THE first meeting for the season of the Victoria Institute took place on Friday last, when a number of new members were elected, the Society being stated to be greatly on the increase. The first paper to be read during the coming session will be by Mr. Charles Brooke, F.R.S., on Force and Energy.

THE Geologists' Association will hold its first meeting for the season on Friday evening, Nov. 1, when Dr. Hyde Clarke will read a paper on the Influence of Geological Reasoning on other Branches of Knowledge.

AMONG the courses of University Lectures and other means of scientific instruction announced to be given at Harvard University, Cambridge, U.S.A., during the present session, are the following:—On General Entomology, by Prof. Hagen—Mondays, Wednesdays, and Fridays, at the Museum of Zoology. Geological Excursions, by Prof. Shaler, on Saturdays—about eighteen during the year. On the Structure and Affinities of the Brachiopoda, by Prof. E. S. Morse—Mondays and Wednesdays, in Roylston Hall. On General Ornithology, by Mr. J. A. Allen—Wednesdays, at the Museum of Zoology.

THE following is the programme of papers to be read at the Winter Session, 1872-73, of the Glasgow Society of Field Naturalists:—On the present tendencies of Science, by J. Allan, Oct. 15.—On the Distribution of Plants, by D. Gregorson, Oct. 29.—A Life History of *Nematus saliceti*, together with some account of its Parasites, by P. Cameron, jun., Nov. 12.—On Spiders, by S. M'Donald, Nov. 26.—On Zoophytes, by W. D. Benson, Dec. 10.—On the Exotic Plants of Clydesdale, by R. M'Kay, Dec. 24.—On the Definition of Species, by Alex. Watt, Jan. 7, 1873.—Notes of Observations on Marine Zoology, by John Harvie, Jan. 21.—Notes of Observations with the Microscope, by G. Barlas, Feb. 4.—Botanical Gleanings from the Rubbish Heaps of the City, by G. Horne, Feb. 18.—On the Cynipidæ of the Glasgow District, by P. Cameron, jun., March 4.

A SERIES of short lectures is about to be delivered at the Ipswich Museum by the Curator, Mr. J. E. Taylor, and other gentlemen, illustrative of the objects in the museum. They will be held on Friday evenings throughout the winter, and admission will be free.

THE first of Abbé Moigno's long-contemplated *Salles du Progrès* was inaugurated on Tuesday evening, Oct. 15, at 30, Rue du Faubourg Saint Honoré, by a distinguished assembly, including M. Otto Struve, the Russian Astronomer. The praiseworthy object of the Abbé in establishing these assemblies is to popularise Science by means of lectures, exhibitions, conversaziones, &c., in which the instructive is combined with the entertaining. On Tuesday he detailed the programme which he intended carrying out at future meetings, and those present were entertained by the performance of some pieces of music. This last rather novel feature in scientific assemblies forms a regular part of the Abbé's programme. One or more pieces from the works of great masters of music will be performed at each meeting.

THE British Association Meeting at Brighton has already begun to bear fruit in that town. A desire has been aroused among several of the inhabitants to know more of Natural Science, and a course of science lectures in the Dome, chiefly to working men, has been projected. But the ladies have taken the initiative, and the germ of a Ladies' Educational Association has already been planted. Prof. W. F. Barrett has been invited to give the first course of lectures on Experimental Physics. The introductory lecture on the "Study of Natural Knowledge," was given last Friday afternoon, when, in spite of the wet, upwards of 50 ladies assembled. Miss Goulty, of 2, Sussex Square, Brighton, to whom it is right to add the effort is mainly due, has permitted the use of her spacious schoolrooms for these lectures. The second lecture on "Magnetism" will be given to-morrow (Friday) afternoon.

SIEBOLD'S NEW RESEARCHES IN PARTHENOGENESIS *

II.

SIEBOLD'S experiments extended over four years, and although some hundreds of nests were more or less observed, only thirty-seven—but these amply sufficient—gave the answer to his questions, passing successfully through all the stages above noted. Firstly, they furnished a virgin colony in a nest absolutely free from eggs and larvæ—except a few advanced larvæ purposely left in some nests and noted down—which colony laid eggs; secondly, these eggs produced without exception (some few eggs not developing) males.

The method of recording which was used must be mentioned to give a notion of the accuracy of the observations. A series of plans of each nest was kept, each cell being represented and its contents at different dates. Successive plans were used for recording the successive changes in the number of cells of the nest, and in their contents at different periods of the observations. Signs jotted down in the plan cells indicate such facts as these—*e.g.*, the cell contains a "parthenogenetic egg," or "a second parthenogenetic egg which was laid after a first one had disappeared," or "a larva sprung from the queen," or "a parthenogenetic male larva," &c., &c. A second record was kept, and is given for twenty-two cases, in which the following facts were noted:—Number of the nest, date it was made moveable, number of cells at that time, day of emergence of first worker-female, date of destruction of queen, eggs, and grubs, number of larvæ and pupæ left undestroyed at this date, date of first laying of parthenogenetic eggs, date of first emergence of parthenogenetic larvæ, date of first emergence of drones born from queens' eggs (these were null in most cases, and were always so late as not to affect the experiments by possibly impregnating the worker-female), number of the same, number of cells observed when the experimental conditions were established, date and duration of the experiment, maximum number of female workers employed in the affairs of the nest, number of larvæ, pupæ, and wasps of the parthenogenetic brood found at the conclusion of the experiment. After the account of the artificially obtained results, two cases are recorded in which Siebold found a parthenogenetic colony naturally established by the same accident which had destroyed their queen and comb.

Before concluding this chapter of his book, Siebold makes the very important observation that the facts observed in the parthenogenesis of Polistes are in opposition to the view maintained by Leydig, viz., that the sexual differentiation of the egg is independent of its fertilisation, and that the evolution of the male sex is due to diminution of nutrition and warmth. Bessels has already, in opposition to Landois, shown that this is not the case in the bee. If it were true for Polistes, the eggs laid in the early year, when it is cold, and when there is only the queen to attend to the larvæ, should produce drones. On the contrary, they produce females, and the drones appear precisely at the time when warmth and nourishment are most abundant.

Siebold concludes, therefore, that (1) the eggs bring with them from the ovary the capacity of differentiating themselves as males, and (2) of developing themselves, independently of male influence into male individuals; (3) but the same eggs can be changed in these properties by the influence of the male sperm elements, and proceed to develop as female individuals.

The second chapter, very short, is on Parthenogenesis in *Vespa holsatica*, which was inferred to occur from the observation of a naturally-produced queenless colony, the larvæ in the cells of which were all male.

The third chapter is on Parthenogenesis in *Nematus ventricosus*, the larva of which is known as the Gooseberry-caterpillar. Since three or more generations of these leaf-wasps occur in the season, they furnished abundant material, and the old supposition of parthenogenesis first put out as regards them by Robert Thorn, in the *Gardener's Magazine*, 1820, is shown by Siebold to be justified by carefully conditioned experiment. Some valuable observations on the anatomy of the generative organs, and on the curious increase in the size of the egg after it is laid, are given. The parthenogenetically produced progeny are in this case also male. The results of the *Nematus* experiments were not ready for publication until after the issue of the present work, and we

* "Beiträge zur Parthenogenesis der Arthropoden." Von C. Th. E. von Siebold, Professor der Zoologie und Vergleichenden Anatomie in München. (Leipzig: Engelmann, 1871.)

have received, through the kindness of Dr. Dohrn, a copy of the Sitzungsberichte of the Munich Academy of November 4, 1871, in which they are fully given. It appears that though an occasional female appeared among the male broods produced by unfertilised females, this was, in every case where it happened, fully accounted for by the accidental access of a fertilised female, or some such misadventure, duly noted in the records kept of the observations.

Of the fourth and fifth chapters, treating of Parthenogenesis in the Lepidoptera, *Psyche Helix*, *Solenobia triquetrella* and *lichenella*, we have not space to speak in detail. The same intimate inquiry, and the same very necessary prodigality in the amount of material subjected to experiment, which we noted above as to Polistes, characterise Prof. Siebold's treatment of these cases. The parthenogenesis in these cases produces female broods, and though the male of *Psyche Helix* has been discovered since Siebold's former researches on this moth, his conclusion is by no means invalidated, for the males are excessively rare. They were first discovered by Claus, of Marburg, who has indicated characters by which future observers may distinguish the sex of the caterpillars. Out of many hundreds of broods reared by Siebold, taken in various places, ranging from the Baltic to the plains of Lombardy, only once did he obtain males. There appear to be thus broods which are entirely female, and broods which are of mixed sexes. The conditions under which the male sex makes its appearance are not yet ascertained. It is exceedingly desirable that those who may be fortunate enough to come across a mixed brood, should make experiments to ascertain if all the eggs which are fertilised produce males. The females of the purely female broods are completely developed in every respect, having perfect copulatory organs, and the egg is furnished with a micropyle; therefore, as Siebold maintains, they must not be called pseud-ova. It should be mentioned that the inquiries necessary to establish the identity of the species, and the distinctive characters with regard to these little moths, have occupied a great deal of our author's time and attention, and are here recorded. In regard both to Psyche and Solenobia examination with the microscope was employed to determine the absence of male elements from the *receptaculum seminis;* and we have moreover an account of the structure of the ovaries. In relation to this matter, Professor Siebold takes the opportunity of replying to some criticisms of his former work by M. Plateau, who appears to have made little of the arguments based on the proof thus obtained of virginity, without knowing the real extent and nature of Siebold's studies, having, in fact, only read of them in an imperfect abstract. It appears also that M. Plateau took "ein einziger Fundort" to mean "un naturaliste collecteur," an amusing mistake to which our attention is drawn in a note, p. 155. We may briefly mention here with regard to Solenobia, that it appears that *S. lichenella* is only the female brood of *S. pineti*, of which males and females regularly occur. No structural difference appears to exist between the two kinds of females, but the former, on escaping from the chrysalis-sac, at once proceed to lay eggs, which produce invariably females; whilst the latter wait for copulation, and if that be withheld, die, and dry up without laying their eggs. These insects offer most promising material for further researches on the conditions attending the differentiation of sex.

We now come to the sixth and last chapter, on "the Parthenogenetic Reproduction in Apus and allied Crustacea." Already, in 1856, Siebold had stated his supposition that *Apus cancriformis*, *Limnadia gigas*, and *Polyphemus oculus*, in which species no males had been observed, presented examples of true parthenogenesis, and were not to be regarded as bud-producing "nurses," in a so-called alternation of generations. Leuckart subsequently expressed the same opinion with regard to the reproduction, independent of males, observed in *Daphnia*, *Apus*, and *Limnadia*. Ever since that period Siebold has continually kept an eye upon Apus. In 1858 the males of Apus were discovered by Kozubowski, and Siebold received specimens from various localities. He thus learned to distinguish with perfect facility the two sexes, and was enabled now to convince himself that, as with the Lepidoptera above spoken of, so with Apus, broods occur which are entirely destitute of males, and go on reproducing parthenogenetically, whilst other broods occur in which both sexes are present. The number of Apus of two species—*Apus cancriformis* and *Apus productus*—examined by Siebold, amounts actually to some thousands. He received quantities taken from various ponds in middle Europe (Apus occurs in shallow pools which dry up during parts of the year, and it can be taken in immense quantity), and had the opportunity of studying one pond—that at Gossberg, near Munich, with minuteness, from the year 1864 to the year 1869 inclusive, besides casual examinations of the same pond in 1857 and 1858. Time after time, taking several hundreds of the Apus from the pond, he never found a single male amongst them. On one occasion he had the whole contents of the little pond removed with the greatest care, so as to feel sure that he had obtained every Apus present. He received on this occasion 5,796 specimens of Apus, *every one of which being carefully examined* proved to be female. At the same time 2,576 specimens of Branchipus were obtained from the pond, which were, as usual, of both sexes. In those cases where ponds afforded both males and females of Apus, it is remarkable that the proportion of the sexes was very variable. The highest proportion of males appears to be in a case recorded by Sir John Lubbock, who found thirty-three male and thirty-nine female *Apus productus* in a pond near Rouen, whilst among 193 specimens of *Apus cancriformis*, from a locality near Krakow, only one male occurred. What is most important about this variation in the proportion of males to females is that in two or three localities, furnishing mixed generations of Apus, from which he has received, year after year, numbers of specimens, Siebold has observed an apparent constantly-augmenting disproportion of males to females, and he is led to the supposition that in these cases the males will at last cease altogether, and thus a female generation be produced which will continue to reproduce itself parthenogenetically, as in the Gossberg and a great number of other ponds. This is, however, by no means proved; and we have no idea at present as to how the males may make their appearance again, or what are the conditions affecting their development and extinction. It occurred to Siebold that an objection might be urged against parthenogenesis in Apus, in that, although he examined consecutive generations and found them always female, he could not be sure that males had not been present before he took his specimens, and had not died and decomposed after having fertilised the females. To meet such an objection, he firstly made himself thoroughly acquainted with the male generative organs and the spermatozoa, and secondly with the ovaries and their development. He found the spermatozoa to be motionless like those of other Crustacea, and he never succeeded in detecting any of them in the female genitalia amongst the specimens belonging to supposed female generations. But he equally failed to find spermatozoa or a receptacle for them in the female genitalia of the specimens of mixed generations, and therefore no conclusion could be drawn from the observation. The structure and development of the ovum, however, made this observation decisive, since it was found that an egg-shell forms round the ovum in the uterus, and, in the absence of a micropyle, fertilisation, if it takes place at all, must be accomplished before this shell is hardened. A further proof of another kind was obtained by experiment. Having removed eggs from females, which certainly at the time contained no spermatozoa, Siebold placed them in a small tank, and from these obtained Apus-embryos. Others were reared to maturity from eggs taken in the pond.

The relative size of male and female is a question about which there is some interest; differences which have been observed seem to depend on this, that Apus continues growing as long as the pond in which it lives does not dry up, and hence the eggs which hatch soonest give the largest-sized progeny. In his tabular statements Siebold gives measurements of the specimens examined by him at different times from various localities.

A few words must be said here upon the very extraordinary history of the ovum of Apus made out by Siebold, the structures being identical, whether the female examined belonged to a parthenogenetic or digenetic brood. The essential female organs of reproduction in Apus may be roughly described as two large tubes placed on either side the alimentary canal, opening externally at the posterior end, and giving off towards the other end primary and secondary branches. On the ends of these short secondary branches are situated the egg follicles. Four cells appear in each egg follicle in a very early stage of its development, and one of these takes on more rapid growth—becoming the egg-cell—whilst the others disappear as deutoplasmogen or vitellogenous cells; the egg then acquires some size and a red colour, and has a visible germinal vesicle. But such eggs are much smaller than the eggs observable in the main stem of the ovarian tube, and this appears to be the very startling explanation. The eggs escape from their

follicles as a matter of course, and pass along the canal leading from it to a primary branch of the ovarian tube, and there two and sometimes three of these eggs *fuse into one mass*, around which a shell is secreted, and which thus forms the actual egg—really a threefold egg; and from such a wonderfully formed egg only one embryo develops. Unfortunately we are not told what becomes of the germinal vesicles; according to the drawings they seem to disappear at this stage. We know of the development in the tunicate *Pyrosoma* of five embryos from one egg, here we have the converse case of one embryo developing from three eggs. Siebold appears to have convinced himself that the fusion is a normal thing, and not due to any pressure or osmotic action taking place during the microscopical examination. The structure of the ovary of Apus is figured in a plate.

As to the other crustaceans named, which are *Artemia salina* and *Limnadia Hermanni*, the occurrence of parthenogenetic broods is inferred from the descriptions of other writers whose works are criticised at some length, and also from examination of specimens. It seems not impossible from an observation of Zenker that in *Artemia salina* parthenogenetic alternate with digenetic broods. In the beginning of the year 1851 this observer found three males among one hundred females, later in July the same pond furnished thousands of females, but not one male.

In conclusion, Prof. Siebold, whilst adopting Leuckart's term "Arrenotoky," to designate the phenomenon of the parthenogenetic production of male offspring, as seen in the Hymenoptera, proposes the parallel term, "Thelytoky," for the parthenogenetic production of female offspring as demonstrated now conclusively in some Lepidoptera and Crustacea. It seems to us that a third term should also be available for the case of mixed offspring (that is of two sexes) such as "Amphotoky;" and the terms need not be limited to parthenogenetic cases. In his concluding remarks, whilst repeating the expression of his conviction that parthenogenesis will be found more and more to be of frequent and fixed occurrence in various classes of animals, Siebold alludes with caution to the list of cases in which parthenogenesis is stated to occur, given by Gerstaecker in Bronn's "Classen und Ordnungen des Thierreichs." Gerstaecker rightly enough distinguishes cases in which parthenogenesis has been observed as an accidental and rare exception, and those in which it has a definitely recurring place. Siebold considers (and after the great pains he has himself expended on the cases recorded in this book, he is fully warranted in so doing) that many of the examples put forward by Gerstaecker require a more careful testing, and he offers some remarks on parthenogenesis in the gall-flies, and in the silkworm moth. Finally, he alludes to cases among Vertebrates in which indications of a power of development in the egg, independent of the male element, have been observed. The most remarkable of these is that quoted by Leuckart in his work already cited, which Siebold omits here, but has done justice to in the short supplementary paper read at the Munich Academy since the publication of this book. In 1844 Prof. Bischoff found ova in the uterus of an unimpregnated sow, which exhibited segmentation of the yelk, some into two and four, and others into sixteen and twenty divisions. Other cases here given are as follows:—In the oviduct of a three-year-old rabbit, thoroughly separated pathologically from the uterus, Prof. v. Hensen of Kiel found ova in various stages of yelk-division, and some of their cells had even advanced into a branched condition. Dr. Oellacher of Innsbruck has observed stages of yelk-division in unfertilised hen's eggs. In fishes, in 1859, Agassiz observed yelk-division occurring in the eggs of Gadidæ, whilst yet in the ovary, and considered it to be due to impregnation, even stating that he had seen certain fishes place themselves in such a position as to favour this supposed intra-ovarian fertilisation. Burnett has since investigated the case, and concludes that the yelk-division is independent of fertilisation, a supposition which is rendered in every way probable from other researches on the fish egg; but, curiously enough, Dr. Burnett thinks these eggs should be regarded as "germs," and not as "true eggs," an opinion to which Siebold, of course, is completely opposed, and which, in invertebrate cases, has been shown to be untenable.

Siebold does not allude to those cases of ovarian cysts found occasionally in the unfertilised human female, and containing hair and teeth—a phenomenon which we should be glad to see further discussed and investigated, since, as far as we can remember, the origin of the contents of such cysts from irregularly developing ova is probable. The eel is suggested as a possible parthenogenetic vertebrate. It is a very strange fact that we are still ignorant of the ripe eggs and embryos as well as of the males of the eel, even as in the time of Aristotle. With the following words of that greatest naturalist, addressing them to those who still refuse to accept the existence of Parthenogenesis, Siebold ends his book:—"More belief must be given to observation than to theory, and this last is only worthy of belief when leading to the same result as experience."

E. RAY LANKESTER

ON SOME NEW POINTS IN THE MOUNTING OF ASTRONOMICAL TELESCOPES *

THE very great inconvenience attendant upon the use of the ordinary position circle of a micrometer divided on a metallic limb, and the necessity of having small lamps hung on to the micrometer for producing that very useful character of illumination of the wires known as the "dark field," has induced me to introduce some modifications in this (to the observer at least) very important part of an equatorial instrument.

These modifications have already been applied with success, and for the first time (as far as I am aware) to a 7-inch refracting telescope now in course of erection at the Observatory of the Royal Artillery Institute, Woolwich; and I have (in consequence of this success) been ordered to adapt them to the Great Equatorials now in course of construction for the Royal Observatory, Edinburgh, and the Observatory of the Lord Lindsay, Aberdeen.†

The rack and pinion tube carrying the eye piece or micrometer revolves freely in the casting which forms the lower end of the telescope tube, and carries a brass plate (all cast in one piece), on which is cemented a flat ring of plate glass, muffed on back, and in front varnished with an opaque varnish. Through this varnish the divisions are cut, so that on being illuminated from behind, the divisions appear bright upon a black ground. The vernier is similarly treated, and the whole of this circle, being covered with a cap, with a glazed window only sufficiently large to expose the vernier and about 15° of the circle, is protected from possible injury and is read most conveniently through this window, being illuminated by a beam of light constantly directed upon it from a lamp hanging on end of the declination axis, as will be afterwards explained.

Between the fixed casting which forms the end of the telescope tube and that which revolves in it is another metallic circle cut into 360 teeth on edge, and with 90 holes drilled accurately on face: into the teeth on edge is geared a screw which is mounted on fixed casting, one revolution of which is of course equal to an angular movement of 1°.

In the other (outer) moveable brass circle is mounted a steel pin working up and down in a small cylinder; this pin, being pressed down by a small spiral spring, enters into one or other of the 90 holes in the intermediate circle, and thus clamps the whole eye-end to the intermediate circle, in which condition a slow motion is obtained by the endless screw. When it is desired to move the eye-end through a large angle, the rack and pinion tube is grasped by the hand, and in doing so the hand almost necessarily grasps also a small steel trigger which lifts the steel pin out of the hole, frees the moveable circle, and allows it to be placed in any angular position. When the desired position is approximated, and the trigger relieved, the pin drops into the nearest hole, and the endless screw is then used for final setting.

The diagram will I think explain the various matters of illumination.‡

From a lamp hanging upon the end of the declination axis is sent a beam of slightly divergent light through this axis, which is hollow; this slightly divergent beam is utilised for six different purposes, three portions of it being reflected out in different directions to illuminate portions of the declination circle, of which one is for a long reader for setting from eye-end, and the other two for micrometer microscopes subdividing the 10′ division of circle into single 1″ arc.

None of these are shown in diagram, but the other three purposes for which the light is utilised, viz., for position circle,

* Paper read before the British Association at Brighton in Section A, Aug. 20, by Howard Grubb, C.E., F.R.A.S.

† The breech-piece and position circle of the Woolwich Equatorial were here produced.

‡ The original diagram showed all three illuminations, and of different colours. Here it has been thought better to show the dark field by itself, and the bright field and position circle illuminations in a separate diagram.