the So-called Migratory Instinct (chaps. ix. and x.), greatly amplified in the German version from the brief paragraphs which represent them in the Swedish original. They are, however, it must be confessed, somewhat verbose; but, for all that, they are well worth reading. Though Herr Palmén refers to an article which appeared in these columns some years ago (NATURE, vol. x. p. 415), he does not seem to be aware of the theory subsequently propounded by Mr. Wallace (vol. x. p. 459) as to the possible or probable origin of migratory habits, wherein is expressed, in far fewer words than his own, what appears to be essentially the same thing. For "Migratory Instinct" Herr Palmén substitutes "Experience" as the piloting power, and though there is much to be said in favour of this explanation in many cases, others there are in which it seems to break down utterly. How do the young cuckoos which stay in this country a month or six weeks after their parents (whom, let us remember, they have never known) have departed find their way to Africa? And how do the scores, hundreds, or thousands of rapacious and wading birds, whose elders do not accompany them, manage in their autumnal journeys to arrive more or less punctually at the spot which countless generations of their predecessors have reached before them? They have had no "experience," and though doubtless many perish by the way, a very large proportion year after year hit off exactly, and at the first intention, the ancestral landing-place. What, also, can "experience," which, after all, means only a knowledge of landmarks, do for the species which travel by night, as seems to be the habit of very many birds, or for those which, like at least two of the annual visitants to New Zealand, traverse a waste of waters? At present no solution of the mystery offers itself, at present such knowledge may be too wonderful for us; but, high as it is, our faith in the progress of science forbids us to say that we cannot attain unto it.

OUR BOOK SHELF

Dynamics; or, Theoretical Mechanics, in Accordance with the Syllabus of the Science and Art Department. By J. T. Bottomley, M.A., F.R.S.E., F.C.S. (London and Glasgow: William Collins, Sons, and Co., 1877.)

THIS little text-book is issued by Messrs. Collins as one of their Elementary Science Series, and will prove useful to beginners, by rendering them familiar, at an early stage of their studies, with the more precise definitions and nomenclature which have been introduced by modern writers on dynamics. The distinction, for instance, between the centre of gravity and the centre of inertia is much more clearly pointed out than is usual in elementary works, and the statement that "there is only a limited number of classes of bodies that possess a centre of gravity" will probably be read by many with surprise. The measurement, composition, and resolution of velocities are treated of in the chapter preceding that on force, and the methods of measuring forces in terms either of gravitation units or absolute units are well and fully discussed. The definition of work given in the last chapter might, we think, be amended. As it stands at present it might lead the student to suppose that no work is done by an agent moving a body, unless the motion is created in opposition to a resisting force, though the language employed in some of the examples would be sufficient to correct such a supposition. Throughout the work the author assists the student to obtain "clear physical conceptions regarding the first principles of dynamics," by frequently directing his attention to the experimental proofs of the various laws he enunciates, and by hinting at the physical, rather than the mathematical, developments of his subject.

On these grounds, we have formed a very favourable opinion of Mr. Bottomley's work, and we have no doubt that it will meet with the success it deserves among a wider class of students than that for which it is specially designed.

A. R.

LETTERS TO THE EDITOR

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Evolution and the Vegetable Kingdom

MR. CARRUTHERS has embodied in the *Contemporary Review* the substance of his Presidential addresses to the Geologists' Association, on which we would offer a few points for consideration.

Although not agreeing with Mr. Carruthers as to the inferences to be drawn from the present state of our knowledge of fossil vegetable remains, we cannot but admire the earnestness with which he makes a stand in what we regard as a losing cause. We set a high value on his researches in fossil botany, and his work is characterised by unvarying and careful exactitude. Whatever may be his theories, his reputation will rest on a solid basis of work. Palæontologists have to thank him for unvarying kindness and readiness to aid them in their researches, forming a marked exception to the treatment which botanists usually give the subject.

In discussing this question, we must keep well in mind the teaching of Sir Charles Lyell, first as to the insufficiency of the geological record, especially with regard to land-surfaces. Considering the denudation and the wasting action of the waves to which remnants of terrestrial conditions are exposed during the slow process of their submergence beneath the sea, and again during their gradual upheaval, it is surprising to us not that so few records are preserved, but that any vestiges whatever remain. Secondly, with regard to lapse of time, we must get the "chill of poverty out of our bones," and not misinterpret "the sign of successive events, and conclude that thousands of years were implied where the language of nature imports millions." Mr. Carruthers admits the imperfection of the geological record, although scarcely with sufficient emphasis, and compares its fragmentary condition to a tablet containing