coachman for a supply. At first this is done gently, but if time passes he imperatively demands attention, or it is doubtful if the stable would contain him. The coachman lives adjoining the stable, and, much to his discomfort, the horse sometimes has imaginary wants during the night, and repeats the same process ; and at whatever hour this occurs, the coachman is under the necessity of getting up to attend to him.

ON the 23rd inst. there will be an election at Balliol College, Oxford, to a scholarship on the foundation of Miss Hannah Brakenbury, "for the encouragement of the study of Natural Science," worth 80*l.* a year, tenable during residence of four years; open to all such candidates as shall not exceed eight terms from matriculation. Candidates are requested to communicate their intention to the Master of Balliol by letter, on or before Tuesday, the 16th inst., enclosing testimonials.

THE formal opening of the Zoological Garden of Cincinnati took place on the 18th of September. It contains sixty-six acres, and is very well arranged for its purposes.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus*) from India, presented by Mrs. Tipping; an Egyptian Goose (*Chenalopex ægyptiaca*) from Africa, presented by Dr. E. Swain; a Ring-necked Parrakeet (*Palæornis torquata*) from India, presented by Miss Thirlwall; a White-fronted Guan (*Penelope jacucaca*), a White Eye-browed Guan (*Penelope superciliaris*) from S.E. Brazil, a Vulpine Phalanger (*Phalangista vulpina*) from Australia, a Blue and Yellow Maccaw (*Ara ararauna*) from S. America, two Jambu Fruit Pigeons (*Ptilonopus jambu*) from the Indian Archipelago, deposited; two Upland Geese (*Chlæphaga magellanica*) from the Falkland Islands, received in exchange.

*OBSERVATIONS ON BEES, WASPS, AND ANTS**

THIS is a continuation of my previous papers on the same subject. In them I recorded various experiments tending to show that in many cases Ants and Bees which have found a store of food or of larvæ certainly do not communicate the information to their friends. This unexpected observation was received with so much surprise, and indeed was so unexpected to myself, that I determined to repeat the experiments: which I have now done, with, however, the same result. To take one as an illustration: I placed an *F. Flava* (the small red ant) to a heap of larvæ, which, as is well known, are fleshy legless grubs incapable of motion. I placed them about two feet from the entrance to her nest. I then watched her from eleven in the morning till after seven in the evening, during which time she made eighty-six journeys from the nest to the heap of larvæ, carrying one off each time ; but although she had so much work to do, and though the precious larvæ were lying for so long exposed to so many dangers and to the weather, she brought no other ant to assist her in carrying them off. One of the ants I observed in this way carried off one by one no less than 187 larvæ in a day. In other instances, on the contrary, the opposite result occurred. I was for some time uncertain, in the latter cases, whether the ants purposely brought friends to their assistance, or whether, as the ants are sociable insects, it merely happened that the one accompanied the other, as it were, by accident. To test this question, I took two ants, and placed them under similar circumstances, the one to a heap of larvæ, the other to a group of two or three, always, however, putting one in place of any that was carried off; and it was quite clear that the ants which were placed to the large group of larvæ brought far more friends to their assistance than those which had apparently only two or three larvæ to move. Of thirty ants which were observed, those placed to a large number of larvæ brought 250 friends, while those placed to two or three larvæ under similar circumstances only brought eighty.

One account, much relied on as showing the intelligence of ants, has been the following observation made by M. Lund in Brazil. Passing one day under a tree which stood almost by itself, he was surprised to hear the leaves falling like rain. On examining the cause of this, he found that a number of ants had climbed the tree, and were cutting off the leaves, which were then carried away by companions waiting for them below. Of course it might be said that the leaves which dropped fell by accident; in which case they would naturally be carried off by the ants below. It occurred to me, however, that this was an observation which might easily be repeated. I placed therefore a number of larvæ on a slip of glass, which I suspended by a tape, so that it hung one-third of an inch from the surface of one of my artificial nests; isolating it, however, in such a manner that for an ant to walk to the nest she would be obliged to go thirteen feet round. I then placed some black ants (*F. nigra*) on the glass with the larvæ. Each of them took a larva in the usual way, and then endeavoured to go by the quickest road home. They leaned over the glass and made every effort to reach down, but of course in vain, though the distance was so small that they could all but touch the nest with their antennæ, and even, in one or two cases, succeeded in getting down by stepping on to the back of an ant below. Those, however, which did not meet with any such assistance, gradually, though at first requiring some help from me, found their way round to the nest, and after a short time there was quite a string of ants passing to and fro from the nest to the larvæ, although it would have been so easy for them to throw the larvæ over the edge of the glass, or to go straight home, if they would have faced a drop of, say, one-tenth of an inch.

Moreover, I placed some fine mould within half an inch of the glass, so that it would have been easy for the ants, by literally one minute's labour, to have constructed for themselves a stepping stone up to the glass ; yet they did not adopt any of these expedients, but for hours together, and by hundreds, continued to make the long journey round. I confess this experiment, which I repeated on several occasions, surprised me very much.

As my previous experiments, which showed that bees did not by any means in all cases bring their friends to share stores of food which they had discovered, have been much questioned by bee-keepers, I have repeated them again.

No doubt, if honey is put in an exposed place, so that it is found by one bee, it is most natural that others should also find their way to it; but this does not, according to my experience, happen if the honey is concealed. For instance, I put a bee to some honey in a flowerpot placed on its side, and so arranged that the bee had only a small orifice through which to enter. Under these circumstances, from a quarter to seven in the morning till a quarter past seven in the evening, she made fifty-nine journeys, and during the whole of this time only one other bee found her way to the honey.

I found that bees soon accustomed themselves to look for honey on papers of particular colours. For instance, on Sept. 13 I placed a bee to some honey on a slip of glass on green paper, and after she had made twelve journeys to and from the hive I put red paper where the green had been, and placed another drop of honey on a green paper, at a distance of about a foot. The bee returned, however, to the honey on the green paper. I then gently moved the green paper, with the bee on it, back to the old place. When the bee had gone, I replaced the green paper by a yellow one, and put the green again a foot off. After the usual interval she returned again to the green. I repeated the same proceeding, but with orange paper instead of green. She returned again to the green. I now did the same with white paper: she returned again to the green. Again I tried her with blue: she again came to the green. I then reversed the position of the blue and green papers, but still she returned to the green. I repeated this experiment with other bees, and with the same result, though it seemed to me that in some cases they did not distinguish so clearly between green and blue as between green and other colours. In other respects they seemed to adhere equally closely to any colour to which they were made accustomed.

As regards wasps, my experiments fully confirm those previously made, and justify everything I have said with reference to their great industry. Indeed, they begin to work earlier in the morning and cease later in the evening than bees, continuing all day with the utmost assiduity. Thus, a wasp which I watched on the 10th of September, worked from seven in the morning until seven in the evening without a moment's intermission, during which time she made no less than ninety-four visits to the honey. As is the case with bees, if a wasp is put to exposed honey, others soon come. To determine this, if pos-

* A paper read by Sir John Lubbock, Bart., M.P., D.C.L., F.R.S., at the Linnean Society, Nov. 4. Communicated by the author.

sible, I trained a wasp to come to some honey which I placed in a box communicating with the outside by an india-rubber tube six inches in length and one-third of an inch in diameter. She came to this honey continuously for three days, during which time no other wasp found the honey. As regards colour, I satisfied myself, by experiments like those made with bees, that they are capable of seeing colour, though they appear to be less influenced by it than are bees.

OUR BOTANICAL COLUMN

IRISH HEPATICÆ.—S. O. Lindberg has just published a quarto memoir on the "Hepaticæ in Hibernia mense Julii 1873 lectæ." This memoir is a reprint from the tenth volume of the "Acta Societatis Scientiarum Fennicæ," and contains a list of eighty-nine species of Hepaticæ collected during a month's visit to Ireland. The author had the benefit of the great geographical knowledge of Dr. Moore—the author with A. G. More of the "Cybele Hibernica"—to enable him to visit, without delay, the most productive portions of Ireland; otherwise it may be doubted if his collections would have been so rich. Many of the species described are very rare; some of them are new. The synonymy of the species is worked out in a manner worthy of the greatest praise. Many of the smaller forms among Lejeunea and other genera are described from fresh specimens or from those preserved in alcohol. The collections were chiefly made in Killarney. Of the new species we may mention *Lejeunea patens*, *L. Moorei*, *Zygodon aristatus*. In an appendix we find a list of the genera of European Hepaticæ classified as follows:—

1. Marchantiaceæ.
2. Jungermaniaceæ.
3. Anthoceroteæ.

The group of Marchantiaceæ is divided into *A. Schizocarpæ* and *B. Cleistocarpeæ* (this latter includes such genera as Tessellina and Riccia); that of Jungermaniaceæ into the same two sub-sections; and these are again much sub-divided.

The existence in Ireland of so large a number of interesting forms, of which so very much yet remains to be known as to their life-history, ought surely to act as a stimulant to the rising school of Irish botanists.

MARINE ALGÆ OF THE UNITED STATES.—Although nearly twenty years have elapsed since the third part of Harvey's "Nereis Boreali-Americana" was sent to the press, yet the contributions to a knowledge of the North American Algæ have been but few. W. G. Farlow, one of Prof. Asa Gray's assistants, ascribes this to the fact that but few American botanists reside on the western coast of America, where novelties might be expected; and he publishes a most welcome list of the marine species of the United States *proper*, not including Alaska, but in part enumerating those of Vancouver's Island. Those added since the publication of Harvey's "Nereis" are denoted by a star. The number of species enumerated is 430, a number that doubtless will be increased when the Algæ are investigated as recent forms either living or preserved in fluid, and not, as is now frequently the case, only examined when in a state of what is but little better than that of stains on white paper. Mr. Farlow's list will be found in vol. x. 2nd ser. of the Proceedings of the American Academy of Arts and Sciences.

COFFEE IN DOMINICA.—A good deal of attention has been directed of late to the island of Dominica as a coffee-producing country, a fact briefly referred to in NATURE, vol. xii. p. 173. At one time coffee was one of the staple products of the island, and was grown not only in large quantities, but also of excellent quality. At the present time little or none is exported to Europe, but the island still grows sufficient to supply its own demands, and we believe sends a little to the neighbouring islands. This falling off in the cultivation of the coffee-plant, in a soil and climate which experience showed was eminently suited to it in every respect, was due to the extensive destruction of the plants by what was then known as the coffee blight. This was soon found to be of insect origin, but no active or energetic measures were taken to rid the island of the pest, which continued its ravages, destroying many plantations, and even driving planters away in great numbers. Nothing seems to have been known regarding the insect itself until within the past few weeks, when specimens in their various stages, together with the injured leaves, have been received at the Kew Museum. Upon submitting these specimens to an entomologist, they were at once identified as the White Coffee-leaf Miner (*Cemiostoma coffeellum*, Mann.), an insect exceedingly destructive to the coffee-plants in Brazil, Rio Janeiro, Martinique, &c. The crops of coffee in Brazil are said to be lessened one-fifth in consequence of the ravages of this insect.

It is remarkable that little seems to have been known in Dominica about the classification or habits of the insect, though it made its first appearance there in 1833, some forty-two years back, and it seems to have been known in Brazil only within the last twenty or twenty-three years. An elaborate description of the insect and its ravages will be found in the *American Naturalist*, vol. vi. pp. 332, 596; 1872.

SCIENTIFIC SERIALS

Annual Report and Proceedings of the Belfast Naturalists' Field Club, 1873, 74.—This Report was written before the meeting of the British Association in Belfast last year, so that its issue must have been very much delayed. The Society, according to the Report, as to financial condition and number of members, is in a thoroughly satisfactory condition. The Society, as a Field Club, makes excursions during summer; an account of those for 1873 is contained in this part of the Proceedings. The papers read during the winter session are all interesting; we have space only for the titles:—"On the British Association, its aims and objects," by Mr. W. Gray; "On Progressive Development," by Mr. G. Langtry; "On the Surnames of the Inhabitants of the County Antrim, and their indications," by the Rev. E. M'Clure; "On Flints, and the Foraminifera, Entomostraca, &c., contained in them," by Mr. Joseph Wright, F.G.S.; "Irish Cranoges and their contents," by Mr. F. Wakeman; "Notes on the Aurora Borealis, taken in Belfast in the years 1870, 71, with suggestions as to its source and that of the earth's magnetism and magnetic currents," by Dr. T. H. Keown, R.N. The Appendix contains two valuable lists; first, of the Mosses of the North-east of Ireland, by Mr. S. A. Stewart; and second, of the Cretaceous Microzoa of the North of Ireland, by Mr. Joseph Wright, F.G.S., the latter illustrated by a large number of figures.

Poggendorff's Annalen der Physik und Chemie, No. 9, 1875.—This number commences with a long paper, in which M. Wilhelm Weber investigates mathematically the motion of electricity in bodies of molecular constitution. Among the points treated are, objections against the fundamental law of electric action; identity of the moveable parts (in all bodies) whose movement is heat, magnetism, or galvanism; identity of *vis viva* of the electromotive force in the current with the heat produced by the current in the conductor; movement and distribution of electricity in conductors; and Kohlrausch's theory of thermo-electricity.—In an article on formation of sound, Prof. Stern inquires why tuning forks without resonant supports give such a very weak sound. It cannot be due, as many physicists suppose, to their less surface of contact with the air, else high-pitched small forks could not sound louder than low and large ones, nor could overtones sound louder than ground tones when *e.g.* a large fork is struck with a hard body. Having shown reason for thinking that the amplitude of vibration and number of vibrations in unit of time have no direct influence on the strength of the sound, Prof. Stern groups together a number of interesting phenomena bearing on the subject: the difference in rate of decrease of sound, in high and low forks, on withdrawal from the ear; a like difference with regard to transverse vibrations and those produced longitudinally; the interference-effects where resonance-cases act on each other; the effects of bringing a resonator near an organ-pipe, &c. The paper is not yet concluded.—The action of the Holtz machine still requires some elucidation, and in a paper to the Berlin Academy (here reproduced) M. Poggendorff furnishes "further facts towards an adequate theory of electric machines of the second kind" (with two moveable discs). One of these facts is as follows:—The two discs turning in opposite directions, stop (say) the front one by holding it (the screw having previously been loosened); then, when the back disc is rotated, a current is obtained as before. Now turn the front disc round through 360°, and rotate the back disc as before. If this turning be done in the direction of the front disc's former rotation, the current in the back disc is unaltered; but if in the opposite direction, it is reversed. A turning of 180° or even of 90° has the same effect. These and similar facts, indicating an influence of *direction* (rather than extent) of dis-