The book is illustrated by a series of thirty-one plates, eight of them in colour and devoted to figures of the protected species, while the rest are black-and-white figures showing the differences between the various species of chats, and certain warblers and wagtails, occurring in the country.

Investigations in the Theory of Hyperion. By Dr. J. Woltjer, jun. Pp. iii+71. (Leyden: E. J. Brill, 1918.)

THE motion of Hyperion, the seventh satellite of Saturn, is of special interest from the commensurability of its period with that of Titan, the two being in the ratio of 4 to 3. The late Prof. Newcomb wrote an important paper, "On the Motion of Hyperion: a New Case in Celestial Mechanics." The present work carries the investigation some steps further. The differential equations are broken up into partial systems, giving the inequalities proportional to the successive powers of e' the eccentricity of Titan's orbit. Newcomb had regarded this development as impracticable, but the present work demonstrates the contrary. The development is at present carried only to the first power of e' , which suffices to give a close approximation to the observed inequalities. For example, the ratio of masses of Saturn and Titan is deduced as 3986, which is close to the values 4172, 4125 found by Eichelberger and Santer respectively. Incidentally, we may note that the mass of Titan is about twice that of the moon, and two-thirds that of Mercury. Also the coefficient of the large inequality that depends on Titan's eccentricity is found as 12.96° , not differing much from the value 14.0° found by H. Struve from observation.

The researches made by Dr. Woltjer form a useful step in the attainment of a complete theory of Hyperion's motion, and it is to be hoped that he will himself continue the work, carrying it far enough to include all sensible terms.

A. C. D. CROMMELIN.

A Field and Laboratory Guide in Physical Nature-study. By Prof. Elliot R. Downing. (The University of Chicago Nature-study Series.) Pp. 109. (Chicago, Illinois: The University of Chicago Press; London: The Cambridge University Press, 1920.) Price 1 dollar net.

At first sight it is difficult to decide whether the book was written for children or for adults—in its assumption of previous knowledge it is hopelessly above the one; in its treatment it is far beneath the other. The preface explains that it is meant for pupil teachers. Directions are given for the making of model aeroplanes, the spinning of tops, etc. But if a youth has missed these delights in his childhood, it is of little use for him to try to find them later on. In training a student to teach children there is no need to treat him as a child himself. Nevertheless, the book is full of good ideas, and many who would find it almost intolerable to use as a laboratory manual would be well repaid for time spent in reading it through.

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Letters to the Editor.

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Genera and Species.

WHEN Linné introduced the practice of giving a generic and specific name to each living organism he probably did not anticipate that the number of names required would run into millions, and with the multiplication of genera and species now encouraged by naturalists some other system of distinction seems desirable.

Of the five or six thousand stars visible to the naked eye only a few have been named, and the rest have to be content with identification by their constellations and by a letter or number.

Something of the same sort might be done for the organic world. The conspicuous and typical examples might retain their names, while both to these and to the remainder a letter or number might be allotted.

If the numbers followed the chronological order in which the species were discovered or first properly described, a catalogue formed on these lines would in itself convey valuable information.

Identification by number or symbol would act as a check to the coining of many barbarous words, and also to the annoying repetition of the same specific names in different genera. All true classification should be genealogical—that is, it should depend on the ancestry of the organism classified. Existing knowledge is insufficient to achieve such an ideal result, but any system not founded on pedigree is open to the objection of not being "natural."

There are often great doubts as to where varieties end and species begin, and where such doubt exists it would, in general, be safer to assume that differences are varietal until it has been found by trial that continued interbreeding tends to produce sterility.

I am informed by authorities well acquainted with the West Indies that this is what happens when half-breed is crossed with half-breed, but not when half-breed mates with white (or better, with black). So far as this evidence goes, it points to something approaching a specific difference between the white and the negro, and many species have been determined on a worse foundation.

Books on special branches of natural history, while giving some sort of description of the various genera and species, do not (there are a few honourable exceptions) indicate, or indicate very imperfectly, the grounds on which the generic or other distinctions rest, and it is not uncommon to find differences between admitted varieties of the same species exceeding those between species reputed to be separate.

To find the reasons for these apparent anomalies by consulting the original papers involves the expenditure of much time and trouble, but the information might be compressed into a small space if properly tabulated.

A. MALLOCK.

9 Baring Crescent, Exeter, July 17.

The Cluster Pine.

Pinus pinaster was probably introduced into Madeira about thirty years before the beginning of the nineteenth century—a hundred years too late to save from wanton extinction the forests of mountain laurel, Cerasus, Persea, juniper, and many a species exclusively Madeiran.

There is a settled method of cultivation. The steep hillsides, ridge, and valley, after the yearly autumn

rains, are made ready to receive the seed which in November and December is scattered broadcast, mixed with wheat and lightly covered over after heavy rain. The green seedlings appear in a few weeks, but there is no tangible development until the wheat is taken away and the decaying stalks have become available as plant-food, and perhaps advantageously helped by a thin surface-dressing of sawdust.

A Pinaster plantation soon becomes productive, yielding in the first years substantial bedding for cattle and, mixed with dried gorse bushes, excellent material for the ovens in the village bakehouses. In four or five years the crop will yield abundantly supporting stakes, 6-8 ft. long, for the climbing beans on which the Madeira peasant so largely depends for his winter food, and, yearly afterwards, sturdy poles in ever-increasing dimensions for the construction of the fascinating trellises in the famous vineyards at a lower level. In twelve or fifteen years the trees have attained the stage of firewood, and, with the exception of a few selected pines left for timber, the ground is once more cleared for planting afresh. The tree-stumps are mostly grubbed up, but those left quickly decay in the ground, and the Pinaster throws up no fresh shoots after cutting. The young Pinaster has a distinct tap-root, but the roots of the mature tree spread in a superficial mat, twining fantastically along the surface among the protruding rocks. In digging the foundations of a lofty tower I met with no roots deeper than 4 ft.

No attempt has hitherto been made to deal with the abundant store of turpentine and resin with which in this region the Pinaster is endowed; and up to the present time the plantations have not suffered from the blights and diseases to which the species is subject elsewhere.

Much Pinaster seed is imported from Portugal, as less costly than collecting locally, but the full-bodied, delicately winged seed from a mature tree is in every way preferable, and to procure it a young, supple-limbed mountaineer will not hesitate over the perilous ascent of the huge trunk, bare of branches 70-80 ft. from the ground. A frail ladder made of ivy-stalk serves his purpose, pegged by segments into the crevices of the rough bark, and on reaching the first horizontal branch the intrepid fellow will pass down a string to a companion and draw up a long pine sapling, and with this, clambering out upon the branch, he will beat down the cone clusters with their prolific crop. Once in three or four years sufficient cones have developed to tempt the climber to this giddy and blood-curdling enterprise, and the seeds are beaten out in a few days when the sunshine has sufficiently opened the cones. The seeds then become the property of the pine steeplejack, the handsome, cinnamon-coloured cones, with the substantial residuum of unextracted seeds, remaining with the landowner.

Pinaster timber of mature growth is a handsome and useful wood, though more difficult to work than the imported deals from America and Norway. I possess some substantial floors which show no signs of decay after thirty years' service.

For general purposes Pinaster is far the most serviceable conifer yet seen in Madeira, and its quick growth, its prolific yield of cones and seeds, and its hardy nature and easy cultivation have given the species a popular pre-eminence which is well established.

Thirty years ago I introduced *Pinus insignis* and made important plantations. One or two of these trees, now twenty-seven years old, stand more than 100 ft. high, with a sturdy corresponding bulk, constituting, with their longer, softer, light green, three-sheathed needles, a handsomer and more attractive

form than seen in the Pinaster. But though of equally rapid growth, the cultivation requires more care than the Pinaster; neither is the tortuous-fibred wood regarded with favour by the working carpenter.

P. pinaster, *P. canariensis*, and *P. insignis* all hold their cones for indefinite periods, but the Himalayan *P. longifolia* sheds all its produce in September, leaving nothing but the embryonic promise of next year's crop, the substantial development of the large cones with their resinous, club-ended bracts occupying only seven months.

I cannot close this account without a reference to *Cupressus macrocarpa* and *C. goveniana* as recent accessions of great promise to the Madeira show of conifers; and some mention is also due to the Douglas fir, *Taxodium sempervirens*, etc., stately examples of which adorn our mountain-gardens.

Madeira, June 29.

MICHAEL GRABHAM.

The Training of Practical Entomologists.

THE increasing demand for fully trained economic entomologists was, I think, evident to all who followed the proceedings of the recent Imperial Entomological Conference held in Burlington House. We are faced with the difficulty of ensuring an adequate supply of keen and experienced young men fitted for service in India, the Soudan, and other of the British dominions wherever the requirements may be greatest. The solution of economic problems in entomology is far more difficult than is commonly supposed, and only men of the broadest biological training, coupled with the gift of imagination, are likely to achieve results of lasting value to the community. Under present conditions they are frequently called upon to take up responsible positions after inadequate training and with only a modicum of practical experience. In the training of an economic entomologist two obvious pitfalls have to be avoided: one is a too exclusively academic or laboratory experience, while the other is a too specialised training in economic entomology at the expense of the necessary preliminary grounding in general biology.

The majority of practical entomologists become attached to an agricultural department, a smaller number enter a forestry department, and it is evident, therefore, that they need to acquire some knowledge of the principles and practice of either agriculture or forestry. The time at a student's disposal is an important factor, and the majority of men can usually only devote four years to training prior to turning out and earning their living. Let us take, for example, the course of a student at Cambridge. If he possesses good abilities, he should be able to take Part I. of the Tripos at the end of the second year and obtain his preliminary grounding in biology and chemistry, and I would suggest that the remaining two years should be devoted to entomology *plus* agriculture. The diploma course in agriculture might well be modified to suit such students, allowing them to devote as much time as possible to entomology, and confining the agricultural training, so far as may be feasible, to a knowledge of the soil and crop cultivation, omitting the greater part of the course dealing with stock and animal nutrition. In so far as entomology is concerned, I would advocate the first year (or the student's third year) being devoted entirely to what may be termed the scientific side of the subject. The second year (or the student's last year) should be given to as full a training as possible in economic entomology with the necessary field work. He should be given every opportunity for observing the common pests in the field and the methods of dealing with them. I strongly advocate every student also being given an independent piece of life-history work to