

rocks are, in Great Britain and Ireland and elsewhere, deficient in lime. In our own experience we have seen most valuable results produced by the application of lime to these soils; and we learn from M. Burat that by the same means several districts in the West of France, which formerly were unable to maintain their people without extraneous supplies of food, have (*i.e.* by the use of lime) become the largest exporters of grain. All the author's illustrations are taken from France, but they have their counterparts in these islands.

On the whole, we are justified in saying that the little work will well repay perusal.

OUR BOOK SHELF

Flora of Dorsetshire. By J. C. Mansel-Pleydell. (London: Whittaker and Co. Blandford: W. Shipp.)

Flora Cravoniensis: or, a Flora of the Vicinity of Settle in Craven, Yorkshire. By John Windsor. (Manchester: Cave and Sever, 1873. Printed for private circulation.)

ALTHOUGH the boundary-lines of our counties are, as a rule, purely arbitrary, it is probably wise for the compilers of local floras to maintain them rather than to erect new ones of their own. The area of their observations is, at all events, thus rendered perfectly clear and certain. Dorset has long been famous for its palæontological wealth, both vegetable and animal; and we have here a record of its living flora, which, as might be expected from its length of sea-board and its variety of geological formations—lias, oolite, forest marble, Oxford clay, coral rag, Kimmeridge clay, Portland sand, Purbeck, chalk, and Eocene—is a rich one. The value of local floras depends greatly on the dependence that can be placed on the determination of the species by the editor and his *collaborateurs*; and on this point it seems to us that the present work can be safely trusted, great pains having been taken to establish the authenticity both of the localities and of the nomenclature. The county is divided into seven districts determined by the drainage, and therefore generally separated by high land; and a very good map of the county accompanies the volume. Among the greatest botanical rarities of the county (some of them almost unique) are—*Polycarpon tetraphyllum*, *Lotus hispidus*, *Simethis bicolor*, *Leucojum vernum* (doubtfully native), *Carex clandestina*, *Scirpus parvulus*, and *Cynodon dactylon*. The flora is confined to flowering plants and vascular cryptogams.

Mr. Windsor's "Flora of Craven" (the veteran author did not live to see its publication, or rather printing) is compiled on a different plan, the area being a somewhat arbitrary one: "about Settle and its neighbourhood to a moderate distance, generally within twelve miles, but in a few instances extending somewhat further." The district is a remarkably interesting one, whether from a geological or a botanical point of view; and the flora has been compiled with as great care as in the other case under notice, with the assistance of several good local botanists, and includes not only the flowering plants and vascular cryptogams, but also the Characeæ, Mosses, Hepaticæ, and Lichens. A district that includes among its native plants such rarities as *Polemonium coeruleum*, *Epipactis ovalis*, and *Cypripedium calceolus*, is of no ordinary interest.

Both these volumes are useful contributions to our library of local botany. We would especially commend to compilers of similar works the plan adopted by Mr. Mansel-Pleydell, of giving the geographical range of each species in the neighbouring counties of England and on the opposite coast of France.

A. W. B.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

Migration of Birds

THE subject to which Prof. Newton has called attention is one of great interest to all naturalists, and requires to be studied systematically; for I can hardly think that the solution is so "simple in the extreme" as Mr. Newton thinks it may be.

It appears to me probable that here, as in so many other cases, "survival of the fittest" will be found to have had a powerful influence. Let us suppose that in any species of migratory bird, breeding can as a rule be only safely accomplished in a given area; and further, that during a great part of the rest of the year sufficient food cannot be obtained in that area. It will follow that those birds which do not leave the breeding area at the proper season will suffer, and ultimately become extinct; which will also be the fate of those which do not leave the feeding area at the proper time. Now, if we suppose that the two areas were (for some remote ancestor of the existing species) coincident, but by geological and climatic changes gradually diverged from each other, we can easily understand how the habit of incipient and partial migration at the proper seasons would at last become hereditary, and so fixed as to be what we term an instinct. It will probably be found, that every gradation still exists in various parts of the world, from a complete coincidence to a complete separation of the breeding and the subsistence areas; and when the natural history of a sufficient number of species in all parts of the world is thoroughly worked out, we may find every link between species which never leave a restricted area in which they breed and live the whole year round, to those other cases in which the two areas are absolutely separated. The actual causes that determine the exact time, year by year, at which certain species migrate, will of course be difficult to ascertain. I would suggest, however, that they will be found to depend on those climatal changes which most affect the particular species. The change of colour, or the fall, of certain leaves; the change to the pupa state of certain insects; prevalent winds or rains; or even the decreased temperature of the earth and water, may all have their influence. Ample materials must exist, in the case of European birds, for an instructive work on this subject. The two areas should be carefully determined for a number of migratory birds; the times of their movements should be compared with a variety of natural phenomena likely to influence them; the past changes of surface, of climate, and of vegetation should be taken account of; and there seems no reason to doubt that such a mode of research would throw much light on, if it did not completely solve, the problem.

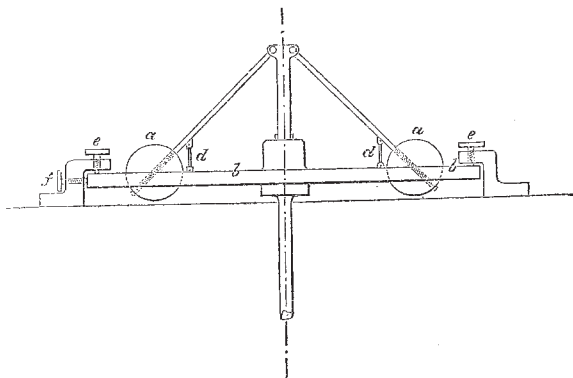
This is an appropriate opportunity for making a suggestion which has long been in my mind. It is, that it would be a valuable and interesting addition to NATURE, if we were supplied with a weekly (or monthly) "Calendar of Periodical Phenomena in Natural History," such as the average dates of appearance and departure of migratory birds, of the opening and fall of the leaf of our forest trees and common cultivated trees and shrubs; of the flowering of our common field and garden plants; and also the mean *highest* and *lowest* temperature of each *day*, the direction of the wind and amount of rainfall for each *week*, according to the Greenwich averages. None of this information is given in the usual almanacks or periodicals, and it is by no means easy to find it when wanted. Yet it is surely of much value to everyone who lives in the country, and would be the means of exciting an intelligent interest in such observations and inquiries as those to which Prof. Newton has called our attention in his interesting article.

ALFRED R. WALLACE

Regular Motion in Clockwork

IN order to ensure perfectly regular motion in the clockwork which drives the revolving dioptric apparatus made by Messrs. Chance, Bros. and Co., I have recently introduced a centrifugal governor, which might perhaps also be useful for the clocks of equatorials. Though it involves nothing new in principle, the form differs from anything I have seen, in that the governor balls have to lift a heavy weight, and that the leather rubbers or brushes are not carried by the revolving balls, but are fixed to the frame of the clock and rub against the disc which forms the extra weight lifted by the balls. The sketch shows the governor

in use on the clock of the apparatus of Cape Bon, Tunis, an apparatus exactly similar to that now standing in the International Exhibition. It consists of a shaft making 170 revolutions per minute, to which the balls *aa* are hung, and on which the disc *bb* can slide, guided by a feather key. When the clock is below speed the disc rests upon a collar fixed on the shaft, the pull exerted by the balls through the links *dd* being insufficient to raise it; but as soon as the proper speed is attained, the disc rises and comes in contact with the screws *cc*, which are tipped with leather and fixed to the frame of the clock. Spaces are cut out of the disc to admit the balls, avoiding unnecessary height. The screw *f* serves as a brake to stop the clock at pleasure. I



calculate that work to the extent of five foot-pounds per minute must be done on the governor to accelerate the clock one second per hour. This form possesses two advantages over that in which the rubbers are carried by the balls—1. It checks any acceleration of the clock more powerfully; 2. It is easier to adjust. In the older form it is necessary to ascertain by careful experiment that *each* ball shall bring its rubber into contact exactly when the speed is correct, whereas in this it is immaterial that the arms of the balls should be exactly equal; it is only needful that they should *together* raise the disc to contact when the speed is right. J. HOPKINSON

Glass Works, near Birmingham, Sept. 1

Rainbows

As a pendant to my note inserted in NATURE, vol. x. p. 437, I may mention that an exceedingly fine lunar rainbow was observed here at 8.40 P.M. on September 29.

Though the moon was near the last quarter, the bow was bright enough to appear reddish on one side and greenish on the other. It is the only one, of some five or six lunar rainbows I have seen, which appeared to show any trace of differences of colour.

I may also mention that about the end of August I saw, two hours after sunrise, a dazzlingly bright and gorgeously coloured parhelion in a small ice-cloud to the right of the sun, the rest of the sky being almost perfectly clear. There had been a sudden and considerable fall of temperature during the previous night.

St. Andrew's, Oct. 2

P. G. TAIT

IN NATURE, vol. x. p. 438, Mr. Schuster complains that in text-books no mention is made of supernumerary rainbows, and that the theory of them is to be sought in original memoirs, not generally accessible. Allow me to mention that in Sir John Herschel's *Meteorology* (a little work published by Black, price three and sixpence, and originally an article in the *Encycl. Britann.*), a complete explanation of the rainbow, and of the supernumerary bows as well, on the principle of interference, is to be found. F.M.S.

U.S. Weather Maps

IN Prof. Loomis's "Results of an Examination of the U.S. Weather Maps for 1872 and 1873" (published in the *American Journal of Science and Arts*), and recently noticed in NATURE, I am struck not only by the general agreement but by the almost verbal coincidence of one or two of his "Results" with some of the rules laid down in my work on the

"Laws of the Winds" prevailing in Western Europe," which was published in the beginning of 1872.

In "Laws of the Winds," Part I. p. 56 and following, I have shown that "we are unable to account for the eastward progress of depressions by attributing it to prevailing westerly upper-currents," but that "each system of depression appears to travel eastward with a kind of self-developed motion," and that the precipitation on the east side of the centre "is the principal agent in producing the change of geographical position." Prof. Loomis writes: "The progress of a storm eastward is not wholly due to a drifting, resulting from the influence of an upper-current from the west, but the storm works its way eastward in consequence of the greater precipitation on the eastern side of the storm."

Prof. Loomis also appears to attribute the formation of some depressions, primarily developed in the United States, to the collision of moist air from the Pacific with the mountains in the north and west, in the same way as I have attributed the primary formation of some of our depressions to the collision of the vapour-laden atmosphere from the Atlantic with the high-lands in the west and north of the British Isles.

I am glad to observe that Prof. Loomis is no advocate of the "circular theory" of storms as still held by some meteorologists. He intimates the mean inclination of the wind towards the lower isobars as "more than 45°" in the United States. In the *Journal of the Scottish Meteorological Society*, No. xxxix. I have shown that at stations in the British Isles the mean inclination is 21°, but that it appears to be considerably higher in continental Europe.

In the work previously alluded to I have shown that depressions appear to travel most to the south when the atmosphere is warmer in the west than in the east, and most to the north under contrary circumstances, but that this influence is interfered with by another, viz., the tendency of depressions to travel so as to have the highest general pressures on their right. A less limited acquaintance even than I can claim with the U.S. Weather Maps would go far to show which of these two influences is the predominant, the general atmospheric conditions of the United States presenting a better field for their investigation than is to be obtained in Europe. Prof. Loomis finds that in North America storms tend most to the south in July and to the north in October. It would be interesting to inquire whether this observation holds good of depressions on the Pacific coast, as well as near the Atlantic. But a two years' average is insufficient to settle such questions.

On the whole it is satisfactory to find that some important results obtained from a study of European weather-charts are found, on good authority, to be in accordance with those derived from the U.S. maps. At the same time some of the theoretical remarks made by Prof. Loomis will not, I think, be generally endorsed by meteorologists. The statement that "it needs no argument to prove that when the wind is flowing from all quarters inwards upon a central area, there is a rapid accumulation of air, which can only escape by an upward motion," is incorrect; the depression of the barometer in the centre showing that there is no accumulation, but a rarefaction, produced in part, as Prof. Loomis has himself previously shown, by precipitation, and which is itself the cause of the influx.

Under the present conditions of anemometry all endeavours to calculate the upward movement in a storm from anemometrical data should also be accepted with much reserve. Still more hazardous (considering the inclination of depression-axes and the frequent difference of direction between currents at small and those at great elevations) is the attempt, in such an inquiry, to correct the observed velocities at sea-level by those on the summit of Mount Washington. With a depression in Eastern Canada a west wind not uncommonly blows on Mount Washington while more southerly airs are felt at the three nearest stations. If in such a case we calculate the amount of influx towards the depression-centre simply from the ratio between the velocity at sea-level and that on Mount Washington, it is obvious that the result will be the reverse of accurate.

Aug. 25

W. CLEMENT LEY

Aurora

ON Sept. 11 I was at Kyle Akin (Skye). The day had been wet and stormy, but towards evening the wind fell and the sky became clear. About 10 P.M. my attention was drawn to a beautiful auroral display. No crimson or rose tint was to be seen, but a long low-lying arc of the purest white light wa