(71)

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

VOL. XII.—SIXTH SERIES.

LONDON:
PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS.
SOLD BY SIMPKIN, MARSHALL, HAMILTON, KENT, AND CO., LD.;
WHITTAKER AND CO.: BAILLIÈRE, PARIS:
MACLACHLAN AND STEWART, EDINBURGH:
HODGES, FIGGIS, AND CO., DUBLIN: AND ASHER, BERLIN.
1893.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

CONTENTS OF VOL. XII.

[SIXTH SERIES.]

NUMBER LXVII.

NUMBER LXVIII.

NUMBER LXIX.

NUMBER LXX.

NUMBER LXXI.

NUMBER LXXII.

PLATES IN VOL. XII.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

"................. per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 67. JULY 1893.

I.—*Observations on the Origin of Hair and on Scales in Mammals.* By MAX WEBER *.

No structure is more characteristic of Mammals than the hairy covering. From a physiological standpoint also it is in many respects a very significant organ, and on this head naturalists are generally agreed.

In striking contrast to this conviction is our ignorance as to the origin of this important structure. If we are unwilling to regard hair as an organ *sui generis*, our knowledge as to its phylogeny does not rise above the level of hypotheses.

There are two hypotheses which may be mentioned.

Of these one which has been repeatedly expressed assumes that hair, feathers, and scales are comparable structures, and that the two former have developed from scales or scale-like formations. The latter conclusion is to a certain extent an evident one, in so far as scales are more primitive contrivances on the part of the integument, and are characteristic of the Reptiles, which are inferior to the Birds and Mammals in position.

* Translated from the 'Anatomischer Anzeiger,' viii. Jahrg., nos. 12 and 13, May 13, 1893, pp. 413–423.

As regards hair this hypothesis is not without opponents, who, however, have attacked it only in so far as it deals with the development of the three structures.

A second hypothesis as to the origin of hair has recently been advanced by Maurer *. This author finds it quite impossible to emphasize sufficiently the difference that exists between scales, feathers, and hair as regards the manner of their earliest development. He states, however, that a great agreement is found between the earliest rudiments of reptilian scales and feathers, since in both cases the rudiment consists of a papilla of the corium, above which the epidermis at first extends unaltered. A hair, on the other hand, arises, according to Maurer, as an epithelial bud, wherein the corium in the first instance takes no share whatever †, though it soon afterwards does so. Nevertheless he admits that the epithelial rudiment of the hair frequently originates upon the summit of a previously-formed papilla of the corium. He regards, however, "the relation of the hair-rudiment to the corium-papilla as a purely topographical one." Maurer then proceeds to explain why a large cutis-papilla of this kind has nothing to do with the hair-rudiment as such. He states that it never becomes the hair-papilla; the permanent hair-papilla is always a subsequent formation. Since Maurer then goes on to assert that he "ascribes great importance to the primitive cutis-papilla," and that "it is undoubtedly homologous with the primitive feather-papilla and with the primitive

* 'Morphologisches Jahrbuch,' Bd. xviii. p. 717.

† Maurer, however, even in his earliest stages already figures a co-existent first rudiment of the subsequent connective-tissue hair-follicle. According to this, therefore, the cutis would participate in the formation of the hair just as soon as the epidermis. The following consideration might perhaps have been worthy of mention. The high degree of specialization which hair has attained indicates a long previous history. The specialization was directed towards longitudinal growth, consequently to the production of corneous matter, and therefore to advanced functional capacity of the epithelial portion of the hair. That this finally made itself apparent in the individual development also of the hair by means of precocious participation of the epithelial portion as soon as the first rudiment of the hair was formed, while the connective-tissue portion, on the contrary, underwent a regressive process, appears to me to be a point that at least deserves to be mentioned. It would be conceivable that the recession in point of time also on the part of the papilla, which subsequently becomes the hair-papilla, did not take place until the class of hair-bearing animals ("Haartiere") was reached. It would not be the first instance of the gradual acquisition by a composite organ of an ontogenetic development which no longer harmonizes with its phylogenetic evolution. Since in considering the very important question of the phylogeny of hair it certainly behoves us to be cautious, this point should at least be touched upon.

rudiment of the reptilian scale," we may deduce the following conclusions. In the Mammalian integument primary corium-papillæ may first appear which are homologous with the scales of Reptiles and are of only transitory duration. Upon these secondary but permanent hair-papillæ may develop, though never until the formation of the epithelial hair-bud has taken place. Hair-rudiments may, however, also be formed in the smooth skin.

The epithelial hair-bud is derived by Maurer from nerve-end eminences, as found in Pisces and Amphibia. In very instructive fashion Maurer develops step by step the points in which the two organs agree. Finally he shows how, in the modification of a specific integumentary sense-organ of the Amphibia into a simple sensory dermal organ like hair, a change of function must occur. This was probably ushered in by the loss on the part of the integumentary sense-organ, owing to adaptation to terrestrial life, of its primary sensory nerves (which came from the vagus), and the acquisition of simple sensory branches of spinal nerves. By this means it became a sensory organ of the integument without specific character, and capable of further development into the hair.

A rudimentary Amphibian integumentary sense-organ, evincing a tendency towards the formation of corneous matter, is indeed a long way from a hair; yet the interval can be traversed by the train of thought which sets up the hypothesis.

Greater difficulty is found in arriving at the hairy coat. Maurer's deduction takes the following shape. The aforesaid integumentary sense-organs of Amphibia were originally distributed in connexion with the *ramus lateralis* of the vagus nerve. In old animals "it is possible to demonstrate a multiplication of the organs, a dissolution of the three rows which were originally present. The rows become indistinct. At the same time in the groups of organs an indication of the formation of rows is still demonstrable." Further on we read (p. 795) :—"In the arrangement of Mammalian hairs also it is always possible to recognize to a certain extent the formation of rows. I regard these as vestiges of the regular arrangement of the integumentary sense-organs in Amphibia." Upon what this conception is based is not clear. The third term of the comparison must, however, be the manner of the arrangement of the rows of hairs and of the rows of dermal sense-organs. We miss the proof of a similarity in this respect. Of the rows of Amphibian integumentary sense-organs it was merely stated a few lines before that they become indistinct, but that in the groups of organs an indication of the formation of rows is still demonstrable. And with reference to hairs we read on page 722 that, contrary to feathers which are arranged in constant rows, "they are more uniformly distributed over the entire body; it is true that they sometimes form rows, but these are not referable to the arrangement exhibited by the scales of Reptiles."

It is certainly not my intention to call to account the respected author, who is also responsible for this suggestive investigation, for possible trivial discrepancies. These, however, point to the slight extent and the vagueness of our knowledge as to the arrangement of the hair. And yet this very elementary question plays no unimportant part in the whole matter.

In opposition to Maurer's repeated assertion that the arrangement of hairs is not referable to that of Reptilian scales, I should like to attempt to prove that such may well be the case.

A close investigation * into the structure and development of the so-called scales of *Manis* taught me, in connexion with the studies made by Leydig †, that they are horny scutes which rest upon an enormous papilla of the cutis. The latter is a bilaterally symmetrical flattened elevation of the derm, which is bent in towards the tail, and upon which a dorsal and a ventral surface can accordingly be distinguished. Arranged in imbricated fashion, these scales differ from those of Reptiles only in subordinate points, corresponding to the difference which is inherent in the Reptilian and Mammalian integument as such. In consequence of this it is true that a perfect homology between the scales of *Manis* and those of Reptiles is out of the question; but I certainly thought it possible to conclude that both arose from common ground, and that even the scales of the Manidæ are structures which are to be derived from the scales of primitive Reptiles. If this conception is correct, we must expect that elsewhere also among Mammals dermal structures still persist which, without making too long a detour, can be traced back to Reptilian scales. This, too, is actually the case. I found a coat of scales upon the tail of *Anomalurus*, *Myrmecophaga jubata*, *M. tamandua*, *Didelphys*, *Mus*, and *Castor canadensis*. The scales were always—although in different stages of degeneration and modification—constructed according to the same type, as is shown at once by my numerous figures. Hairs

* Max Weber, 'Zoologische Ergebnisse einer Reise in Niederländ. Ost-Indien,' Leiden, 1892, Bd. ii. p. 5.

† F. Leydig, Müller's 'Archiv für Anatomie und Physiologie,' 1859, p. 704.

are always wanting upon these scales, but they appear behind and sometimes also between them. Where the scales are well developed slight development of the hair is usually noticeable. This is especially striking in the case of so-called naked tails. Naked indeed they are not, *e.g.* the tails of rats and mice, but the quadrangular scales are here arranged in rings. Behind each scale project the hairs, which accordingly assume a verticillate arrangement. In other forms (*Didelphys*, *Myrmecophaga tamandua*) the scales are imbricated and the scanty hairs appear behind them. These different conditions led me to the important conclusion that the scales are the primary structures and that the arrangement of the hairs is due to them. This proposition is literally confirmed by Römer *, in his recently-published investigations upon the armature of the armadillos. The author referred to found this armature—apart from the ossification which subsequently sets in—to be composed of scales, "to which he attaches the morphological value of a scale in the sense of the scales of Reptiles."

My earlier investigations led me to conclude that in former times Mammals in general were provided with a coat of scales which in the case of *Manis*, albeit in a peculiarly specialized manner, still extends over the entire body, so far as it is turned towards the light. Elsewhere, on the contrary, I found it still persisting upon the tail alone. This point naturally attracted attention, and to a certain extent the following explanation seemed to suggest itself:—The tail, as a terminal structure of the body which has in many cases not undergone specialization, might have preserved more primitive conditions in its integument than the trunk. For the trunk a thick coat of hair was of importance, if only to preserve the animal heat. A hairy coat of this kind naturally came into conflict with the covering of scales, as to which proofs will be furnished later.

In spite of this, my hypothesis here exhibited its weak side †. Hence it was inevitable that there should arise, to a certain extent of itself, the question whether there are still found in the case of other Mammals, and also in other places, indications of a coat of scales, or at least indications of the previous existence of such a coat.

* Römer, Jenaische Zeitschr. f. Naturw. Bd. xxvii., 1893, p. 543.

† This was, moreover, not entirely disposed of by the observation made in the meantime by von Jentink (in Max Weber's 'Zoologische Ergebnisse einer Reise in Niederländ. Ost-Indien,' Bd. iii. p. 81), that also in the case of mice scales appear upon the extremities,—an observation which was extended by de Meijere (*l. i. c.*) to numerous Rodentia, to Dasypodidæ, and especially to Insectivora.

The response to this question must be connected with my observation already mentioned, that the hairs appear behind the scales, never upon them. In consequence of this I came to the conclusion that the hairs are dependent upon the scales in their arrangement. If the scales are imbricated, which was probably the primitive condition, the hairs must consequently form alternating rows and groups. Now what will happen when the scales disappear? Will the hairs preserve their arrangement, as though they still stood behind scales, or will they lose this regular formation? In the event of the first-mentioned case, we might conversely find in it the proof of the former presence of scales. The question to be answered would therefore be, whether in scaleless Mammals, or upon regions of the skin without scales, the hairs are so arranged as though they stood behind scales.

The abundant literature upon the subject of hair supplied no answer upon this point, since beyond incidental observations, with which there was really nothing to be done, it contains nothing that touches the question. Now this problem has been made by Heer J. C. H. de Meijere * the object of an exhaustive investigation, which was conducted in my laboratory, and will shortly also be made accessible in a German form to a wider circle of interested students. De Meijere examined two hundred and twenty species of Mammals, and arrived at various surprising results, of which the following is the only one that here concerns us. In the great majority of cases the hairs are arranged in alternating groups, which are formed in very different ways. As a primitive and very simple condition must rank a group which consists of three similar hairs †. Usually, however, the hairs in a group are more numerous. At the same time the hairs may issue from isolated follicles or form bundles. De Meijere distinguishes false bundles, which have arisen through fusion of follicles, and genuine bundles. The latter probably arose through the formation upon a follicle of several secondary ones by means of budding. It is an important fact that bundles of this kind also appear in alternating groups. Now if we further consider that upon the scale-bearing portions of the integument the hairs represent alternating groups, and that upon the scaleless portions they frequently form exactly such groups, or that their arrangement is usually traceable thereto,

* De Meijere, 'Over de haren der Zoogdieren in 't byzonder over hunne wijze van rangschikking,' Dissert. Amsterdam, 1893.

† The important occurrence of three hairs behind scales in mice has already been pointed out by Jentink in the memoir previously quoted (Zoolog. Ergebnisse, iii. p. 81).

we may well assume that the portions of the skin which are now scaleless formerly likewise bore scales. The scales were lost, but the arrangement of the hairs still exhibits their former presence. At any rate, I do not know of any other cause to mention such as would be capable of explaining the regular alternating arrangement.

Through this important result of de Meijere's investigation my hypothesis acquires considerable support, just as conversely it explains and makes intelligible the observations of de Meijere.

Römer, who, in his thankworthy paper, by the investigation of the armature of the armadillos comes to the conclusion that this is likewise composed of scales, conforms entirely to my view with regard to their morphological value. In two points, however, he differs from me. In the first place he considers scales to be a secondary acquisition on the part of Mammals.

It would appear to me that the entire series of de Meijere's results is a continuous argument against this view. The arrangement of the hairs points to the former general existence of a coat of scales. The facts bearing upon this were, however, still unknown when Römer concluded his investigations. But even the facts of the case, as my investigation left them, must plead against the view that the scales have been secondarily acquired; for if so we should have to explain the repeated occurrence of scales as being due to convergence. I am certainly imbued with the importance of the phenomena of convergence in Mammals. I have even so long ago as 1886, in my paper on the origin of the Cetacea, pointed out probably more than my predecessors the importance of this process. But there is a limit in all things.

Römer* writes (p. 546):—"*Manis* and *Dasypus* are to be derived from true hair-bearing animals, and their present scale-like body-covering is to be regarded as a new acquisition of a secondary nature, which has arisen in consequence of adaptation to the similar burrowing mode of life. . . ." I will pass over the fact that the mode of life of the species of *Manis* is in part very dissimilar from that of the Dasypodidæ. *Manis tricuspis*, Raf., and *M. longicaudata*, Briss., are exclusively arboreal, and *M. javanica*, Desm., partially so. Furthermore, *M. crassicaudata*, St.-Hil., and *M. aurita*, Hodgs., are also climbers; but both are actually capable of digging holes to dwell in. *Manis gigantea*, Ill., and *M. Temminckii*, Smuts, are the only species which are exclusively terrestrial.

* F. Römer, Jenaische Zeitschrift f. Naturw. Bd. xxvii.

Yet even were the Manidæ also burrowers in the sense that the Dasypodidæ are, it would certainly be surprising that among the large number of most pronounced burrowers among Marsupials, Insectivores, and Rodents not a single one should have acquired a coat of scales. Further on we read (p. 547) :—"As their embryology shows, both originate from true, typical, hair-bearing animals, which in consequence of a newly adopted mode of life have acquired a new body-covering." Much is here demanded of embryology. Yet we find in Römer's paper no new facts as to the development of the integument in *Manis*, but merely the statement (p. 545) : "The origin of the scales, which are strikingly large in the case of the small Manidæ, may well be explained by the fusion of several small scales. . . ." This mode of explanation is a personal one on the part of Römer. I have exerted myself to discover the development of the scales on his behalf, from their earliest appearance onwards, but have observed no trace whatever of a fusion of the scales. Since the investigation is a very easy one, I have no reason to deviate from what I saw and to adopt an explanation which is not based upon observation.

But also the manner of the occurrence of the scales in Mammals tells against the view that they are to be regarded as a new acquisition of a secondary character in connexion with the mode of life. A few examples may make this clear.

Myrmecophaga tamandua, whose climbing tail is but thinly clothed with hair, has the scales but little more strongly developed than the exclusively terrestrial *M. jubata,* whose tail is thickly clothed with bushy hair, and in spite of that bears scales. *Myrmecophaga* (*Cyclothurus*) *didactyla,* with an exclusively arboreal mode of life and a typical prehensile tail, has no trace of scales. Of *Ptilocercus* and *Tupaja,* which are the only arboreal Insectivores, *Ptilocercus* has, as shown by de Meijere, well-developed polygonal caudal scales, while *Tupaja,* with a precisely similar mode of life, has nothing of the kind. *Tarsius spectrum* of authors comprises, as I was able to prove *, two species precisely similar in their mode of life. Of these the one, *Tarsius fuscomanus,* Fisch., has distinct scales on a hairy tail, while the almost bare tail of the other, *T. spectrum,* Pall., is entirely without them. Scales were found by de Meijere upon the thickly haired tails of *Petrogale penicillata* and *Macropus ruficollis,* while in the case

* Max Weber, 'Zoolog. Ergebnisse einer Reise in Niederl. Ost-Indien,' Leiden, 1893, Bd. iii. p. 260.

of other species of *Macropus*, which use their tails in a precisely similar fashion, scales are wanting. What advantage does the short tail of *Perameles doreyanus* derive from its well-developed coat of scales, while the similarly constituted tails of *Perameles Gunni* and *P. obesula* are scaleless? The species of *Phalanger* with a typical prehensile tail are without a coat of scales, and the same applies to the prehensile tails of monkeys. The arboreal Sciuridæ, too, have scaleless tails. The large rows of scales on the ventral surface of the root of the tail of the Anomaluridæ are a specialization and a further development from small scales, which cover the entire tail.

Moreover, what is the nature of the adaptation that causes the extremities of many Marsupialia, Rodentia, and especially Insectivora to bear scales or indications of such?

The foregoing examples clearly illustrate the irregularity of the occurrence of scales even in the case of most closely allied species, as well as their independence of the mode of life of the animals. They become intelligible when we consider them from the point of view that scales are rudimentary structures, which have persisted in different degrees or in part already disappeared, and only in altogether isolated cases underwent further development in a specialized form (Manidæ, Dasypodidæ, *Castor*, *Anomalurus*). Römer, on the contrary, considers that the scales "are secondary phenomena of adaptation, which were acquired by true hair-bearing animals, since they were more advantageous to them for their mode of life, *e. g.* for the tail as a prehensile and supporting organ, than the less firm coat of hair."

On the other hand, Römer justly ascribes to me the view, that I held it to be improbable that the scales had developed as structures entirely new and without an inherited basis. In opposition to this Römer observes, "The inherited basis is, however, supplied in the wonderful capacity for differentiation possessed by the skin, which is indeed to be found in all groups of animals." What the respected author meant to convey by this somewhat formal paraphrase of the fact that the mammalian integument can actually produce scales, I was unable to quite understand. I found the greater difficulty in doing so since he goes on to state that "the scale-like coverings of Mammals, which develop in consequence of a capacity of the integument inherited from the Reptiles, and so to a certain extent are to be regarded as a case of 'throwing-back,' justify the conclusion that such a covering was formerly of general occurrence and clothed the entire body, or at least the dorsal parts thereof."

How great the agreement between us is may be gathered from my previous words (*l. c.* p. 14) :—"I do not maintain that these scales, as they lie before us, are acquired from the Reptiles, but I regard as that which is inherited only the capacity of the caudal integument of *Anomalurus* to form such scales." And further on (p. 19) :—"We had come to the conclusion that the 'scales' of the Manidæ are structures which are to be derived from the scales of Reptiles. From our statement it will be clearly seen that we do not regard the two organs as completely homologous. The considerable difference between the horny scales of Reptiles and those of the Manidæ has indeed already been expressly pointed out. But we really believe that both had a common origin. . . ." When, therefore, Römer proceeds to declare that we must not, however, forget "that we here have not before us scales in their original form," I cannot apply the admonition to myself, if Römer by an "original" scale means a Reptilian one. Now, however, comes the difference, for Römer goes on to write—"but a secondary scale, which has developed anew upon true hair-bearing animals, for that is proved by the embryonic hairs of *Manis* * and *Dasypus*, and is traceable to an adaptation of the skin to the mode of life." It is consequently assumed by Römer that Mammals, proceeding from scaly Reptiles, lost their coat of scales, developed hairs, and now could obtain scales once more only by adaptation to the mode of life, and therefore as a "secondary new acquisition."

In my opinion, however, the primitive Mammals, which developed from primitive, scaly, poikilothermic Reptiles, were clothed with scales. Behind these scales small and sparse hairs at first arose. Whether these were developed by modification from smaller scales or proceeded from nerve-end eminences which were situated between the scales I do not venture to decide.

With the production of the constant body-temperature and of vigorous metabolism, wherein influences of temperature must have been decisive, the hairy coat acquired a better development, since it protects the body against loss of heat by radiation and conduction. With this the integument had assumed its special Mammalian character, which also expressed itself in the scales, especially in their horny superstructure. Indeed I previously designated the difference between the Reptilian and Mammalian scales as one of the kind that belongs to the Reptilian and Mammalian integuments as such. With the increase in the number and size of the hairs, which conse-

* The embryonic hairs of *Manis* only prove that the hairs are formed where they afterwards stand, consequently in always scanty numbers behind the scales.

quently owed their arrangement to the scales, the scales degenerated. In isolated cases only did they persist in a specialized form over the greater portion of the body (Manidæ, Dasypodidæ), otherwise usually upon the tail alone, and frequently also upon the extremities. Generally, however, they are already much reduced in the last-named region, and in the case of the majority of Mammals every trace of scales has disappeared. But very commonly the arrangement of the hairs has still remained, as though they yet stood behind scales. In this manner the hairs also point to the former presence of scales.

Contrary to my desire, this paper has assumed the appearance of a polemical character towards Römer's memoir. It seemed to me, however, to be of importance that now, when it is to be hoped that still further studies in a similar sense to that of Römer will advance the questions here touched upon, the different views should be accurately expressed and their mutual limits defined. By this means we shall attain a precise idea of the question at issue, which cannot fail to be advantageous.

Amsterdam, March 13, 1893.

II.—*List of Insects collected by Miss Elizabeth Taylor in Western North America in the Summer of* 1892. By Arthur G. Butler, F.L.S., F.Z.S., &c., and W. F. Kirby, F.L.S., F.E.S., &c.

LEPIDOPTERA. By A. G. Butler.

Most of the species recorded in the following list were obtained on the Slave River in the months of June and July. The collection is of interest as extending our knowledge of the range of species hitherto received from the Rocky Mountains, California, &c. Two species are described as new to science.

Of Butterflies twenty-three species are in the collection, of which ten belong to the Nymphalidæ, four to the Lycænidæ, six to the Papilionidæ, and three to the Hesperiidæ.

1. *Anosia plexippus.*

Papilio plexippus, Linnæus, Mus. Lud. Ulr. p. 262 (1764).

♀. Winnipeg, Manitoba, 11th September.

2. *Limenitis arthemis.*

Papilio arthemis, Drury, Ill. Exot. Ent. ii. pl. x. figs. 3, 4 (1773).

Fort Simpson, Mackenzie River, 9th July, and Fort Good Hope, 18th July.

3. *Argynnis atlantis.*

Argynnis atlantis, Edwards, Proc. Acad. Nat. Sci. Phil. 1862, p. 54; Butt. N. Amer., *Arg.* pl. v. (1868).

Fort MacMurray, Athabasca River, 17th August.

4. *Brenthis myrina.*

Papilio myrina, Cramer, Pap. Exot. ii. pl. clxxxix. B, C (1779).

Rapids of the Drowned, Slave River, 1st July, and Fort Good Hope, 18th July.

5. *Brenthis freja.*

Papilio freja, Thunberg, Diss. Ins. Suec. ii. p. 34, pl. v. fig. 14 (1791).

Fort Good Hope, 18th July.

We have this species in the Museum from Repulse Bay.

6. *Brenthis bellona.*

Papilio bellona, Fabricius, Syst. Ent. p. 517. n. 317 (1775).

Rapids of the Drowned, 29th June.

7. *Phyciodes morpheus.*

Papilio morpheus, Fabricius, Syst. Ent. p. 529. n. 370 (1775).

Rapids of the Drowned, 29th June.

8. *Phyciodes gorgone.*

Dryas reticulata gorgone, Hübner, Samml. exot. Schmett. vol. i. pl. xl. (1806–16).

Rapids of the Drowned, 28th June.

9. *Œneis bore.*

Papilio bore, Esper, Eur. Schmett. i. 2, pl. c. fig. 1, pl. cviii. fig. 1 (1790).

Rapids of the Drowned, 28th June.

10. *Cœnonympha inornata.*

Cœnonympha inornata, Edwards, Proc. Acad. Nat. Sci. Phil. 1861, p. 163.

Carberry, Western Manitoba.

11. *Everes comyntas.*

Polyommatus comyntas, Godart, Enc. Méth. ix. p. 660. n. 147 (1823).

Rapids of the Drowned, 29th June.

12. *Cupido lygdamus.*

Polyommatus lygdamus, Doubleday, Entomologist, i. p. 209 (1842).

Athabasca River, 5th June.

13. *Plebeius podarce.*

Lycæna podarce, Felder, Reise der Nov., Lep. ii p. 282. n. 359, pl. xxxv. figs. 22, 23 (1865).

Rapids of the Drowned, 1st July.

14. *Plebeius Scudderi.*

Lycæna Scudderi, Edwards, Proc. Acad. Nat. Sci. Philad. 1861, p. 164.

East bank of the Mackenzie River, 30 miles north of the Arctic circle, 18th July.

15. *Colias occidentalis?*

Colias occidentalis, Scudder, Proc. Bost. Nat. Hist. Soc. ix. p. 109 (1862).

♀ var.? Carberry, Western Manitoba.

This specimen has an orange flush on the primaries and is not unlike some females of *C. ariadne* excepting in its superior size.

16. *Colias interior?*

Colias interior, Scudder, Proc. Bost. Nat. Hist. Soc. ix. p. 108 (1862).

♀. Fort Good Hope, Mackenzie River, 18th July.

It is quite possible that I have failed rightly to identify the two preceding females of *Colias*; in fact I do not believe that anyone but Mr. W. H. Edwards could form any definite opinion respecting them.

17. *Ganoris hulda.*

Pieris hulda, Edwards, Trans. Am. Ent. Soc. ii. p. 370 (1870).

Rapids of the Drowned, 29th and 30th June; Pulo River, 31 miles south-west of the Mackenzie Delta, 15th July.

We have specimens of this species in the Museum from British Colombia.

18. *Ganoris pallida.*

Pieris pallida, Scudder, Proc. Bost. Nat. Hist. Soc. viii. p. 183 (1861).

Winnipeg, Manitoba, 11th September.

19. *Euchloë simplonia.*

Pontia simplonia, Freyer, Beitr. Schmett. ii. pl. lxxiii. fig. 2 (1829).

Rapids of the Drowned, 29th June.

A second example of this species was in the "Zeller" collection from Colorado labelled *Anth. lanceolata*. We have no authenticated *E. lanceolata*, Boisd., in our collection; but the species so labelled is identical with *E. simplonia*. From *E. ausonides*, to which it is closely allied, it differs chiefly in its inferior size and the smaller and narrower white markings on under surface of secondaries.

20. *Papilio turnus.*

Papilio turnus, Linneus, Mant. Plant. p. 536 (1771).

Banks of Athabasca River, 3rd June; Rapids of the Drowned, Slave River, 26th and 27th June and 1st July.

21. *Erynnis colorado.*

Pamphila colorado, Scudder, Mem. Bost. Soc. ii. p. 349, pl. x. figs. 16–18, pl. xi. figs. 1, 2 (1874).

♂ ♀. Rapids of the Drowned, 29th and 30th June.

22. *Adopœa*, ? sp.

A single somewhat broken and headless example of a species apparently allied to *A. hylas*, Edw., but with the ground-colour of the wings almost black.

Carberry, Western Manitoba.

23. *Thanaos martialis.*

Nisoniades martialis, Scudder and Burgess, Proc. Bost. Nat. Hist. Soc. xiii. p. 291, fig. 5 (1870).

Rapids of the Drowned, 29th June.

Of Moths twenty-two species were obtained, of which one is a Sphingid, four are Noctuæ, and the remainder Geometræ; of these the Noctuæ are the most interesting and are, fortunately, in the best condition.

24. *Hemaris buffaloensis.*

Hæmorrhagia buffaloensis, Grote and Robinson, Ann. Lyc. Nat. Hist. New York, viii. p. 437, pl. xvi. figs. 18, 19 (1867).

Banks of the Slave River, 26th June.

25. *Acronycta lepusculina.*

Acronycta lepusculina, Guenée, Noct. i. p. 46. n. 55 (1852).

Fort Good Hope, Mackenzie River, near the Arctic circle, 18th July.

26. *Syneda petricola.*

Euclidia petricola, Walker, Lep. Het. xiv. p. 1462. n. 8 (1857).

Rapids of the Drowned, 1st July.

The type of this species was from the Rocky Mountains. It is like a small pale form of *S. divergens*, Behr., and the markings of the secondaries vary in the same way, the comma-shaped discocellular black dash being either isolated or connected by a bar to the submarginal band.

27. *Euclidia annexa.*

Euclidia annexa, H. Edwards, Entom. Amer. vi. p. 115 (1890).

Banks of the Slave River, 26th June; Rapids of the Drowned, 28th June and 1st July.

The type specimen and others collected with it were obtained in Oregon by Lord Walsingham.

28. *Euclidia cuspidea.*

Drasteria cuspidea, Hübner, Samml. exot. Schmett. Zutr. i. p. 16. n. 35, figs. 69, 70.

Banks of the Slave River, 26th June; Rapids of the Drowned, 30th June.

29. *Metrocampa perlata.*

Metrocampa perlata, Guenée, Phal. i. p. 128. n. 197.

Fort Good Hope, Mackenzie River, 18th July.

30. *Cosymbia pendulinaria.*

Ephyra pendulinaria, Guenée, Phal. i. p. 414. n. 674.

Rapids of the Drowned, 2nd July.

31. *Deilinia exanthemata.*

Phalæna exanthemata, Scopoli, Ent. Carn. p. 218. n. 542.

Fort Resolution, Great Slave Lake, in a marsh, at 2 P.M. on the 7th July, and at 11.15 P.M. on the 9th July.

The specimens differ in no respect from European examples; they do, however, differ somewhat from the allied *D. erythemaria* of the United States.

32. *Deilinia variolaria.*

Cabera variolaria, Guenée, Phal. ii. p. 56. n. 987.

Fort Good Hope, Mackenzie River, 18th July.

33. *Physostegania lineata.*

Physostegania lineata, Warren in litt.

Rapids of the Drowned, 4th July at 11.30 P.M.

This being a common Californian species, it is hardly probable that it can have been overlooked by American describers, and therefore I give the name for what it is worth without diagnosis. The single example obtained is much worn, but quite recognizable.

34. *Thamnonoma marcescaria.*

Halia marcescaria, Guenée, Phal. ii. p. 92. n. 1067.

♀? Rapids of the Drowned, 4th July, at 11.30 P.M.

I believe this to be the female of *T. marcescaria*, but as we only possess one male of the species, it is difficult to decide the point. The two insects differ in slight details of pattern, which are probably of not more than sexual significance.

35. *Thamnonoma brunneata.*

Phalæna brunneata, Thunberg, Diss. Ent. i. p. 9 (1784).

Fort Good Hope, Mackenzie River, 18th July.

I feel very doubtful respecting the identity of the uniformly coloured American species with the sharply lined European species; but, seeing that Dr. Packard, in his Monograph, calls the New-World form *T. brunneata*, I abstain from separating it without abundant material to prove its distinctness.

36. *Thamnonoma gracilior*, sp. n.

Allied to *T. brunneata*, but smaller and more slender; ferruginous; the basal area, especially of the secondaries, irrorated with blackish grey up to the median shade; the latter narrow, dusky, dentate-sinuate on the primaries and arched on the secondaries, where it is impinged upon by a more or less defined blackish lunule on the discocellulars; postmedian line blackish, sinuous, almost bracket-shaped on the primaries, limiting the external area, which is densely irrorated with blackish grey (leaving the outer borders clear in the female); the secondaries of the male are moreover more or less densely irrorated throughout; marginal line slender, black; fringe tawny ferruginous; body of the male above blackish, the anal extremity with tawny bands Wings below clear tawny, with blackish markings, the median shade represented by an imperfect arched line, interrupted in the male by black discocellular stigmata; postmedian line regularly dentate-sinuate; marginal line black as above: primaries with traces of the subbasal line. Body below dark grey, sprinkled with tawny scales; the centre and anal segments pale tawny; legs creamy white.

Expanse of wings, ♂ 25, ♀ 24 millim.

♂. Rapids of the Drowned, Slave River, 1st July; ♀. Pulo River, near Mackenzie Delta, 15th July.

I have failed to discover any published description of this very distinct species, and therefore have ventured to name it.

37. *Tephrina*, sp.

I have not discovered any name for this species, but we have a fair series of it in the Museum from the Dalles and Rouge River, collected by Lord Walsingham. It is therefore quite possible that Mr. H. Edwards may have described it in one of his numerous papers on Californian Lepidoptera.

Rapids of the Drowned, 4th July.

38. *Tephrina*, sp.

A pair of an obscure little species in not very good condition, the female headless.

♂. Pulo River, near Mackenzie Delta, July 15th; ♀. Fort Good Hope, Mackenzie River, near the Arctic circle, July 18th.

39. *Coremia*, ? sp.

A worn male specimen, for which I have failed to find a name, from Fort Good Hope, July 18th.

40. *Odezia albovittata*.

Odezia albovittata, Guenée, Phal. ii. p. 520. n. 1757.

Athabasca River, 17th and 20th June.

41. *Eutype gothicata*.

Melanippe gothicata, Guenée, Phal. ii. p. 388. n. 1521.

Rapids of the Drowned, 26th June.

42. *Eutype obductata.*

Cidaria obductata, Moeschler, Wien. ent. Monatschr. 1860, p. 374, pl. x. fig. 3.

Pulo River, near Mackenzie Delta, 15th July.

PSEUDOSIONA, gen. nov.

Form of wings and short palpi as in *Siona*; pattern and neuration similar to *Eubolia*, the subcostal branches of secondaries (veins 6 and 7) being emitted separately; discoidal cell much longer.

Type *Pseudosiona Taylori.*

43. *Pseudosiona Taylori*, sp. n.

Greyish white; the wings being white, densely irrorated with grey, with a darker spot on the upper discocellulars and an oblique stripe of grey from costa near apex to inner margin on all the wings; vertex of head and base of abdomen whiter than the remainder of the body. The under surface is whiter, the irrorations less numerous but darker, the markings also darker and browner; legs brownish; venter indistinctly zoned with grey.

Expanse of wings 35 millim.

Pulo River, near Mackenzie River, 15th July, 1892.

44. *Ochyria designata.*

Phalæna designata, Hufnagel, Berl. Mon. iv. p. 612.

Rapids of the Drowned, 1st July.

45. *Larentia incursata.*

Geometra incursata, Hübner, Eur. Schmett. Geom. fig. 351.

Rapids of the Drowned, 1st July.

COLEOPTERA.

Of the two Coleoptera obtained by Miss Taylor, Mr. C. O. Waterhouse has given me the following note:—

"A single specimen of one of the Elateridæ—*Corymbites*—very near *C. æripennis*, Kirby, but with rather longer elytra; possibly distinct. I have not, however, material to enable me to determine it at present. This was taken at the Great Rapids, Athabasca River, on June 9th, 1892.

"The other is *Upis ceramboides*, L., which has a wide geographical range, occurring in Saskatchewan &c. This was taken on the banks of the Slave River, June 6th."

HYMENOPTERA, RHYNCHOTA, NEUROPTERA, AND ORTHOPTERA. By W. F. Kirby.

Only a few species of these orders were obtained, and in most cases only single specimens. Some of these belong to well-known and widely distributed North-American species; but several of the remainder belong to imperfectly studied groups, in which the genera only can be determined with certainty from the materials before us. Most of the specimens were taken at Carberry, Western Manitoba, on August 4, 1892.

HYMENOPTERA.

1. *Nematus erythrogaster* (?).

Nematus erythrogaster, Norton, Proc. Ent. Soc. Philad. iii. p. 8 (1864); Trans. Amer. Ent. Soc. i. p. 205 (1867).

Carberry, Aug. 4, 1892.

Norton's species is recorded from the United States and Canada. His type was from Massachusetts.

2. *Sirex albicornis.*

Sirex albicornis, Fabr. Spec. Ins. i. p. 419. n. 9 (1781).

Carberry, Aug. 4, 1892.

Widely distributed throughout the northern part of North America, being met with from Newfoundland to Vancouver's Island.

3. *Sirex bizonatus.*

Sirex bizonatus, Steph. Ill. Brit. Ent., Mand. vii. p. 114, pl. xxxvi. fig. 2 (1835).

Carberry, Aug. 4, 1892; Athabasca River, Aug. 15, 1892.

As common and widely distributed a species as the last.

4. *Ichneumon*, sp.

Carberry, Aug. 4, 1892.

5. *Mesoleptus*, sp.

Carberry, Aug. 4, 1892.

6. *Mimesa borealis.*

Mimesa borealis, Pack. Proc. Ent. Soc. Philad. vi. p. 408 (1867).

Carberry, Aug. 4, 1892.

Described by Packard from Canada. This species will ultimately require a new name, unless it has already been redescribed in America, as it is quite distinct from *M. borealis*, Smith, a black insect from Labuan, with which Dr. Packard has confounded it.

7. *Vespa maculata.*

Vespa maculata, Linn. Amœn. Acad. vi. p. 412. n. 91 (1764).

Slave River.

The commonest of the North-American wasps, and very distinct from any European species.

8. *Cœlioxys*, sp.

Carberry, Aug. 4, 1892.

RHYNCHOTA.

1. *Rhyparochromus*, sp.

Carberry, Aug. 4, 1892.

2. *Cicada pruinosa.*

Cicada pruinosa, Say, Proc. Acad. Nat. Sci. Philad. iv. p. 330 (1825).

Carberry, Aug. 4, 1892.

A common North-American species.

3. *Glossonotus*, sp.

Carberry, Aug. 4, 1892.

NEUROPTERA.

1. *Enallagma boreale.*

Enallagma boreale, De Selys, Ent. Mo. Mag. xi. p. 242 (1875).

Rapids of the Drowned, June 29, 1892.

Described by De Selys from Newfoundland.

2. *Pteronarcys proteus.*

Pteronarcys proteus, Newm. Ent. Mag. v. p. 177 (1838).

Grand Rapids, Athabasca River, June 6, 1892.

The specimens in the British Museum are from New York and Mackenzie River.

3. *Isogenus frontalis.*

Isogenus frontalis, Newm. Ent. Mag. v. p. 178 (1838).

Grand Rapids, Athabasca River, June 10, 1892.

Recorded from Trenton Falls, New York, and St. Martin's Falls, Albany River, Hudson's Bay.

4. *Limnophilus*, sp.

Carberry, Aug. 4, 1892.

ORTHOPTERA.

1. *Arphia sulphurea.*

Gryllus sulphureus, Fabr. Spec. Ins. i. p. 369. n. 39 (1781).

Carberry, Aug. 4, 1892.
A common North-American species.

2. *Stenobothrus*, sp.

Carberry, July 11 and Aug. 4, 1892.

III.—*The Morphology of the Generative System in the Genus* Testacella. By WALTER E. COLLINGE, Demonstrator of Biology, Mason College, Birmingham.

[Plate I.]

CONSIDERING how plentiful and widely distributed the three British species of this genus are, and the interesting relations that exist between the *Testacellæ* and a number of genera not found in Great Britain, it is somewhat surprising to find that they have received so little attention from malacologists in this country.

One of the most valuable and important works upon the European slugs is that by Dr. Simroth *, published in 1886, in which he drew attention to the importance of the generative and alimentary systems as a basis for classification ; and, although I think it very desirable when describing new species of slugs to fully describe the general anatomy of the same, this valuable monograph has been the means of placing the study of the slugs upon a more rational basis than it has hitherto occupied, and has given students a ready means of distinguishing one species from another by the morphology of the reproductive organs.

Dr. Scharff, in his admirable account of the Irish slugs †,

* Zeitschr. f. wiss. Zool. 1885, vol. xlii. pp. 203–366, 5 pls.
† Trans. Roy. Dublin Soc. 1891, vol. iv. ser. 2, pp. 513–562, 2 pls.

has figured and described the generative system of most of the slugs found in this country, and I have more recently described * the same system in a number of *Arions* not found in Ireland or not known as occurring in the British Isles at the time Dr. Scharff wrote. A similar description, with figures of the *Testacellæ*, is, I think, desirable.

My best thanks are due to Mr. J. G. C. Taunton, of Mason College, for the abundance of material which he has been good enough to procure for me, and also to Messrs. Morris Young, E. W. Swanton, and Charles Oldham for specimens which they from time to time have favoured me with.

Testacella haliotidea, Drap. (Pl. I. figs. 1 and 4.)

It will be unnecessary to dwell at any length upon the system in more than one species, as it is one of comparative simplicity. I shall therefore describe in detail the individual organs in this species, and point out in the two following ones the various differences and modifications, and then briefly compare the three.

The vestibule opens into a dilated vagina, from which the receptacular duct is given off. At the point of juncture of the vestibule and vagina the penis passes off; it is a long curved organ, the anterior portion of which is sometimes dilated in a somewhat cæcal-like form, as shown in Pl. I. fig. 4. This must not be regarded as the typical form of the penis. I would specially draw attention to this fact, as it has been figured and described as such † and certain comparisons instituted between the form of the organ in *T. haliotidea* and *T. scutulum.* A reference to Lacaze-Duthiers's well-known paper and accurate figures ‡ supports my statement. The direct continuation of the penis is the vas deferens; from the point of juncture of the two organs a long dilated flagellum is given off laterally. In the paper just cited Mr. J. W. Taylor very wrongly describes the vas deferens as passing off laterally from the penis and flagellum, whereas, as previously stated, the vas deferens is a direct continuation of the penis. In none of the European *Testacellæ* which I have examined does the vas deferens differ in its relation to the penis from the same organ in any other slug; that is to say, although it may externally appear to pass off from the penis as a lateral tube, morphologically it is

* 'Conchologist,' 1892, vol. ii. pp. 56–66 and 76–83; also 1893, vol. ii. pp. 113–117.

† Journ. Conch. 1888, pp. 337–347.

‡ Arch. de Zool. exp. et gén. 1887, vol. v. pp. 459–596, 12 pls.

the direct continuation of that organ. The receptacular duct arises from the most anterior portion of the vagina; it is a fairly wide tube, which opens into a dilated and slightly oval-shaped sac, the receptaculum seminis. The vagina in the majority of the Testacellidæ is of great length. This feature is more marked in *T. scutulum* and *T. Maugei* than in this species. It is continued as the oviduct and prostate—the common duct of many authors. There is a large albumen-gland present, which calls for no special mention. The hermaphrodite duct is a densely convoluted canal leading from the hermaphrodite gland, which is usually of an oval form.

Testacella scutulum, Sowerby. (Pl. I. fig. 2.)

This species has been classed as a variety of *T. haliotidea* by most of the writers upon the British Mollusca.

It was described and figured by Sowerby in 1823, in his 'Genera of Recent and Fossil Shells.' Férussac, who in the same year examined specimens, came to the conclusion that it was but *T. haliotidea*, with which view Mr. Sowerby agreed, and since then it has been regarded as a variety of that species by Gray, Forbes and Hanley, Jeffreys, Rimmer, and other authors. It was redescribed as a new species by Mr. Tapping in 1856, as *Testacella Medii-Templi*. In 1886 Mr. Charles Ashford made anatomical examinations of the slug and clearly proved its specific distinctness. An account of his work is embodied in a paper previously referred to (Journ. Conch. 1888). Although to Mr. Ashford is due the credit of having placed this slug in its proper position, the above-mentioned account, both description and figures, leaves much to be desired.

The distinctness between vestibule and vagina is scarcely perceptible in this species. The upper part of the vagina is dilated in a pouch-like manner, but narrows previous to entering the oviduct. The penis is a large muscular organ and readily distinguishable from that in the preceding species, being rather shorter and always much broader. It opens into the vas deferens. There is no flagellum. The penal retractor muscle is attached laterally to the penis. The receptacular duct leaves the vagina as a broad pouch-like organ, and continues as such for quite two thirds of its length, when it tapers off suddenly into a narrow and short tube, which opens into the small globular receptaculum seminis. Judging from the peculiar form of the receptacular duct and the internal structure, I think it is very probable that the ova are fertilized in this broad pouch-like portion. The hermaphrodite gland is slightly larger than in *T. haliotidea* and the duct longer.

Testacella Maugei, Fér. (Pl. I. fig. 3.)

In this species the vestibule and vagina are rather easier to distinguish than in the preceding one. At the junction of the two organs the penis passes off; it commences as a narrow tube, and then broadens out into an expanded head. It is much longer than in *T. scutulum*. The vas deferens previous to entering the prostate is thrown into a series of convolutions; these were characteristic of all the specimens dissected and quite unlike anything I have previously seen in this organ. The receptacular duct commences as an ovoid dilatation from the vagina, and is continued as a long narrow tube, which enters the receptaculum seminis laterally, reminding one somewhat of the condition in *Arion fasciatus*, Nils., only the shape here is oval, and not tapering and pointed as in that species. The oviduct and prostate are sharply folded upon each other, a character fairly constant. The hermaphrodite gland is somewhat triangular in shape and readily distinguishable from that organ in either of the two preceding species.

Variation.

Although a large number of specimens of each species have been dissected, the amount of variation noted in any individual species was very slight and unimportant.

In *T. haliotidea* the flagellum exhibits a series of minor variations, being either a straight tapering tube with the distal portion sometimes dilated, or it forms a dilatation at an angle to the general body, not unlike the head of a golf-stick. I have already referred to the variation in the form of the penis (Pl. I. fig. 4).

In *T. scutulum* the penal retractor muscle often exhibited a division into two portions, while in others there was a small retractor muscle given off below the ordinary one.

Summary.

There are certain resemblances in the form of the generative organs in *T. scutulum* which connect it with *T. Maugei*, such as:—

a. The dilatation of the proximal portion of the receptacular duct.

b. The absence of a flagellum.

c. The form of the penis and vas deferens.

There are few anatomical points which connect either of the above species with *T. haliotidea*, and there are no grounds whatever for retaining *T. scutulum* as a variety of *T. haliotidea.*

The generative systems of *T. bisulcata*, Risso, and *T. Pecchiolii*, Bourg.*, have been compared with those of all the above three species, and they agree very closely with *T. scutulum*, of which both are probably varieties; but a further investigation of their general anatomy is desirable before finally classing them as such.

EXPLANATION OF PLATE I.

Fig. 1. *Testacella haliotidea*, Drap.
Fig. 2. *Testacella scutulum*, Sowerby.
Fig. 3. *Testacella Maugei*, Fér.
Fig. 4. *Testacella haliotidea*, Drap. Variation in the form of the penis.

alb.g. Albumen gland.
fl. Flagellum.
h.d. Hermaphrodite duct.
h.g. Hermaphrodite gland.
ov. Oviduct.
p. Penis.
pr. Prostate.
p.r.m. Penal retractor muscle.
r.d. Receptacular duct.
r.s. Receptaculum seminis.
v. Vestibule.
v.d. Vas deferens.
vg. Vagina.

IV.—*On the Names or Existence of three Exotic Starfishes.* By F. Jeffrey Bell, M.A.

I hope the following notes will be found to be of some assistance in the systematic nomenclature of Asteroidea.

"*Asterina marginata* (Val.), Perrier."

The species referred to thus in the 'Challenger' Report of Asteroidea should be called *A. stellifer*, Möbius. So far as Valenciennes is concerned he only wrote a manuscript label for the Museum in the Jardin des Plantes. Hupé, in 1857, printed the name in vol. iii. (Mollusques) p. 100 of the Exp. de l'Amér. du Sud, but it is a *nomen nudum*. In 1859 Möbius, in the Abh. Geb. Naturw. Hamburg, iv. 2, p. 4, described *Asteriscus stellifer*, and, in 1860, Lütken (Vid.

* Boll. Mus. Zool. Torino, 1888, vol. iii. no. 43, pp. 1–10, 1 pl.

Medd. 1859 [1860], p. 57) described *Asteriscus brasiliensis*, and in a footnote at the end of his memoir identified his with Möbius's species.

The synonymy of this species should therefore run as follows :—

Asterina stellifer.

Asteriscus minutus, M. & Tr. Syst. Ast. (1842), p. 41 (not Gray, 1840).
Asteriscus stellifer, Möbius, Abh. Geb. Naturw. Hamburg, iv. 2 (1859), p. 4; Verrill, Trans. Conn. Acad. i. ("1867"), p. 343.
Asteriscus brasiliensis, Lütken, Vid. Medd. 1859 (1860), p. 57.
Asteriscus marginatus, Val. MSS.; Hupé, n. n.; Perrier, Ann. Sci. nat. xii. (1869), p. 289.
Asterina stellifera, Lütken, Vid. Medd. 1871, p. 301.
Asterina marginata, Perrier, Arch. zool. exp. v. (1876), p. 211; Slad. Chall. Rep., Ast. (1889), p. 774.

Goniodiscus articulatus.

Mr. Sladen (Chall. Rep. Ast. p. 754) writes "*G. articulatus* (Linné), de Loriol," meaning, I believe, by this formula that Linnæus named this species and de Loriol put it in the genus *Goniodiscus*; and on his principles—those of a writer who accepts pre-Linnean quasispecific or distinctly nonspecific names as specific appellations—he is quite right.

M. de Loriol (Rec. Zool. Suiss. i. p. 638) writes "*Goniodiscus articulatus* (Linné), Lütken;" this collocation of words must mean something different from Mr. Sladen's, as Dr. Lütken put the species in the genus *Goniaster*; and I take it to mean Linnæus *before* the tenth edition of the 'Systema Naturæ' named this species, and Lütken revived the name.

I do not see on what grounds we are to associate Linnæus's name with this species: in the tenth and twelfth editions of the 'Systema Naturæ' it is included under *A. aranciaca*, and it is to Lütken that the credit is due of distinguishing the form and reviving the name.

The 'Museum Tessinianum,' in which *A. articulata* is described and figured, bears date 1753, or is anterior to the tenth edition by five years *; it is said by well-qualified bibliographers (see Cat. Libr. Mus. Pract. Geol.) that the work was published privately, though Count Tessin's preface hardly supports this view.

If we accept 1758 as the year from which to start we must

* "1758, the zoological *ab urbe condita* of binominal chronology," Lovén, Echinoid. Linn. (1887), p. 50.

associate the name of Lütken, and not Linnæus, with the species under discussion. But if we do this we come at once into contact and opposition with the views of Dr. Lütken himself, who (Vid. Medd. 1864, p. 161) replaces *O. clavatus*, M. & Tr., by *O. dorsatus*, L., *A. dorsata* being one of the three species of *Asterias* mentioned in the Mus. Tessin.

Dr. Lütken has done so much for our knowledge of Echinoderms, and has treated questions of nomenclature in so reasonable a manner, that I am sorry to appear to disagree with him; but I think we are exchanging firm ground for shifting sands if we budge from 1758 as the year from which binominal appellations are to begin.

Those who accept this view will write the synonymy of the two species thus:—

Goniodiscus articulatus.

Goniaster articulatus, Lütken (ex Linn. Mus. Tessin. (1753), p. 114), Vid. Medd. 1864, p. 147.
Asterias aranciaca, Linn. Syst. Nat. 1758, p. 662 (pars).
Goniodiscus sebæ, M. & Tr. Syst. Ast. (1842), p. 58; Perrier, Arch. zool. exp. v. (1876), p. 46 (pars).
Goniodiscus articulatus, de Loriol, Rec. Zool. Suiss. i. (1884), p. 638.

Pentaceros clavatus.

Asterias nodosa, Linn. Syst. Nat. 1758, p. 661 (pars).
Oreaster clavatus, M. & Tr. Syst. Ast. (1842), p. 49.
Oreaster dorsatus, Lütk. (ex Linn. Mus. Tessin. (1753), p. 114), Vid. Medd. 1864, p. 161; Bell, P. Z. S. 1884, p. 77.
Pentaceros dorsatus, Perrier, Arch. zool. exp. v. (1876), p. 61.

A Phantom Species.

"*Goniodiscus gracilis*, Gray."

This is one of the most curious inventions I have ever met with. The hare seems to have been started by Dr. von Martens, who (Arch. f. Nat. 1866, p. 86) writes:—

"c. Randasia, Gray.

"*Goniaster Luzonicus*, Gray, Ann. mag. n. h. vi., 1841. Philippines.
"*Goniaster gracilis*, Gray, Ann. mag. n. h. vi., 1841. Ternate (Molukken)."

A reference to the volume cited—it is of some significance that Dr. von Martens gives no page—shows that the last two lines of this quotation are not to be found either following the reference to *Randasia luzonica* (p. 278), or, indeed, in any other part of Gray's paper. I cannot find that Gray at any time described a species called *Randasia*, *Goniaster*, or *Goniodiscus gracilis*, or, indeed, ever gave the name *gracilis* to any Asterid except a *Dactylosaster* (i. e. *Ophidiaster*) from the west coast of Columbia.

Prof. Perrier takes no notice of this species, if such it be, in his well-known revision; but in his Essay on the geographical distribution of starfishes (Nouv. Arch. Mus. i. (1878) p. 82) he writes:—"*Goniodiscus gracilis*, Gray . . . . . Moluques." On p. 24 he speaks of *Pentagonaster gracilis*, Gray (Moluques) (Philippines). Whether these two names are meant to be synonyms I cannot of course say; but the latter name does not find a place in the systematic list. From what I have already said it is clear I have no information to give as to *Pentagonaster gracilis*, Gray. I have something more than a suspicion that M. Perrier is here quoting Dr. von Martens from memory.

The only other author who speaks of *Goniodiscus gracilis* is Mr. Sladen, who gives it in his list of known species at the end of his 'Challenger' Report. But I understand that he bases his citation on Prof. Perrier's list, and I may therefore be content with merely mentioning his name, and ask why, under the circumstances, *Pentagonaster gracilis* was not also cited?

It may fairly be concluded that "*Goniodiscus gracilis*, Gray," is a species which Dr. J. E. Gray at any rate never described, and I am inclined to think that the whole citation is due to an error on the part of some copyist employed by Dr. von Martens. For the present I would suggest that "*Goniodiscus gracilis*, Gray," be the technical term for the Sea-Serpent, for the one has as shadowy an existence as the other.

This suggestion is not made in a spirit of mere buffoonery; in the one case as the other we have assertions repeated without discrimination or independent inquiry; this may be pardoned, though it is not justifiable, in a penny-a-lining paragraphist who is in want of a crust of bread, but it is unpardonable and unjustifiable in any one who aspires to be the author of a zoological monograph.

Gymnasterias valvulata.

Gymnasterias valvulata, Perrier, Arch. zool. exp. v. (1876), p. 97.

The locality of the specimen described by Prof. Perrier is Lord *Howe's* Island, and not Lord *Hood's* Island, as stated in the text; Lord Hood's Island is one of the Low Group, and is not the same as Hood Island. I presume a misunderstanding on the latter point was the cause of Mr. Sladen giving Galapagos Islands as the locality. M. Perrier states that the second specimen he saw in the British Museum was from an unknown locality; however that may be, there is a specimen from Moreton Bay. So that the localities are not equatorial and eastern Pacific, but subtropical and western Pacific.

V.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N., commanding.*—Series II., No. 8. *Note on* Calypterinus Allmani. By A. Alcock, M.B., C.M.Z.S., Officiating Superintendent of the Indian Museum.

In their Report upon the 'Challenger' Alcyonaria, Messrs. Perceval Wright and Studer describe * in the family *Primnoidæ* a remarkable new species, *Calypterinus Allmani*, from the vicinity of Fiji. The 'Challenger' specimens are stated to have been fragments about 100 millim. long.

We have recently on board the 'Investigator' dredged several fine branches, one of them 200 millim. in length, of this Alcyonarian; and as it is such a beautiful and remarkable form I venture to offer a few observations, complementary of the original description, upon our specimens.

The axis is branched in either one or two planes; when in two planes they are at right angles to one another, and the branching in one plane (the lateral) greatly predominates.

The branches like the axis are quite rigid, and they ascend with a gentle curve parallel to one another to form a lofty compressed rigid umbel or candelabra: they have little tendency to give off secondary branches, but where such exist they arise singly low down near the origin of the primary branch and ascend parallel with it in the same plane. No tertiary branches occur in any of our specimens. All the branches repeat the same gentle curve with the most remarkable uniformity.

The polyps, as stated by Messrs. Wright and Studer, are disposed in whorls of from four to seven, and they hang head downwards, or downwards and outwards, they having evidently the power of flexion and extension upon the stem.

* The Voyage of H.M.S. 'Challenger,' Zoology, vol. xxxi. pp. 53 and 54, pl. xi. figs. 1, 1*a*, pl. xiv. fig. 5, pl. xx. fig. 2.

The structure and arrangement of their spicules and of the cœnenchyma have been already so well described and figured that nothing further is to be said here.

In our specimens the tunnel formed by the series of expanded wing-like scales at the bases of the lateral polyps makes a very convenient shelter for a slender chætopod.

Several beautiful branches were dredged in the Laccadive Sea off Piti Sandbank (lat. 10° 47′ 45″ N., long. 72° 40′ 20″ E.) at a depth of 705 fathoms, the bottom being hard rock and fragments of dead and waterworn reef coral.

Of Alcyonaria there were dredged, at the same time, some large branches of a peculiarly beautiful new species of *Stenella*, near to *S. spinosa*, Wright and Studer; a new species of *Acanella*, represented by a single bush-shaped colony complete in every point; and a branch of *Callistephanus Koreni*, Wright and Studer. Of these and other deep-water Alcyonaria from the Andaman Sea I hope shortly to give an account.

VI.—*Description of a new* Sciuropterus *from the Philippines.* By OLDFIELD THOMAS.

FOR many years there have been in the British Museum three specimens of a Flying Squirrel from Palawan resembling superficially *S. alboniger*, Hodgs., but proving on a careful comparison of the skulls and other characters to be essentially different from that animal. I propose to call the species

Sciuropterus nigripes, sp. n.

Size large, one of the largest of the genus. Fur long, thick and rather woolly, not so silky as in *S. alboniger*. General colour above grizzled greyish brown, the woolly under-fur pale slaty grey, the straight upper-fur with broad pale drab terminal or subterminal bands. Ears large, thinly haired and blackish terminally, but with longer yellowish hairs on their basal surfaces externally. No longer hairs round base of ears, nor any cheek-tuft. Parachute above rather thinly haired, similar in colour to the back. Lips, both upper and lower, black, contrasting markedly with the pale colour of the cheeks and throat.

Throat, chest, and centre of belly whitish, the hairs yellowish white to their roots; rest of under surface greyish white, the bases of the hairs slaty grey; but the distribution of the patches of uniform whitish and grey and whitish hairs is quite irregular. Posterior fringe to hind limbs like back, or rather tending towards an orange tone. Upper surface of hands and feet uniform black; under surface of heel and fringe of hind feet brownish black. Tail long, thickly clothed, indistinctly distichous; its proximal hairs yellowish or whitish, broadly tipped with brown, its terminal ones wholly dark brown.

Skull decidedly larger than that of *S. alboniger*, but very similar in its proportions, in the relative length of the muzzle, and in the size and direction of the postorbital processes. Interparietal unusually produced antero-posteriorly, its length nearly equalling its breadth. Mastoid portion of bulla swollen posteriorly above and behind the meatus. Teeth large and heavy, their crests well developed and the valleys between them deep; $\underline{\text{p. 4}}$ elongate, its longitudinal diameter slightly exceeding that of $\underline{\text{m. 1}}$; surface of teeth with minute crenulations; $\underline{\text{m. 3}}$ with a minute extra ridge running longitudinally across the inner end of the main transverse ridge.

Dimensions of the type (an adult female in skin):—

Head and body (c.) 330 millim.; tail 250; hind foot (damped) 50; ear from notch (dried and shrunk) 26.

Skull *: upper length (c.) 51·5; zygomatic breadth 32·5; nasals, length 15·1, greatest breadth 8·6; interorbital breadth (ignoring supraorbital notches) 12·3, intertemporal breadth 12·2; palate, length 28; diastema 10·6; length of upper cheek-teeth, from front of $\underline{\text{p. 4}}$ to back of $\underline{\text{m. 3}}$, 11·4; length of $\underline{\text{p. 3}}$ alone 3·0.

Hab. Puerta Princesa, Palawan. Coll. A. Everett.

Besides the type (B.M. 79. 5. 3. 2) there are two other skins and a skeleton of this species in the Museum collection; all were obtained by Mr. Everett between Nov. 1877 and Jan. 1878. One of the other skins is mottled all over with white and is evidently a partial albino.

The only species with which *S. nigripes* could be confounded is *S. alboniger*, Hodgs., a native of Nepal, Sikim, N. Burma, &c., and from this it is readily distinguished by its decidedly greater size, its black lips, black hands and feet (in *S. alboniger* the hands are grey and the feet brown), its paler and less thickly haired parachute, and its larger and heavier teeth.

* The following additional measurements are taken on the more perfect skull belonging to the skeleton:—Basal length 45·8; tip to tip of postorbital processes 23·5; horizontal antero-posterior diameter of bulla 10·4.

VII.—*On a supposed new Species of* Rhiostoma *from Borneo, and Notices of Two other Species of Shells from Palawan.* By Lieut.-Col. H. H. GODWIN-AUSTEN, F.R.S. &c.

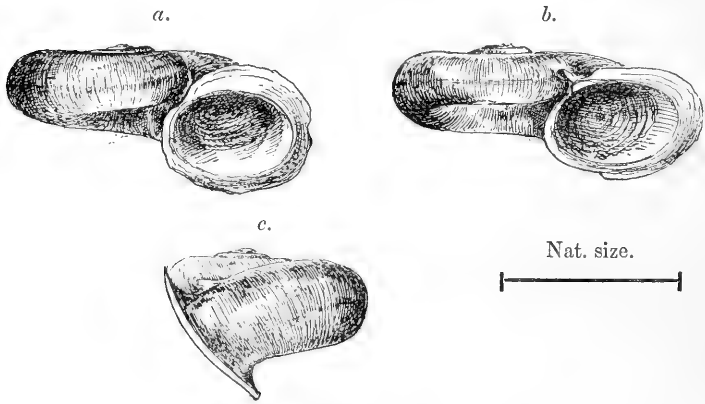
THE *Rhiostoma* I now describe was collected by Mr. Boxall and was sent by him to Dr. Hungerford, who asked me to describe and name it after its discoverer; but I received it too late to bring into my paper on Bornean shells published in the Proc. Zool. Soc., June 1889, p. 332.

Rhiostoma Boxalli, sp. n. (Fig. 1, *a*, *b*, *c*.)

Loc. Near Kina Balu (*Boxall*). In Coll. Dr. Hungerford.

Shell discoid, widely and perspectively umbilicated; sculpture smooth; colour dark madder-brown, with a few white splotches on the second and third whorls; spire scarcely raised above the last whorl, apex rounded; suture deep; whorls 4, round, rapidly increasing, the last separated for a

Fig. 1.



Rhiostoma Boxalli.
a. Specimen from Kina Balu; *b*, *c*. Ditto from Palawan.

short distance from the penultimate; the sutural tube short, horizontal; aperture oblique, circular; peristome double, the inner simple, the outer expanded at right angles to the body-whorl, and curved slightly backwards on the outer margin and with a slight nick near the sutural tube.

Size: maj. diam. 24·0, min. diam. 16·25, alt. axis 5·75 mm.

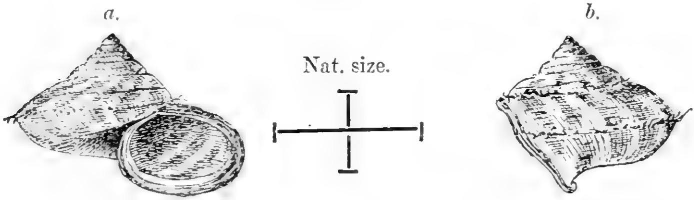
This species comes nearest to *R. iris*, G.-A. (described in the Proc. Zool. Soc., June 1889, p. 343), in the expanded peristome; the general form differs, it is not so turbinate or streaked with zigzag markings.

One specimen of this species occurred in a collection of land-shells sent to me by Mr. John Whitehead from the island of Palawan.

Lagocheilus similis, var., Edgar Smith. (Fig. 2, *a*, *b*.)

Among the shells collected by Mr. John Whitehead in Palawan and sent to me there are three specimens of what I

Fig. 2.



Lagocheilus similis, var., Edgar Smith.

take to be the above species, only much better grown. When in perfect preservation it is covered with a brown epidermis having well displayed transverse, regular, fine liration and the periphery adorned with a strong hairy fringe.

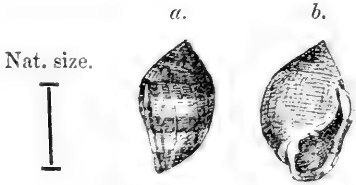
The largest specimen measures:—major diam. 18·75, minor 15·0, alt. axis 7·5 mm.

Cassidula bicolor, sp. n. (Fig. 3, *a*, *b*.)

Palawan. Collected by Mr. John Whitehead.

This is a smaller shell than *sulculosa*, Mouss., to which it is nearest as regards the form of the aperture, but it is not so strongly formed. The body-whorl is crossed by shallow

Fig. 3.



Cassidula bicolor.

longitudinal plications. The colour is a very dark sepia-brown, with two broad, parallel, very white bands, which extend to the outer margin of the peristome. I could find nothing like it in the British Museum collection.

VIII.—*Descriptions of Two new Species of Butterflies from Kina Balu, North Borneo, in the Collection of H. Grose Smith, captured by Mr. Everett.* By H. Grose Smith.

Delias cathara.

Male.—Upperside. Both wings lacteous white. Anterior wings with the apex and outer margin as far as the lowest median nervule black, shading internally between the veins into grey, the black and grey portion extending obliquely over the apical third of the wings, but not extending beyond the lowest median nervule. Except within the dark apical space and on the costa, the veins are white. Posterior wings narrowly irrorated with grey on the outer margin from the anal angle to the extremity of the uppermost median nervule, the veins from the middle of the wing to the margin narrowly black.

Underside. Anterior wings with the inner three-fourths white, the outer fourth to the lowest median nervule dark grey centred with a curved band of whitish spots between the veins; the veins traversing the apical third, which on the upperside is black and grey, are black, the remainder except the costal vein being white. Posterior wings pale lemon-yellow, somewhat darker towards the base, nearly white towards the outer margin; a rather narrow dark-grey band on the outer margin, centred with narrow lunular whitish spots between the veins; all the veins are narrowly and brightly black.

Expanse of wings $2\frac{1}{16}$ inches.

Allied to *singhapura*, Wallace, but very distinct, on the underside especially.

Allotinus caudatus.

Male.—Upperside. Anterior wings brown. Posterior wings also brown, except the anal third, which is white, the white space extending horizontally across the lower part of the wings from a little above the anal angle to the extremity of the lowest subcostal nervule, the line of junction of the brown and white spaces being irregularly defined; on the margin the median nervules are somewhat elongated, especially the uppermost, which forms a short tail.

Underside. Both wings white, more or less speckled with brown, especially towards the apices of both wings, where the brown speckling forms dark irregular patches. There is a submarginal row of black spots on both wings, those in the dark patches being edged with white externally. Across the posterior wings, in the position where the white space on the upperside joins the brown, is a horizontal row of curved brown lines; the outer margin of anterior wings and of the posterior wings as far as the tail is brown.

Expanse of wings $1\frac{1}{2}$ inch.

The underside resembles *Logania sriwa* and *malayica* of Distant, both of which species have lately been received by me from North Borneo; but the length of the antennæ and shape of the anterior wings of *caudatus*, irrespective of the neuration, preclude its being placed in that genus.

IX.—*Note on the Capture of a Freshwater Eel in a Ripe Condition.* By W. L. Calderwood.

A female eel (*Anguilla vulgaris*), measuring $29\frac{1}{2}$ inches in length, was captured on the 27th of December last. The capture was of some interest because the female was almost ready to spawn and was found about twelve miles south of the Eddystone, *i. e.* twenty miles from Rame Head, the nearest point of land. That a freshwater eel should be found so far out at sea, at the breeding-season, is not in itself very surprising, because it has long been conjectured that *Anguilla* spawns in salt water; but in the present state of knowledge any of the rare instances of the actual capture of a specimen in the condition of sexual maturity should be recorded.

The ovaries were pure white in colour, and corresponded exactly in appearance with those described and figured by Broek in 1881*. They extended the entire length of the abdominal cavity, showed no signs of any blood-supply, and when touched crumbled away most easily. The ova were apparently quite ready to drop from the outer surfaces of the organs. Sections showed, however, that in each ripening ovum the nuclear membrane was still distinctly visible. The nucleoli of largest size were arranged round the periphery, smaller bodies being found amongst the granular protoplasm of the nucleus. The substance of the ovum itself was richly stored with oil-globules, giving the characteristic appearance known in the conger's egg †.

* Broek, "Untersuchungen über die Geschlechtsorgane einiger Muraenoiden," Mitt. zool. Stat. Neapel, Band ii. p. 415.

† Calderwood, "A Contribution to our Knowledge of the Ovary and Intraovarian Eggs of Teleosts," Journ. Mar. Biol. Assoc. vol. ii. no. 4, pl. xi.

X.—*On Two new Species of the Genus* Enoplotrupes, *Lucas*. By the Hon. Walter Rothschild and Dr. K. Jordan.

The species of *Enoplotrupes*, Lucas (Bull. Soc. Ent. Fr. (4) ix. 1869, p. xiii, redescribed and figured Ann. Soc. Ent. Fr. (5) ii. 1872, p. 288), a genus of Geotrupidæ remarkable for the development of a horn more or less long in the middle of the head and a bifurcate one in the middle of the prothorax in the males, are found, so far as we are aware, only in the south-eastern parts of Asia. *E. sinensis*, Luc. (*l. c.*), from Szechuen and Mupin, was the first-known species, of which we have specimens from Chang Yang, taken in May at elevations of 4000–6000 feet. The Western Chinese and Eastern Tibetan countries have provided us with three more species—*E. Potanini*, Semenow (Horæ Soc. Ent. Ross. t. xxiii. 1889, p. 401), from Gan-ssu; *E. Largeteaui*, Oberthür (Coleopt. Novit. 1883, p. 58); and *E. Bieti*, Oberth. (*ibid.* p. 56, described as a *Gynoplotrupes*), from Ta-tsin-lu. Besides these forms one has been described from Yunnan (*E. yunnanus*, Fairm. Ann. Soc. Ent. Belg. t. xxxii. 1888, p. 17), two from Kiang-si (*E. Chaslii*, Fairm., and *E. variicolor*, Fairm., Ann. Soc. Ent. Fr. (6) vi. 1886, pp. 320 and 321), and one from Upper Burmah (Bhamo) (*E. burmanicus*, Gestro, Ann. Mus. Civ. Genov. (2) vi. 1888, p. 111). We are able to add two new species, one from Assam and the other from Siam.

Enoplotrupes Sharpi, sp. n.

E. nigro-violaceus vel cyaneus; capite tibiisque nigris; supra æqualiter leviterque rugosus; capite antice rotundato, utrinque ad oculos dentato, vertice impresso lævigato nitido; prothoracis margine laterali et angulis posticis valde rotundatis, impressionibus ad angulos anteriores lævibus nitidis, linea media obsoleta; elytris latis paulo convexis; tibiis anticis quinquedentatis.

♂. Caput cornu longo, curvato; prothorax cornu procero angusto, bifurcato, arcuato, utrinque late impressus, impressionibus in medio supra cornu fere attingentibus.

♀. Caput cornu brevi, prothorax antice carina transversa acuta bidentata, angulis anticis dentatis.

Long. 22–32, lat. 13–17 mm.

Typ. in Mus. Walter Rothschild.

Dark blue, with a violet tint (some specimens more black), slightly shining; head and tibiæ, especially the fore tibiæ, black; body beneath and legs with pitch-black hairs. Upper surface obsoletely rugose, not much difference between the rugosities of the head, prothorax, scutellum, and elytra. Head behind the horn, prothorax at the anterior margin and in the impressions at the side of the horn smooth, shining. Head with a small longitudinal carina in front of the horn, especially distinct in the female; the anterior margin equally rounded; a tooth on each side near the eyes, not large; the impression behind the horn somewhat arcuate. Prothorax broader than the base of the elytra, at the sides and posterior angles strongly rounded, not toothed at the outer margin; the median line behind the horn nearly obsolete. Elytra broad, rounded, slightly convex, with some obsolete raised lines, one of which near the shoulder is a little more raised at its base.

♂. The horn of the head very long, curved backwards, that of the prothorax also long, curved towards the front, bifurcate, its base compressed, nearly surrounded by the smooth impressions; the latter are only separated by a small carina above the horn. The smaller the males the shorter are their horns, and their prothorax more resembles that of the female as they diminish in size.

♀. Head with a short conical horn; prothorax with an acute transverse carina, elevated on each side into a tooth; these latter are a little larger than those at the anterior angles of the prothorax. The impressions on the sides of the carina are nearly obsolete.

This species is principally distinguished by its uniformly slightly rugose upper surface in the male, by its long curved horns on the head and prothorax, and by the wide impressions of the prothorax. The elytra are of the same size and form as those of *E. sinensis*, Luc., but are much more rugose, and the raised lines are stronger.

We have both males and females from Siam.

Enoplotrupes splendens, sp. n.

E. cæruleo-viridis, nitidus, capite prothoraceque leviter rugosis; vertice arcuatim impresso; capite extus ad oculos obtuse angulato, antice rotundato; prothoracis lateribus rotundatis, angulis posticis distinctis paulo rotundatis; scutello rugoso-punctato, apice excepto, in medio subimpresso; elytris ad humeros subrotundatis, convexis, fortiter irregulariterque striatis, interstitiis rugosis; tibiis anticis sexdentatis.

♂. Caput cornu acuto, arcuato; prothorax cornu bifurcato non arcuato, ante angulos anticos valde impressus, fere toto spatio circum cornu lævi.

♀. Caput cornu brevi; prothorax carina transversa leviter producta, non dentata, angulis anticis dentatis, impressionibus ad marginem anteriorem fere nullis.
Long. 19–26, lat. 11–15 mm.

Typ. in Mus. Walter Rothschild.

Bluish green, shining; head rounded, produced at the eyes into a slight tooth, rugose, with an arcuate, nearly smooth impression behind the horn; the latter moderately long, recurved, rugose in the male; that of the female is short. The prothorax slightly rugose, outer margin rounded but somewhat produced in the middle, posterior angles in both sexes scarcely rounded; an impressed line above the horn, quite distinct in the male. The prothoracic horn of the male bifurcate and quite straight, moderately long, the impressions deep and smooth, approaching each other above the horn. The transverse carina of the female is small, without teeth. Anterior angles of the prothorax of the female with a prominent tooth, the impressions quite obsolete.

The scutellum slightly impressed before the apex, rugosely punctured nearly throughout. Elytra striped with raised lines, one of which is situated at the suture, two or three in the middle between suture and shoulder, and one at the shoulder prominent, especially at the base, obsolete near the apex; the spaces between these lines rugose; the stripes near the outer margin obsolete.

This species resembles *E. yunnanus*, Fairm., and *E. Potanini*, Sem., in its striated elytra (which give it in the female almost the appearance of *Geotrupes sylvaticus*, Panz.); it differs, however (so far as we can tell from the descriptions), chiefly in the development of the horns and the impressions of the prothorax.

Our specimens (2 ♂ and 2 ♀) were taken in North Manipur at elevations of 5000 to 8500 feet (Aug. 1889) and in the Naga Hills (4 ♂, 2 ♀); and we have also some specimens (2 ♂, 2 ♀) said to have come from the Punjaub.

XI.—*Descriptions of Five new Species of Australian Saw-flies.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum (Natural History).

The following new species were received from Mr. Charles French, of Melbourne, and were probably collected in that neighbourhood:—

Perga divaricata.
—— *sericea.*
—— *sellata.*
—— *lalage.*
Cerealces cyathiformis.

Among other saw-flies in the collection were two female specimens of *Perga Lewisii*, Westw., differing from the type in having black antennæ.

Perga divaricata.

Antennæ six-jointed.

Long. corp., ♂ 15 millim., ♀ 19 millim.

Male.—Reddish chestnut, redder beneath; antennæ, a spot within each, a spot below each eye, clypeus, labrum, prothorax (except a curved transverse stripe in front), the tip of the central lobe of the mesothorax, the legs, a stripe on the lower part of the mesopleura (curving to the base of the middle coxæ), a spot above the hind coxæ, and a row of spots on the sides of the abdomen beneath yellowish white. Abdomen with segments 2–6 silky black above. Wings yellowish hyaline; stigma large, reddish, grooved, with a blackish cloud beneath; only three submarginal cells, and even these imperfectly separated. Hind wings with a blackish cloud covering the middle cell and extending beyond it above and below.

Head, thorax, and scutellum thickly punctured; a deep groove running backwards outside each ocellus and slightly curving inwards to the occiput, the space between convex and rather raised behind; mesothorax with the frontal and lateral lobes well separated, the former with a deep groove in the middle, and the latter each with three ridges meeting behind, the space between the two outer ones smooth. Scutellum convex on each side at the base and with a wide central groove, diverging behind, the projecting lateral spines rather wide apart.

Female similarly coloured, but more varied with yellowish white, the punctures larger and the grooves on the head, thorax, and scutellum somewhat less strongly marked. The following additional yellowish-white markings may be noted:—The hinder orbits, two spots on the grooves near the occiput, the upper borders of the prothorax (which is red in the female), a line below the wings, a narrow line bordering the sides of the mesothorax above, and the extremity and lateral points of the scutellum. Wings yellowish hyaline, unclouded, but with some of the nervures (which are entirely reddish in the male) black. Four distinct submarginal cells. Legs redder than in the male, with the coxæ and trochanters whitish.

I was at first inclined to refer these specimens (which I think I am correct in placing together as sexes) to *P. castanea*, Kirb.; but in that species the scutellum is much less thickly punctured.

Perga sericea.

Long. corp. 11 millim.

Male.—Antennæ six-jointed, the club as long as the three preceding joints; joint 3 rather longer than 4 and 5, and slightly constricted near the base. Head above, thorax, and pleura thickly and closely punctured; head black above, including the antennæ and mandibles, clypeus and labrum testaceous; orbits broadly testaceous, from outside the antennæ to the hinder rim of the head, but ending in a point where the occiput becomes concave. Grooves outside the outer ocelli indistinct. Prothorax testaceous, with the extreme front black, this colour curving slightly forwards on the sides. Mesothorax and scutellum black; a wide stripe on the pleura, narrowed behind, the hinder borders of the mesonotum (narrowly) and the lateral margins and hinder angles of the scutellum (rather broadly) testaceous. Mesonotum with the sutures slightly marked; a groove on the frontal lobe and two slight ridges on each of the lateral lobes; scutellum slightly grooved; the terminal tubercles unusually small. Wings hyaline, with rufous costa and nervures, with three or four submarginal cells; nervures greatly interrupted with bullæ. Legs testaceous, the extremities of the hind femora, of the hind tibiæ, and of the joints of the tarsi black. Abdomen blue-black above, with a fine white silky pubescence; terminal segment and under surface testaceous.

Not closely allied to any species before me, but much resembles the description of *Pseudoperga ventralis*, Guér., from Tasmania, though apparently distinct.

Perga sellata.

Long. corp. $12\frac{1}{2}$ millim.

Male.—Antennæ six-jointed, the club as long as the three preceding joints.

Head, thorax, and pleura thickly and closely punctured; head luteous, the tips of the mandibles black; vertex between the eyes above black, from a curve just behind the antennal tubercles to the occiput, where the black colour is convex, being contracted behind; a shallow groove on each side of the outer ocelli. Thorax luteous; mesothorax black above, with the sutures scarcely marked; frontal lobe slightly grooved; a slight ridge bounding the black colour on each side; the smooth space between this and the large oblique ridges running back to the scutellum are tawny. Scutellum tawny, grooved in the middle, with the apical points lobate, situated at the hinder angles, and projecting very slightly outwards. Wings yellowish hyaline, with reddish costa and nervures; four submarginal cells. Legs and abdomen luteous; hind femora, apical half of hind tibiæ, and the greater part of the hind tarsi beneath rufous.

Resembles *P. bicolor*, Leach, in the structure of the thorax.

Perga Lalage.

Long. corp. 10–12 millim.

Male.—Antennæ seven-jointed, black, with testaceous yellow markings, paler beneath.

Head testaceous yellow; antennæ tawny, sometimes with the two basal joints blackish; ocelli occupying the upper and broadest part of a spade-shaped blotch. The upper ocelli are black and stand at the extremities of a ridge like a pointed arch, below which the lower ocellus, which is reddish, stands. A broad stripe runs backwards from the spade-shaped spot nearly to the occiput; the spot tapers forward between the antennæ, leaving a space within the base of each yellow, and the black colour then extends over the clypeus (except a short line on each side at its lower extremity) and labrum. The mandibles are also blackish or dark red. Above the antennæ a black stripe, contiguous with the spade-shaped spot, curves inward on each side to the occiput.

Thorax black, thickly and rather finely punctured, the sutures well defined; prothorax with a waved yellowish stripe on each side of the hind border; mesothorax with the central lobe with a smooth furrow, extending nearly to the extremity, which is marked with a testaceous spot. Hinder lateral borders of mesothorax narrowly testaceous; tegulæ and scutellum testaceous, the latter grooved and with the apical tubercles nearly straight. Pleura with three testaceous or whitish stripes on each side, one below the wings, one (the broadest) lower down, widened upwards in front and tapering behind, and one slender, nearer the median line; there is also a large testaceous spot above the hind coxæ.

Legs testaceous, femora more or less black; hind legs with the base of coxæ, femora (which are rather thickened), tips of tibiæ, and tarsi black.

Abdomen blue-black above, with a testaceous stripe on the hind border of the second segment; anal segment and under surface pale testaceous; base of segments beneath more or less blackish; a row of small but conspicuous black dots on the sides beneath.

Wings hyaline; fore wings much clouded with yellowish and thickly studded with hairs; nervures testaceous, costal nervure and stigma broadly castaneous; four submarginal cells.

Allied to *P. Jurinei*, Westw., but rather more slender. In *P. Jurinei* the lower part of the face and the under surface of the abdomen are almost destitute of black markings.

Cerealces cyathiformis.

Long. corp. 10 millim.

Male.—Black, varied with yellow; head, thorax, and pectus covered with large depressed punctures; head black, a groove running from the occiput outside each of the outer ocelli; eyes bordered before and behind with testaceous; antennæ tawny, eleven- or twelve-jointed, the two basal joints darkest, sometimes nearly black; joints 3 to 8 broad, about twice as broad as long (joint 3 the longest) and cyathiform, being widely expanded at the extremity, which gives them a somewhat nodose appearance; the terminal joints more rounded at the extremity and the last rather small; a testaceous spot below and sometimes above each scape; clypeus rather narrow, testaceous, slightly concave, and bordered with testaceous below; labrum black; jaws black or marked with red; prothorax with the hinder angles bordered with testaceous in front of the tegulæ, which are testaceous or pitchy; mesothorax with a groove in front and two slight ridges on each side behind. Wings hyaline, with brown nervures, and set with numerous but scattered short bristles. Legs with the femora and coxæ mostly black or striped with black (hind legs darkest); tips of coxæ, trochanters, and base of femora white; four front tibiæ and tarsi testaceous; hind tibiæ and tarsi reddish, the former slightly brownish at the extremity; scutellum black, grooved, laterally ridged, and narrowly edged behind with testaceous, and ending in a short testaceous spine on each side. Abdomen black, first segment with a whitish spot on each side; second with a waved testaceous stripe above, on the middle, interrupted on the median line; terminal segment tawny.

Described from two male specimens, one darker than the other, and differing also in the number of joints of the antennæ, but in no other particulars. *C. scutellata* is very similar in form and structure, but the antennæ are only ten-jointed, not cyathiform, and the three terminal joints are much less distinctly separated than in *C. cyathiformis*.

XII.—*Notes on the Genus* Entomogramma *as represented by the Noctuid Moths of that Group in the Collection of the British Museum.* By Arthur G. Butler, F.L.S., F.Z.S., &c.

When he founded the genus *Entomogramma*, M. Guenée separated the species under distinct groups in consequence of their different antennal structure; indeed, no two species of the genus as originally constituted are quite alike in their male characters, and one of them was considered by Mr. Moore to be so dissimilar that he made it the type of a new genus. The latter, however, has no higher claim than the others to be so distinguished; and as it would be necessary for the sake of consistency to found a separate genus for every species of the original group, provided that the secondary sexual characters were taken into account, it seems preferable to regard them, as Guenée did, merely as sections of one variable genus.

The practical common sense of this mode of procedure being admitted, Mr. Hampson has called my attention to the fact that various other species, differing only from typical *Entomogramma* (in the variability of the same organs in the male sex) in a similar though somewhat different manner, have been wrongly described in the genera *Thermesia*, *Phurys*, &c. By adding these to *Entomogramma* I find that a tolerably gradational series is formed, evidently related throughout. The species of *Entomogramma* in the Museum series thus resolve themselves into eight sections, each of which differs somewhat from all the others in its male structure, whilst that of the female remains almost the same, excepting in the case of section *g*, where the female is the modified sex. These sections will now stand as follows:—

Entomogramma, Guen.

Section *a*. Taramina, Moore.

Males with basal third of antennæ dilated, outer two thirds pectinated, inner two thirds with short fine deflexed ciliations; basal area of primaries and basi-internal area of secondaries below densely clothed with hair; femora and tibiæ also densely hairy.

Entomogramma torsa.

Entomogramma torsa, Guenée, Noct. iii. p. 204. n. 1605 (1852).

Java, Ceylon, Nilgiris, N. India. Type in Coll. B. M.

Section *b.*

Antennæ dilated as in Section *a*, but biseriate-denticulated and fasciculated; under surface of wings much less hairy; legs quite different, the anterior pair emitting a large fan-shaped pencil of hair at the origin of the femur, the latter with a short fringe below, the tibia thickly covered at the back with appressed hairy tufts; remaining legs not hairy, the middle tibiæ coarsely scaled in front and spiny, the posterior tibiæ spiny.

Entomogramma pardus.

Entomogramma pardus, Guenée, Noct. iii. p. 205. n. 1606 (1852).
Hypopyra anteponens, Walker, Lep. Het. xiv. p. 1323. n. 2 (1857).
Remigia venusta, Walker, *l. c.* Suppl. iii. p. 1011 (1865).

S. Africa, Natal, Delagoa Bay, Sierra Leone. B. M.

Section *c.*

Antennæ very slightly dilated towards the base, with coarse biseriate ciliations, hardly amounting to denticulation; the legs rather more spiny than in Section *b.*

Entomogramma mediocris.

Entomogramma mediocris, Walker, Lep. Het. Suppl. iii. p. 949 (1865).
Remigia decora, Walker, *l. c.* p. 1015 (1865).
Remigia antica, Walker, *l. c.* p. 1016 (1865).

South India. Types in Coll. B. M.

Section *d.*

Antennæ regularly ciliated in the male, front and hind legs densely hairy.

Entomogramma fautrix.

Entomogramma fautrix, Guenée, Noct. iii. p. 204. n. 1604 (1852).

Silhet, Sikkim, Mussoorie, Kangra, Khasia Hills, Nilgiris, Andamans. Type in Coll. B. M.

Section *e.*

Antennæ? The female with all the tibiæ fringed externally; second joint of palpi elongated, thickly fringed with dense scales at the back.

Entomogramma subcostalis.

Thermesia subcostalis, Walker, Lep. Het. Suppl. iii. p. 1059 (1865).

Moulmein. Type in Coll. B. M.

Entomogramma ussuriensis.

Remigia ussuriensis, Bremer, Bull. Acad. Sci. St. Pétersb. iii. p. 587.

Japan. In Coll. B. M.

Section *f.*

Second joint of palpi arched at the back, but not densely fringed as in Section *e.* Antennæ of male with short delicate ciliations; legs almost naked, the front and middle tibiæ alone being partly fringed with hair externally.

Entomogramma nigriceps.

♀. *Renodes nigriceps* (as ♂), Walker, Lep. Het. xv. p. 1595. n. 6 (1858).
♂. *Herminia? nigrifrontalis* (as ♀), Walker, *l. c.* xvi. p. 258 (1858).

Aden, Abyssinia, Sierra Leone, Natal, South Africa. Types in Coll. B. M.

Var. *pallidula.*

Renodes pallidula, Butler, Ann. & Mag. Nat. Hist. 1875, vol. xvi. p. 409. n. 91.

Natal. Type in Coll. B. M.

Entomogramma melanocephala.

Poaphila melanocephala, Hampson, Ill. Typ. Lep. Het. viii. p. 82, pl. cxlvi. fig. 9 (1891).
Var. *Poaphila marmorea,* Hampson, *l. c.* fig. 7 (1891).

Nilgiris. Types in Coll. B. M.

Entomogramma fuscescens.

Thermesia fuscescens, Walker, Lep. Het. Suppl. iii. p. 1054 (1865).
Thermesia obumbrata, Walker, *l. c.*
Thermesia morosa, Walker, *l. c.* p. 1055 (1865).
Scambina? larvata, Walker, *l. c.* p. 1119 (1865).

Natal (*Gueinzius*). Types in Coll. B. M.

Entomogramma enervis.

Phurys enervis, Swinhoe, Trans. Ent. Soc. 1890, p. 231. n. 352, pl. viii. fig. 8.

Rangoon. Type in Coll. B. M.

Section *g*.

Female with the second joint of the palpi broadly fringed both in front and at the back with compressed hair-scales, giving it a wedge-shaped form.

Entomogramma obliqua.

Phurys obliqua, Moore, P. Z. S. 1867, p. 80.

Burma and Sikkim. In Coll. B. M.

Section *h*.

Second joint of palpi in male broadly fringed and compressed.

Entomogramma oblita.

Thermesia oblita, Moore, Descr. Ind. Lep. Atk. ii. p. 176 (1882).

Khasia Hills and Chinn Hills. In Coll. B. M.

Mr. Hampson also refers the *Thermesia rivulosa* of Walker to *Entomogramma*; but I think it differs so considerably as hardly to warrant its being considered a section of this genus. Both sexes have the third joint of the palpi extremely short, much more so even than in *E. pardus*; the legs are rather more hairy than in Sections *f* and *g*; the antennæ of the male are densely but finely fringed on the inside with short ciliations, and at regular intervals emit single longer hairs on both sides; the secondaries of this sex also have the abdominal border expanded and broadly fringed with long hair towards the base. The button-like third joint of the palpi in both sexes redeems this genus from the charge of being based solely on secondary sexual characters, and therefore I propose to call it *Blasticorhinus*.

XIII.—*Notes on some Mexican* Coccidæ. By T. D. A. Cockerell.

Having recently had occasion to travel through Mexico, I was naturally anxious to collect as many Coccidæ as I could, having paid much attention to that group of late. The Coccidæ of Mexico, so far as I can find them recorded, number fourteen species, and to these twelve more can now be added, making twenty-six altogether.

Arriving at Vera Cruz on May 7, the first Coccid I saw was *Aspidiotus ficus* on an orange on the table at the hotel. In the hotel were several plants growing in large pots, and an examination of these yielded *Aspidiotus ficus*, *Lecanium hesperidum*, *L. terminaliæ*, and *Planchonia pustulans*. Towards evening I had an opportunity to go out into the plaza, and almost immediately came across a beautiful bright yellow *Pulvinaria*, a new species, on *Croton*. Further search led to the discovery of *Orthezia insignis* and *Aspidiotus articulatus*.

The next day we took the train to the City of Mexico. While the train stopped at Soledad, in the State of Vera Cruz, I ran out and picked a few leaves, on which I found *Aspidiotus articulatus* and an interesting new species of the same genus. It was quite evening when we arrived at Mexico City; but, strolling out, a few small specimens of a *Dactylopius* were found on a tree in one of the streets. The next day the same species occurred on two or three trees in front of the cathedral, and I was so fortunate as to get adults, both male and female, which on examination showed the species to be undescribed. At the same place *Lecanium oleæ* was common on many trees, and in the gardens of the public library I found *Lecanium hesperidum*.

The two following days were spent in travelling, and, although a good look-out was kept at the stations, no Coccidæ were found. At about 2 a.m. on May 12 we were suddenly awakened by a sharp shock, and the train came to a standstill. It proved that the engine and freight cars in front had left the rails, owing to a "wash-out," and consequently we had to spend many hours in the middle of nowhere, six miles north of Montezuma R. R. Station, in the State of Chihuahua. This was a desert spot, unfavourable for collecting; but a search revealed an undescribed *Ceroplastes* on *Artemisia*. Later, while the line was being mended, they took us back to Montezuma, and here I found another *Ceroplastes*, also new.

Thus, out of twelve Coccidæ found during the journey through Mexico, five were new, equal to about 41 per cent. In the present state of our knowledge of the Coccidæ this is probably about the normal percentage of novelties obtainable on the mainland. When I went to Jamaica in July 1891 very little was known of the West-Indian species, and of seventy-five now listed thirty-three were undescribed at that time, equal to 44 per cent.

Descriptive Notes and List of Species.

(1) *Aspidiotus articulatus*, Morgan.

Vera Cruz, abundant on stems of rose; Soledad, on a tree.

(2) *Aspidiotus ficus*, Ashmead.

Vera Cruz, on an orange and on stem of rose-bush.

(3) *Aspidiotus scutiformis*, sp. n.

Soledad, on leaves of a tree somewhat resembling those of an Avocado pear, with *A. articulatus*, *Aleurodes* sp., and black ants.

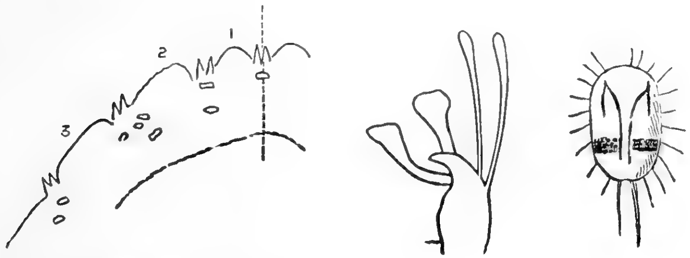
♀. *Scale* very flat, circular or suboval, with the (covered) exuviæ placed a little to one side. Diameter of scale about $2\frac{1}{2}$ millim. Colour dull brown-black, with the margin whitish; exuviæ large, pale orange, more or less shiny, not nipple-like. One scale shows ten parasite-holes, five on the exuviæ and five on the scale; another shows twelve holes, six on the exuviæ and six on the scale. Twelve seems a large number of parasites to have emerged from a single *Aspidiotus*.

♀. Broad pyriform. General colour pale orange; lobes yellow. No grouped glands seen. There are three pairs of lobes, the middle pair distinct and rounded, not close together, being separated by a pair of spine-like plates; second and third pairs of lobes flattened and elongate, the second pair crenate. A pair of spine-like plates between the first and second and second and third pairs, and also beyond the third pair. Beyond third pair of lobes the margin is wavy, due to the presence of six broad rudimentary lobes, with more or less rudimentary spine-like plates between them. The last of these lobes is a little more produced than the others. Beyond this the margin is straight, with single spines or hairs at moderately long intervals. Between the lobes are very long narrow saccular incisions.

Larva broad, oval, yellowish. Legs (at least the hind ones) with knobbed digitules and tarsal hairs. The digitules of claw short, the knobbed hairs of tarsus long and stout, reaching considerably beyond the end of the digitules. The larva shows only four lobes (two pairs). Median ones large and prominent; next pair almost rudimentary. Beyond the second lobe are about four scaly bifid plates.

This species has some superficial resemblance to *A. ficus*, but is actually very distinct. Structurally it seems rather nearly allied to *A. smilacis*, Comstock.

A. B. C.



A.—*Aspidiotus scutiformis*; lobes of ♀.
B.—*Pulvinaria lutea*, ♀; foot.
C.—*Dactylopius mexicanus*, two-thirds grown; diagram of markings.

(4) *Planchonia pustulans*, Ckll., var.

Vera Cruz, crowded on the stems of a plant not identified.

Scales about 1 millim. diam. or rather more. These are smaller than Jamaican specimens, but I cannot find any characters that would separate them specifically.

While examining these scales I saw what looked very much like an antenna—an organ not possessed by the species of *Planchonia* when adult. It took a moment's consideration to realize that this appearance was no antenna, but a jointed hair from the host-plant! I mention this lest some future observer should be thus deceived.

(5) *Dactylopius mexicanus*, sp. n.

City of Mexico.

♀ (not adult). Body about 3 millim. long, broad, with subtruncate broad extremities; sides with many long hairs, not covered with secretion, but their bases partly enveloped in white secretion. Caudal filaments about as long as lateral and without (or nearly without) secretion; caudal filaments about (or hardly) half length of body. Body above pale yellowish grey, with mealy white secretion rather sparsely scattered all over, except where there are black markings. These black markings consist of a band passing obliquely backwards from each ocular region towards the dorsum, but instead of meeting dorsally, these bands bend and form two parallel faint dorsal bands. Each oblique band, near its origin, sends off a posterior branch, which, running along the side of the body, forms one arm of a **Y**, the other arm and the base being the oblique band. In addition to this, a short distance behind the middle, three segments are black external to the dorsal bands, together forming on each side of the back a conspicuous black patch.

♀ (adult). Body about $5\frac{1}{2}$ millim. long. General colour pale greyish, the dorsal black patches almost obsolete and the dorsal bands or lines becoming interrupted; the black **Y** alone remaining distinct. Caudal and lateral filaments or hairs without white secretion, caudal ones about (or hardly) half as long as body.

The adult is thus less conspicuously marked than those about two-thirds grown. The young, however, have the black marks nearly or quite obsolete, the white secretion tends to form interrupted dorsal and lateral keels, and the caudal and lateral filaments are broadly covered with fine white secretion, the caudal appearing rather longer than the lateral. One can only distinguish five to eight secretion-covered processes on each side, each representing more than one hair.

♂ sac (puparium) white, ordinary.

♂ (adult). Body about $2\frac{1}{2}$ millim. long. Caudal filaments 5 millim. long. Wings $3\frac{1}{2}$ millim., grey, slightly ochreous at base, veins darkened. Head, body, and legs grey, but dorsum of abdomen white with secretion. Filaments diverging, curving near their ends, conspicuously white.

All the above characters can be observed with a hand-lens.

A microscopical examination revealed the following additional features:—

♀ (adult). Legs and antennæ brown. Antennæ eight-jointed, third the longest; 4 longer than 2, 6 and 7 about equal; 5 a little shorter than 4, but a little longer than 6; 8 a little longer than 4; 1 about as long as 2. Antennal formula therefore 384 (215) (67).

Tibia longer than femur, tarsus less than half as long as tibia. Claw large.

Larva with seven-jointed antennæ, 7 longest, then 3. Tibia about one fourth longer than tarsus.

Eggs oval.

This species is somewhat allied to *D. virgatus*, Ckll., but amply distinct. It is remarkable for its large size and the **Y** markings.

(6) *Orthezia insignis*, Dougl., var.

Vera Cruz.

The specimens differ a little from those found in Jamaica, but there is nothing to separate them specifically from *insignis*.

(7) *Pulvinaria lutea*, sp. n.

Vera Cruz, on variegated *Croton*.

♀ (adult). On underside of leaves. Sacs about 10 millim. long and 4 broad, convex but depressed, of satiny texture, with nearly parallel sides. Colour bright lemon-yellow. The brown shrivelled female is largely overlapped by the ovisac, which is here plicate, with a tendency to be trifid.

Substance of body (in caustic soda) yellow; margin with large, distinct, and numerous spines. Derm with numerous tubular glands.

Legs reddish. Femur about one third longer than tibia; tarsus a little more than one third length of tibia. Claw short and curved. Trochanter with two equal strong bristles. Femur with a very stout large bristle at right angles to its surface, before its middle. In one specimen this bristle was observed to be accompanied by a smaller similar one. Tibia with a few hairs and a long bristle at right angles to its surface at the distal end. Three strong oblique bristles spring from the side of the tarsus. The tarsal knobbed hairs are very long and stout and distinctly knobbed. The digitules of the claw are immense, with very stout stalks, and broad large flattened knobs. Both digitules and tarsal hairs must be deciduous, as the first leg I examined showed none.

Egg oval, reddish (in soda).

Young larva has the claw longer and practically straight, with the usual digitules and knobbed hairs. Hind end truncate, with a cleft in the manner of *Lecanium*, and a short bristle arising from each side of the cleft.

The young exhibit the usual characters of the group—the anal cleft, the four lateral incisions, &c. The spines in the lateral incisions are short. The hairs along the margin are short, not very numerous, and show a tendency to be knobbed. The posterior cleft is open, and two bristles project from its centre. The shape of the young is elongate, with nearly parallel sides. Colour pale brown or whitish. The eyes, situated on the margin, are reddish brown. The dorsum is bluntly keeled.

I do not know any species nearly allied to this. It is easily distinguished by its bright yellow ovisac, bristly margin of the female, long femoral bristle, and the large thick digitules of the claw. It is possible that the two bristles ascribed to the trochanter are really on the distal end of the coxa.

(8) *Lecanium oleæ* (Bern.).

City of Mexico.

(9) *Lecanium hesperidum* (L.).

On stems of rose, Vera Cruz; on tree (not identified), City of Mexico.

(10) *Lecanium terminaliæ*, Ckll., var.

On leaves of a liliaceous plant, Vera Cruz.

♀ (adult). Margin with very few (simple) hairs. Derm with small circular gland-spots. Sides of scale with radiating pigment-bands. Parts of the scale and insect turn reddish purple in soda. Anal plates with their posterior external margins considerably longer than their anterior margins. Legs small; tarsus with slender knobbed hairs, knobs rudimentary; tarsus about two thirds length of tibia; tibia about three fourths length of femur.

Eggs oval, granular.

Larva with long and slender knobbed tarsal hairs, the knobs rudimentary. Femur decidedly shorter than tibia + tarsus.

L. terminaliæ was described from specimens found on *Terminalia* at Jamaica, and its occurrence on a liliaceous plant at Vera Cruz was quite unexpected, so much so that until I examined the details of its structure I did not suppose I had *terminaliæ*, but rather Signoret's *acuminatum*, which was found on orchids in a Parisian hothouse.

These Vera-Cruz *terminaliæ* were only a few feet away from a rose-bush swarming with *hesperidum*, and as one looked at them it was hard not to conclude that they were all one species, the *terminaliæ* modified by the nature of the food-plant. Yet in Kingston, Jamaica, where one finds *terminaliæ* on *Terminalia*, I have found occasionally on liliaceous plants true *hesperidum*, and not *terminaliæ* at all!

In some few respects, such as the details of the feet, the Vera Cruz specimens differ from typical *terminaliæ*; but I am certainly not prepared to make a new species out of them on these grounds. From *acuminatum* they differ in the length of the tarsus and the shape of the larva, and also in being oviparous.

(11, 12) *Ceroplastes*, spp.

These two species (one of which will probably have to be referred to a distinct genus) are held over, to be described in another article treating of the Mexican species of this genus.

Las Cruces, New Mexico, U.S.A.,
June 5, 1893.

XIV.—*Description of a new Bornean* Tupaia. By Oldfield Thomas.

Tupaia gracilis, sp. n.

Intermediate in size between the smallest species of the genus (*T. javanica, minor*, &c.) and the middle-sized ones (*T. dorsalis, picta, montana*, and others). Build slender; feet and tail long.

General colour all over above, including the head, back, outer sides of limbs, and upper surface of tail, clear finely grizzled olive, nearly uniform throughout. Shoulder-streak distinct, pure white. Under surface and inner sides of limbs dirty whitish, the throat with a strong salmon-coloured suffusion. Hind feet very narrow and elongated, recalling in their proportions those of the very much larger *T. ferruginea longipes*. Tail very long, fairly bushy, markedly distichous; its upper surface coloured like the body, although rather darker, its lower olive along the line of the vertebræ, then with a broad yellowish band on each side, outside which the hairs are finely ringed with black and yellowish.

Skull short and broad, with a particularly short and stumpy muzzle (see measurements).

Dimensions of the type (an adult male in skin):—

Head and body 165 millim.; tail 175; hind foot, without claws, 38.

Skull: greatest length, occiput to gnathion, 39·4; greatest breadth 21; nasals, length 12, breadth 5·4; interorbital breadth 12; orbit to gnathion 16·2; palate, breadth outside $\underline{\text{m. 2}}$ 12·8, inside $\underline{\text{m. 2}}$ 7·3; length of upper tooth-series 19; length of lower jaw 25·5; combined lengths of three lower molars 7·6.

A second specimen, also a male, preserved in spirit, has a trunk-length of 138 millim., with its tail 161 millim. and its hind foot 41·2 millim. in length; but the differences between these measurements and those of the skin appear to be mainly due to the difference in the method of preservation.

Hab. Apoh River, base of Mount Batu Song, Baram district, East Sarawak.

Type collected September 1891.

The typical skin of this species was obtained by Mr. A. H. Everett, and was recognized both by him and Mr. Charles Hose (who also got a specimen at the same time and place) as a different species to any previously known to them; and this opinion is quite confirmed by an examination of the Museum collection of *Tupaiæ*. There is, however, another example of it in the Museum, obtained by the Marquis G. Doria in Sarawak in 1867, and generously presented by him in 1888. This specimen I had not previously closely examined, but had supposed it to be an old individual of *T. minor*; it proves on comparison, however, to be quite similar to the example collected by Mr. Everett.

Although without any conspicuous or specially characteristic colours or markings, *T. gracilis* is readily distinguishable both by its size (in which it is just intermediate between two groups of species) and by its coloration, the only species resembling it at all in this respect being the much smaller and sharper-nosed *T. minor* and the equally larger *T. Belangeri* of Burma and the Malay Peninsula.

XV.—*The Coxal Glands of* Scorpio. By HENRY M. BERNARD, M.A. Cantab. (from the Huxley Research Laboratory).

[Plate II.]

WHILE working at the comparative morphology of the Galeodidæ, I have found it necessary to make a careful examination of the coxal glands of *Scorpio*, for purposes of comparison. Although these glands, through the researches of Lankester * and Sturany †, are already fairly well known, some points were left uncertain and vague—*e. g.*, the nature of the "medullary substance," and the question whether in adults the glands opened to the exterior. This paper embodies the definite results which I have obtained on these two interesting points.

While reserving full details of the coxal glands of *Galeodes*

* "On the Skeleto-trophic Tissues and Coxal Glands of *Limulus*, *Scorpio*, and *Mygale*," Quart. Journ. Micr. Sci. xxiv., 1884.

† "Die Coxaldrüsen der Arachnoideen," Arb. Zool. Inst. Wien, t. ix. Heft 2, 1891.

for my larger publication, it is necessary briefly to describe them here, as their arrangement throws important light on the morphology of the coxal gland in *Scorpio*. A long coiled tube opens just behind the first pair of legs; it runs backwards among the muscles and nerves, free of connective tissue, then, bending forward again, ends near its external opening. The proximal end of this long duct is occasionally found expanded into a spongy mass of branching and anastomosing tubules, which join with the similar mass of tubules from the coxal gland of the other side to form a barrier across the cephalothorax. Through this spongy mass the blood, flowing backwards freely through the body, must filter. It is important to bear in mind that these tubules are simply a development of the ends of the ducts, and the whole may be dissected out free from the body without any entanglement of connective tissue or blood-vessels, which latter do not exist in *Galeodes*.

I am inclined to think that the histology of this gland is not so simple as it appears at first sight, and that Macleod's description* of it, though in the main correct, requires revision. I am not, therefore, as yet in a position to make any histological comparisons between the coxal gland of *Galeodes* and that of *Scorpio*.

The gland opens in *Scorpio*, not on the first leg, as in *Galeodes*, but in exactly the spot where I have recently shown † that the coxal gland of the Chernetidæ opens, viz. on the posterior face of the coxa of the third leg. In *Scorpio* this posterior face of the coxa of the third leg is fused with the anterior face of the coxa of the fourth leg. But this fusion is so far incomplete as to form a channel close up against the body; this channel runs forward from the external opening of the gland, so that the excretory matters find their way to the exterior between the tips of the coxæ of the third and fourth pairs of legs close to the sternal plate. In serial sections both the duct of the coxal gland, on its way to the chitinous channel thus formed by the fused coxæ, and the chitinous channel itself are very easy to find, and the fact that they have been missed by former investigators ‡ can only be explained by the frequent tearing of the sections by fragments of hard chitin.

Plate II. fig. 1 shows the chitinous channel in section, while figs. 2 and 3 show the connexion of the duct of the coxal gland with this channel.

The duct of the gland is much coiled and forms a compact

* Bull. Ac. Bruxelles (3) t. viii., 1884.

† Journ. Linn. Soc., Zoology (in press).

‡ Quart. Journ. Micr. Sci. xxiv. p. 154.

mass bound together by connective tissue. The walls of the duct are bulged out to form what look like short branches, but which are in reality only pocket-like outpushings. A large nucleus lies in each pocket.

The cells of the duct are no longer demonstrable as simple cells; their outermost portions are arranged in strands of staining protoplasm and clear matter. Lankester has suggested that these clear striæ might be tubes; but I think it more probable that they are inflowing streams of the excretory matter. This excretory matter, after passing through the outer portions of the cells, seems to be absorbed by the nuclei, which swell enormously and bulge out the wall of the duct as above described. In this swollen state they no longer take stain, but are large clear vesicles which are detached into the lumen of the tube, where they finally break down. Besides these enormous nuclei (21 μ in long diameter), others of all sizes are found, some comparatively small (12 μ), with deeply-staining chromosomes. Although I have found no traces of dividing nuclei—dividing *i. e.* in order to replace those which are cast off—Lankester has a figure * of the coxal gland of *Buthus cyaneus* in which the nuclei are obviously dividing. Between the nuclei and the lumen of the tube there is a very thin layer of staining and apparently undifferentiated protoplasm.

While in *Scorpio* the nuclei appear, as above described, to absorb the excretory matter and to be cast off, in *Galeodes* this matter is apparently collected in vacuoles of the cytoplasm, which are then detached and fill the lumen of the duct with clear round vesicles. The detachment of the nuclei in *Scorpio* has been mentioned by Lankester and Sturany; but both seem doubtful whether this may not be due to the preparation of the sections. Fig. 2, however, shows a portion of the duct in which there are more detached nuclei in the lumen of the duct than could have been derived from the wall, where, indeed, the nuclei are still found *in situ*. Further, the different character of the nuclei (the solid staining and the large clear vesicular nuclei) seems to have escaped observation. The latter alone are found free in the lumen of the duct. This remarkable function of the nuclei, as to the correctness of which I think there can be little doubt, deserves further investigation.

This highly differentiated duct terminates, as is sometimes the case in *Galeodes*, in a sponge-like system of branched tubules. This mass of tubules does not, however, develop freely among the tissues of the body as in *Galeodes*, but is gathered together into a compact mass, round which the main

* Quart. Journ. Micr. Sci. xxiv. pl. xii. fig. 5.

duct above described coils. These tubules are bathed in a blood-stream, which is brought by a special vessel which arises from that accompanying the nerve running into the third leg. The blood is conducted by this vessel between the anterior layer of the coil of the coxal gland, and is then discharged freely among these end-tubules. The histology of these tubules differs considerably from that of the main duct. The epithelium lining the tubules in *Scorpio* is apparently discontinuous, the cells, containing large nuclei, being irregularly scattered upon the membranous wall of the tubule (figs. 4 and 5). This mass of tubules with the blood-spaces between them has been called by Lankester the "medullary substance." This name, while it applies perhaps to the state of the end-tubules figured by him, which must represent that of a very young specimen, is totally inapplicable to the adult condition. That this part of the gland happens to be medullary at all is simply due to the coiling of the main duct around its proximal branched portion. In the Chernetidæ we also have the proximal end of the gland surrounded by the coils of the duct; but there are no branching tubules such as we find in *Galeodes* and *Scorpio*.

No one can examine these end-tubules of the coxal gland of *Scorpio* without being reminded of the end-saccules to the antennal and shell-glands of the Crustacea. Sturany suspected that these tubules represented a typical end-saccule, but was unable to prove it. Perhaps I have been more fortunate in my sections; working from before backwards, it is easy to find in the anterior sections the blood-spaces in connexion with the blood-vessel above described. The actual opening of the blood-vessel into the blood-spaces is much disguised by a peculiar group of cells (Pl. II. fig. 4, *c*), between which the blood seems to flow. In these sections the blood-spaces are more conspicuous than are the tubules. In the posterior sections the connexion between the main duct and the tubules is also easy to find (fig. 5).

The transition between the scattered epithelium of the end-saccule and the specialized striated epithelium of the main duct I have endeavoured to show in fig. 5.

The presence of typical end-saccules at the proximal ends of the coxal glands of *Galeodes* and *Scorpio* has an important bearing on the morphology of the antennal and shell-glands of the Crustacea. In the first place, it is difficult to doubt that these are all homologous structures; the extraordinary histological likeness between the main ducts and their common development of end-saccules seems to me to render the homology almost certain. The great importance of this homology, however, lies in the fact that the end-saccule in the Crustacean gland would then be, what it clearly is in *Galeodes*, a development of the proximal end of an originally simple tubule, and not, as is often suggested, a modified portion of a primitive cœlom.

The establishment of this point would be one more argument in favour of my view that the antennal and shell-glands of the Crustacea are probably derivations of acicular or setiparous glands*. It is interesting to note that a similar suggestion had already been made by Eisig † with regard to the origin of the coxal glands of the Arachnids.

In both cases (*i. e.* in Crustacea and Arachnida) we should then have setiparous glands gradually specialized for excretory purposes as the primitive nephridia became specialized into genital ducts. The extreme plasticity of the setiparous glands is well known—slime-glands, spinning-glands, and poison-glands being generally deduced from them; further, tracheal invaginations and salivary glands may also with great probability be traced back to them. That some of them should have become specialized for excretion is not improbable.

Without enlarging any further on this suggested derivation of the antennal and shell-glands of the Crustacea and the coxal glands of the Arachnida from setiparous sacs, I should like to point out a remarkable physiological connexion which appears to exist between the different kinds of Arachnidan glands. *Galeodes* has no spinning- or poison-glands, but highly developed coxal glands and Malpighian vessels. *Scorpio* has well-developed stinging-glands, which, however, are but occasionally employed, and well-developed coxal glands and Malpighian vessels. The Chernetidæ have very large true spinning-glands and modified spinning- (cement-) glands, which are periodically developed. They have, further, coxal glands, but no Malpighian vessels. In these animals we have to bear in mind that the spinning- and cement-glands are not always functional, so that some purely excretory apparatus for the direct removal of waste products is required during those times when these excretory matters are not being utilized for the formation of silk or cement.

In the Araneidæ we have, as a rule, a perennial flow of silk and a consequent degeneration of the purely excretory glands. The coxal glands have, as a rule, degenerated, while the Malpighian tubules no longer come in contact with the blood-stream, but ramify through the peritoneal cells which bind the numerous diverticula of the mid-gut into a solid mass,

* 'The Apodidæ' (Macmillan, 1892).

† Eisig, 'Die Capitelliden des Golfes von Neapel' (1887).

often erroneously called the "liver." The Malpighian tubules have here, as it appears to me, become specialized for the removal of fæcal matter from the tips of the diverticula*. In this case the waste products appear to be entirely used up in the formation of silk.

We find, then, a distinct physiological connexion between the purely excretory glands and the silk-glands; when the latter are well developed, the former tend to atrophy or to become specialized for other functions, and, on the other hand, when there are no glands for using up the waste products the purely excretory glands are well developed. This physiological relationship need not necessarily imply any homology between the spinning- and poison-glands, on the one hand, and the excretory glands (coxal glands and Malpighian vessels) on the other. At the same time the common derivation of all these glands from setiparous sacs would render such connexion very natural.

EXPLANATION OF PLATE II.

Fig. 1. A transverse section of *Euscorpio italicus,* passing through the tip of the coxa of the fourth leg, c_4. c_3, coxa of third leg, the posterior face of which is fused with the anterior face of c_4, leaving, however, an open channel, *ch*; *en*, endosclerite; *n*, nerve to the third leg (the accompanying blood-vessel gives off a branch, *b*, to the coxal gland); *sp*, sternal plate.

Fig. 2. A few sections further back, showing the part of the duct (*d*) leaving the chitinous channel (*ch*), and the blood-vessel (*b*) running backwards. The coil of the coxal gland is also cut through tangentially; nuclei in various stages of vesiculation are found, the largest and most vesicular being detached.

Fig. 3. A portion of the cuticle of *Palamnæus Thorellii*, Pocock, macerated in caustic potash, showing the posterior face of the coxa of the third leg seen from within. *ma*, chitinous attachments for muscles; *ch*, the channel between c_3 and c_4'; *d*, chitinous intima close to the aperture of the duct; *sp*, portion of the sternal plate.

Fig. 4. Anterior section through the end-saccule (the so-called "medullary substance"). The clear portions are the blood-passages, the dotted parts are the tubules of the end-saccule. The opening of the blood-vessel is marked by a curious aggregation of cells (*c*) (? Sturany's "Blutzellen") between which the blood flows.

Fig. 5. Posterior section through the end-saccule, showing that the latter is but an expansion of the coiled duct. Between the scattered epithelium of the end-saccule and the highly specialized epithelium of the coiled duct occurs a short band of epithelium apparently quite undifferentiated.

Fig. 6. Diagram of the gland, showing the special blood-vessel discharging its contents among the tubules of the end-saccule. Lettering as above.

---

* "Notes on some of the Digestive Processes in Arachnids," Journ. R. Micr. Soc. (in press).

XVI.—*On the Nature of "Hæmapophyses," in reply to some Criticisms of M. Dollo.* By G. A. Boulenger.

In two papers published in the 'Bulletin scientifique de France,' xxiv. 1892, of which extracts have been kindly sent me by the author, M. L. Dollo has endeavoured to show that his maxim, "Chez tous les vertèbrés, les côtes sont homologues aux côtes et les hæmapophyses aux hæmapophyses," being true, the views I have expressed as to the nature of the Reptilian chevrons are necessarily incorrect. I fear my friend lets himself be carried astray by theories which, however fascinating they may appear when treated in the talented manner with which all readers of his works are familiar, are, in this special case, unsupported by facts. I maintain that there is not at present the slightest evidence that the chevrons are homologous throughout the Vertebrata, as my critic will have it. An examination of the vertebral column of *Amia* suffices to show how, in that type, the true ribs gradually converge ventrally towards the caudal region, and do duty for the "hæmapophyses." The embryological researches of C. Scheel (Morphol. Jahrb. xx. 1893, p. 1) also prove that in the Teleostei the hæmapophyses are formed by the parapophyses or parapophyses and ribs. It further appears to me that M. Dollo, when writing on the subject, had not present to his mind the multitudinous modifications of the vertebral column of Teleosteans, for I cannot see how his account of the relations of the ribs and hæmal arch can be reconciled with the structure of such a well-known type as the typical Scomberoids, Mackerel or Tunny.

I here quote Cuvier on the Mackerel :—" L'épine a trente et une vertèbres, ... Les apophyses transverses forment l'anneau [hæmapophysis] dès la dixième. Elles ont d'abord deux côtes de chaque côté, partant du même point ; ensuite les côtes se séparent un peu. Les supérieures, plus courtes, durent jusqu'à la dix-huitième vertèbre ; les autres, plus longues, cessent dès la treizième." Hence we have on one and the same vertebra (10th to 13th) the two ribs, assumed by M. Dollo to represent the true rib and the hæmapophysis, in addition to the hæmal arch.

A further argument against M. Dollo's theory of the homology of the hæmal arch throughout the Vertebrata is derived from the fact that in certain Cyprinoids the anterior thoracic vertebræ possess a ventral arch enclosing the aorta. This arch is pronounced by Scheel to be formed by mere fibrous processes of the centrum, and to be homologous with the chevrons of Urodele Batrachians.

I therefore conclude that the hæmal arch is not homologous throughout the Vertebrata, as it may be formed by the ribs alone (*Amia*), by the parapophyses or parapophyses and ribs (*Teleostei*), or by mere ventral processes of the centra or intercentra; that the "hæmapophysis," as an element, does not exist; and that the interpretation I have given to the chevrons of Reptiles is correct.

XVII.—*On the Tadpole of* Pelobates syriacus, *Boettger*. By G. A. Boulenger.

Among some Batrachians from Syria which their collector, Professor J. Barrois, has kindly sent me, were four large tadpoles, which I should have pronounced as of *Pelobates fuscus*, were it not for the locality whence they were procured—the immediate environs of Damascus. Now, the *Pelobates* of Syria which, in its perfect condition, stands much nearer to *P. cultripes* than to *P. fuscus*, has recently been described by Dr. Boettger under the name of *P. syriacus*; and I therefore feel justified in applying that name to these tadpoles, although I am unable to point out any character of importance by which they are to be distinguished from the common species, *P. fuscus*.

The nostrils are equally distant from the eyes and the end of the snout; the distance between them equals one half the interocular width, which equals once and a half to once and two thirds the width of the mouth. The tail is nearly thrice as long as deep, acutely pointed, once and two thirds to twice the length of the body. The beak and lips agree entirely with *P. fuscus*.

The largest specimen measures 120 millim. Length of body 42, width of body 25; length of tail 78, depth of tail 28.

I may add that I have received from Prof. R. Collett a young specimen of *P. syriacus*, stated to be from Smyrna.

XVIII.—*Notes on the Changes of Plumage in the Red Grouse* (Lagopus scoticus). By W. R. Ogilvie Grant.

So many books have been written on British Birds that it seems curious any new facts regarding the sexual differences or changes of plumage in our common species should still remain unrecorded or only imperfectly described.

Some time ago, in two articles published in the columns of the 'Field' (21st Nov., 1891, and 9th April, 1892), I pointed out that the true sexual differences in the plumage of the Common Partridge (*Perdix perdix*) had been entirely overlooked, and that the chestnut horseshoe mark on the breast, generally supposed to be a distinctive character between the male and female, was of little or no value, being largely developed in the great majority of young female birds of the year. The only reliable character for distinguishing the sexes was to be found in the markings of the lesser and median wing-coverts. The *longitudinal* buff shaft-stripe in these feathers is well defined in both sexes, but the females have the ground-colour blackish *transversely* barred with buff, while in the males (except in the feathers of the first plumage) these markings are always absent, and the whole feather is sandy buff, finely mottled and vermiculated with blackish, and blotched with chestnut on one or sometimes on both webs. Very young males in the first plumage resemble the female, but the chestnut-blotched lesser wing-coverts of the adult plumage are among the first to appear, so that one can easily distinguish the two sexes at a very early period of their existence.

During the preparation of the twenty-second volume of the 'Catalogue of Birds,' I have been enabled, through the kindness of numerous friends, to add enormously to our series of British game birds, so that, at the present time, the British Museum series of *Perdix perdix* and *Lagopus scoticus* are fairly complete. In the present note I wish to submit some extremely interesting and important facts concerning the latter species, the like of which, so far as I am aware, are without parallel in ornithology. My present remarks are the result of nearly a year's careful study of the changes of plumage in the Red Grouse, during which I have gradually obtained from various sources the necessary specimens representing the different male and female plumages throughout the entire year.

When I first examined our very incomplete series, I had little doubt that my present conclusions were correct, but the chain of evidence was then too incomplete to speak with the absolute certainty I can at present.

Mr. J. G. Millais (Game Birds and Shooting-Sketches, pp. 69, 70 [1892]) gives a most excellent and complete account of the various changes of plumage undergone by the Ptarmigan (*L. mutus*) during each month of the year. These changes are of three kinds:—firstly, those caused by three distinct partial moults, which occur in spring, autumn, and winter in both male and female; secondly, those produced by a change of pattern in the feathers themselves, which is accomplished without any moult; thirdly, those arising from the wearing-off of the tips and fading of the colour.

Mr. Millais speaks of the changes in the Red Grouse as being coincident with those of the Ptarmigan, but this is not really the case.

There can be little doubt that our Red Grouse is merely an insular form of the Willow-Grouse (*L. lagopus*), and that the protective white winter plumage, being no longer a necessity, has been gradually dropped. The Willow-Grouse, like the Ptarmigan, has three distinct partial moults during the year, and one would naturally suppose that in the Red Grouse the white winter moult common to both sexes was the one which had been omitted, but this is only the case with the female.

Lagopus scoticus is subject to great variation, and before attempting to give any description of the different plumages I must state that in the male three distinct types of plumage are recognizable—a *red* form, a *black* form, and a *white-spotted* form. The first of these, in which the general colour is red without any white spots, is mostly found in the low grounds of Ireland, the west coast of Scotland, and the Outer Hebrides. Of the second or black form typical examples are rarely met with, and it is usually found mixed with either the red- or white-spotted forms; but most often with both, and specimens in mixed plumage are those most commonly met with. The third or white-spotted form is spotted all over the breast and belly, and sometimes on the head and upper parts, with white. The most typical examples of this form are usually found in the high ground of the north of Scotland. In the female five distinct types are recognizable—the *red*, the *black*, the *white-spotted*, the *buff-spotted*, and the *buff-barred* forms. The first two are the rarest: the white-spotted form occurs as in the male; the buff-spotted form, which is the commonest and the one usually met with, has the feathers of the upper parts spotted at the tip with yellowish buff. The fifth or buff-barred form, which is met with in the south of Ireland, resembles in *winter* the ordinary female in breeding-plumage, and has the upper parts rather coarsely barred with buff and black.

Bearing in mind the above remarks, the changes of plumage in the ordinary forms may be briefly described as follows:—

Adult male (winter and summer plumages). General colour above black, with finely mottled bars of dark chestnut; head and neck dark chestnut; top of the head and back of the neck marked with black; feathers of the mantle, lower back, rump, and upper tail-coverts with narrow transverse bars and vermiculations of black and chestnut, the latter colour usually predominating. As is usual in this group of birds with incomplete moults, the autumn plumage is rarely completely donned, a greater or lesser number of worn summer feathers being retained. No change whatever is made in the plumage of the male, when once his winter garb is complete in October, till *after the breeding-season*; and towards the end of June or beginning of July he commences gradually moulting into his autumn plumage, which is complete by the middle of August. In summer the white spots on the underparts, if present, are much less prominent, but this is accounted for by the wearing-off of the ends of the feathers.

Adult male (*autumn plumage*). The upper parts are black, marked and spotted with rufous-buff or buff, and edged all round with paler buff; the markings are usually more or less concentric on the mantle and back, and the chest is more or less strongly barred and marked with black and buff.

In September the first feathers of the winter plumage begin to appear on the back, and the barred chest-feathers are mostly replaced by dark chestnut feathers narrowly barred with black.

Adult female (*autumn and winter plumages*). Upper parts black, with narrow irregular bars of rufous, and a buff spot at the tip of most of the feathers; chest feathers narrowly and often irregularly barred with rufous and black, and usually more or less tipped with buff. This plumage is retained throughout the autumn and winter; in early spring the feathers of the summer plumage begin to moult, and by the end of April or beginning of May the summer plumage is complete. Many of the rufous and black autumn-winter feathers, especially those of the chest, sides, and flanks, are *not* renewed, but change their pattern without a moult. Down the middle of these there first appears a buff shaft-stripe; gradually this stripe resolves itself into several spots, which spread laterally towards the margins of the feather; meanwhile the interspaces become black, and thus a black and buff barred feather is produced very similar to those which are newly moulted, but not so bright and fresh-looking.

Adult female (*summer plumage*). Upper parts black, coarsely mottled and margined with buff or rufous buff; most of the markings are more or less concentric, and the buff margins to the feathers of the back and scapulars give the bird a more or less scaled appearance; most of the feathers of the neck, chest, sides, and flanks are buff, coarsely and irregularly barred with black. In July the autumn plumage begins to appear, and is complete about the end of August or beginning of September; no further moult takes place till the following spring.

This species is distinguished from all other members of the genus *Lagopus* by having the primaries brownish black.

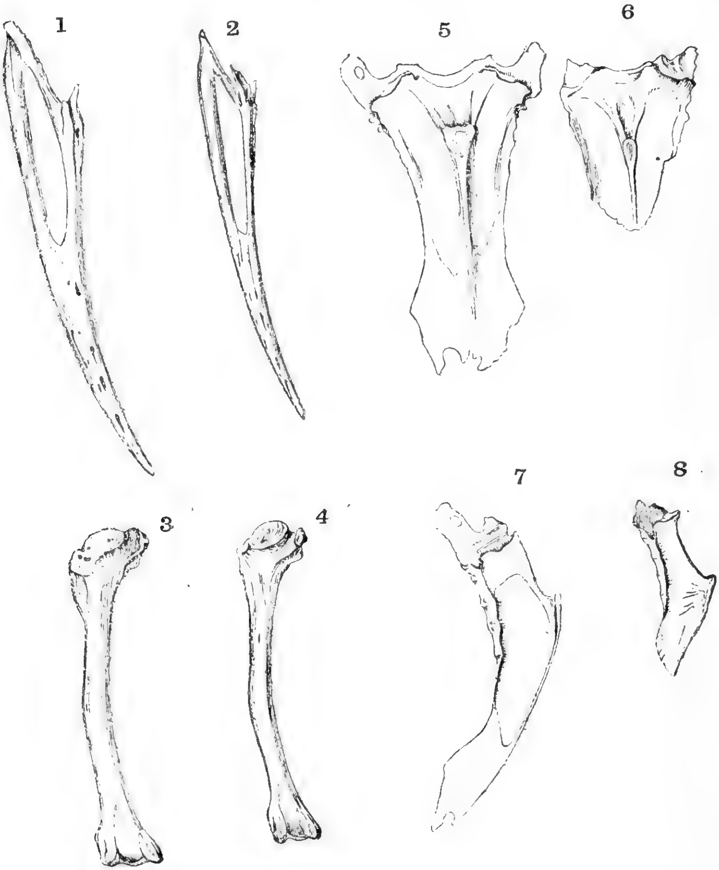
From the above remarks it will be seen that two very extraordinary facts have been ascertained beyond doubt:—

1. That the male gets no distinct *summer* plumage, but has distinct *autumn* and *winter* plumages, and retains the latter throughout the breeding-season.

2. That the female has a distinct *summer* plumage, which is complete by the end of April; also a distinct *autumn* plumage, but never assumes a distinct winter garb, retaining her autumn plumage till the following spring.

XIX.—*Note on the* Aphanapteryx *of Mauritius and of the Chatham Islands.* By H. O. FORBES.

THE importance, from the point of view of the geographical distribution of life in the Southern Hemisphere, of the accurate determination of the osteological remains discovered last year in the Chatham Islands, and of having them identified or not with the types preserved in the Cambridge University Museum, has induced me to anticipate my fuller paper on the remains of the extinct birds of the New-Zealand region, by presenting to those interested in this subject careful figures (two thirds of the natural size) of some of their more important bones. I have selected those which have been described and figured by Sir Edward Newton and Dr. Gadow in their valuable paper "On Additional Bones of the Dodo and other Extinct Birds of Mauritius obtained by Mr. Théodore Sauzier," read before the Zoological Society of London on November 1st, 1892, and about to appear in the next part of the 'Transactions' of the Society. Through Dr. Gadow's kindness in giving me a proof of this paper, to facilitate my comparison of the Chatham-Island material with the Mauritian, I am able to exhibit figures of the types of the premaxilla, the left humerus, and the sternum by the side of the corresponding bones from the Chatham Islands. The remains from the former locality are more fragmentary than those from the latter. Of the cranium from Mauritius no more, with the exception of the mandible, is known than is shown in fig. 2. Several of the skulls of *Aphanapteryx Hawkinsi*, on the other hand, are absolutely complete except for their pterygoid bones, which have not yet been found. I have figured (fig. 1) therefore only the portion of *A. Hawkinsi* corresponding to that known of *A. Broecki.* It will be observed that, except in size, the premaxillæ in the two forms agree very closely together. The same, indeed, may be said of the humeri. The humerus of *A. Hawkinsi* (fig. 3) differs from that of *A. Broecki* (fig. 4)



only in being somewhat larger and stouter. The sternum of the former (figs. 5 and 7, in its ventral and lateral aspects respectively) is much more perfect than that of the latter, whose anterior lateral processes and posterior portion (figs. 6 and 8) are all wanting.

I think it will be generally conceded by those ornithologists who compare the four pairs of drawings here given that they present no characters by which the Chatham-Island bones can be generically distinguished from the Mauritian, and that they both belong to the same genus, *Aphanapteryx*, though perhaps they may constitute two species.

BIBLIOGRAPHICAL NOTICE.

Wild Spain (España agreste): Records of Sport with Rifle, Rod, and Gun, Natural History and Exploration. By Abel Chapman and Walter J. Buck. London: Gurney and Jackson, 1893.

No reader will close this book without admitting that it is at least the production of authors who are thoroughly conversant with their subject; and that is a great deal more than can truthfully be said of a large number of works on Spain, many of which are made up of the grumbles or the gushings of the very ordinary tourist, with descriptions—compiled from guide-books—of the principle antiquities and utterly impossible versions of bull-fights. There is no padding of that kind in the present work; no cathedral or picture-gallery is ever mentioned; and it is much if the word "railway" occurs incidentally, although in travelling from the great plains to the south of Seville or the Sierra Nevada—beloved of the ibex—to the snows of the Sierra de Gredos and the trout-streams of Biscay, railways are useful accessories. This sketch of *España agreste*—rural, sport-affording Spain—is redolent of the keen air of the mountains, the indescribable freshness which, even in the heat of summer, is wafted across the *marisma,* and the spicy resin-laden odour of the *pinales*; and, as such, it will commend itself to every true lover of nature. To many of our readers Mr. Chapman is already known by his 'Bird-life on the Border'—which we noticed favourably about four years ago—and his excellent articles on the ornithology of Spain contributed to 'The Ibis'; while Mr. Buck has long been a resident at Jerez, and is one of the keenest sportsmen in the Peninsula. And they have shown no undue haste in publishing their experiences, for more than twenty years have elapsed since they commenced those sporting excursions which have extended to the present day and have resulted in the handsome and profusely illustrated work now before us.

Spontaneity and an absence of effort are noticeable features of the book, and another characteristic is the mixedness of its contents, resembling in this respect those *ollas* which are a household word in connexion with Spanish cookery. Sometimes, as in the chapters on the fighting-bull of Spain, brigandage, agriculture, and viticulture (with important observations on crops, horse-breeding, live-stock, the olive, and the vine), the gypsies, past and present, &c., we detect the preponderance of the experienced resident in the person of Mr. Buck; other chapters show joint collaboration, and it is not always easy to understand which of the partners is speaking in the first person singular; while the notes on bird-life in the *marisma* as well as in the mountains will be recognized as principally due to Mr. Chapman. Most ornithologists are aware that he was the first of our countrymen who obtained absolute proof of the manner in which the Flamingo nests, having waded under a burning sun for long distances through mud and water in order to sketch these wary birds actually sitting on their nests. That the old statement respecting the bird's position astride was an easily explained fable had for some time been the opinion of those persons who had given the matter a thought; but it was Mr. Chapman who proved the correctness of these surmises, and the accuracy of his descriptions have been corroborated by the subsequent observations made by Sir H. H. Blake, when Governor of the Bahamas. Among the happiest of the many illustrations are those relating to the flamingoes, stilts, avocets, herons, ducks, &c., which inhabit the great marshes forming the delta of the Guadalquivir, and known as the *marisma*; while the sketches of birds of prey, both in the plain and on the mountain, leave nothing to be desired. The attitudes of the vultures, whether at their nesting-places, banquets, or on the wing, are admirable; and even should exception be taken to a little hardness in plate xxv., its deficiencies from the artistic point of view may well be pardoned in consideration of the spirit and fidelity with which the evolutions of the assembling vultures are rendered. There is also an illustration of a soaring *Gypaëtus barbatus* carrying a snake in its talons; the bird passed slowly along the line of the sportsmen in the Sierra Bermeja and appeared to have about "four feet of writhing reptile" dangling beneath it. Some interesting particulars are given respecting this handsome species, persistently styled "Lammergeyer" [*sic*] by the authors, who prefer, for some inscrutable reason, a mis-spelt German word to a descriptive English term. As a rule the German name is, even when correctly spelled, somewhat misleading, for the Bearded Vulture, as we prefer to call the bird, feeds chiefly on bones (which it smashes by dropping them from a height), carrion, and—especially in India—the foulest garbage; but there appears to be strong evidence that *during the breeding-season* the bird is destructive to very young kids and lambs: while Manuel de la Torre, of Madrid, whose accuracy is unimpeachable, has actually seen one of these birds kill a rabbit. The above animals, small though they are, would probably be torn to pieces and swallowed on the spot, for we do not think that this species could carry off in its clutches anything exceeding a few pounds in weight. Moreover, *Gypaëtus barbatus* certainly has a way of coming sharply round the edge of a cliff, and that it might frighten or even knock a kid off a narrow ledge we have no doubt whatever; indeed its sudden apparition, when a man is holding on with both hands, is sufficiently startling, and under such circumstances the bird will sometimes sweep past far more closely than at other times; but we never knew it to attack anybody, or to defend its nest even when it had young.

It is impossible to refer to half the interesting points presented by this volume, but the authors' experiences with the ibex of the Peninsula deserve notice, for they are, by far, the most novel feature of the book. This ibex is quite distinct from the *steinbok* of the Italian Alps, and belongs to the group of "turs," or sheep-like goats, found in Southern Europe from the Caucasus westward. No true wild sheep, such as the moufflon, are now known to exist in Spain; and although Mr. Lydekker, to whose authority we bow, has stated that the moufflon was formerly abundant in the Peninsula, we have no knowledge of its existence within historic times further west than the Balearic Islands, and even there it has long been extinct. To return to the ibex: it is still found in some of the deep and remarkably narrow limestone gorges on the Spanish side of the Pyrenees, and in 'Short Stalks' Mr. E. N. Buxton has given a capital account of his experiences with that wily animal in some of its haunts in Aragon, which were practically, we believe, rediscovered by the late Sir Victor Brooke. From the Pyrenees we trace it along the mountains of Central Spain to the Sierra de Gredos, which forms the apex of the watershed between the Douro and the Tagus, and by a continuation of that range—known as the Serra da Estrelha—the ibex enters Portugal. South of this there appears to be a break of continuity, and when the ibex reappears in the Sierra Morena (according to the authors) and undoubtedly in the Sierra Nevada, as well as in the Sierra Bermeja overhanging the Mediterranean, it has varied so far from the northern type, *Capra pyrenaica*, that Schimper considered the differences as specific, and conferred the name of *C. hispanica* upon the southern race. From their practical and consequently valuable experiences of both races the authors are able to give us some useful details respecting the habits and haunts of these animals; from which it appears that in the higher ranges ibex never descend, even in winter, to forests or coverts of any kind; but in the Sierras of Bermeja and Palmitera, which do not exceed 5000 feet in elevation and are clothed to the summit with wood, ibex make lairs in the scrub like those of a roe-deer, and in one drive "wild goat" and wild boar were afoot simultaneously. But both races resort to the narrowest and most overhung ledges on the first alarm.

If we were writing for sportsmen we could dilate upon the chapters on "Deer driving in the Forests," "Wild-fowling in the Wilderness" both with the *cabrestos* or stalking-horses and the stanchion guns, the hunting of the grisly boar, trout-fishing in the northern provinces, bustard-shooting, and many other topics; while if we have refrained from saying anything about the wild (feral) camels of the *marisma*, it is because almost every other reviewer has, metaphorically, had a shot at them. But we think we have said enough to give a fair idea of one of the most fascinating volumes which has ever come under our knowledge.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 22, 1893.—W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

The following communications were read:—

1. "On the Microscopic Structure of the Wenlock Limestone, with Remarks on the Formation generally." By Edward Wethered, Esq., F.G.S., F.R.M.S.

Microscopic sections of limestone have been examined from May Hill, Purley, and Ledbury, and the exposures of Wenlock Limestone were visited by the Author. As a result of their study, it appears that these limestones have been deposited under varying local conditions. At May Hill, the Wenlock Limestone shows three divisions:—at the base of the quarry a massive limestone, succeeded by thin-bedded limestones separated by shales, and above these a nodular, irregularly-bedded limestone. The limestone of this district shows abundance of granules similar to Oolitic ones, and it is marked by the occurrence of *Girvanella problematica*, with new and important forms of the genus *Girvanella*.

At Purley, near West Malvern, is a section somewhat similar to that at May Hill. Pisolite has been described from this area, and the Author succeeded in finding a weathered block of limestone full of pisolites, whilst sections from the beds at the base of the quarry show them to be more or less oolitic. Amongst other *Girvanellæ*, a form occurs at Purley which has not been noticed at May Hill.

The Ledbury limestone is very different from those at May Hill and Purley. The variety of calcareous organisms which appear to have contributed to its formation is small. No sign of oolitic structure has been found here, and *Girvanella* is only represented by occasional aggregations of *G. problematica*, whilst the extraordinary number of forms obtained from May Hill and Purley shows in how great a measure the tubules of this organism have contributed to the formation of the limestones of those places.

The Author at present offers no opinion as to whether *Girvanella* is animal or vegetable.

2. "On the Affinities (1) of *Anthracoptera*, (2) of *Anthracomya*." By Dr. Wheelton Hind, B.S., F.G.S.

In this paper the Author gives the generic characters of the genera *Anthracoptera* and *Anthracomya*, and discusses their affinities. He gives reasons for supposing that the forms referable to these two genera lived in fresh water. The following species are described:—

(i) *Anthracoptera modiolaris*, Sow., *A. triangularis*, Sow., *A. carinata*, Sow., *A. quadrata*, Sow., *A. tumida*, Eth. jun., *A. obesa*, Eth. jun., *A. elongata*, n. sp.; (ii) *Anthracomya Adamsi*, Salt., and var. *expansa*, Hind, *A. dolobrata*, Sow., *A. Phillipsii*, Williamson, *A. scotica*, Eth. jun., *A. modiolaris*, Salt., *A. elongata*, Williamson MS., *A. lanceolata*, n. sp., *A. obtusa*, Ludwig, *A. angusta*, n. sp., *A. subcentralis*, Salt., *A. pumila*, Salt., *A. senex*, Salt., *A. obovata*, n. sp., *A.* n. sp., *A. Wardi*, Salt. MS.

March 22, 1893.—W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

The following communications were read:—

1. "On the Jaw of a new Carnivorous Dinosaur from the Oxford Clay of Peterborough." By R. Lydekker, Esq., B.A., F.G.S.

The Author describes a fragment of the left side of a lower jaw of a Carnivorous Dinosaur from the Oxford Clay of Peterborough, indicating a new genus and species, which he names *Sarcolestes Leedsi*.

2. "On a Mammalian Incisor from the Wealden of Hastings." By R. Lydekker, Esq., B.A., F.G.S.

In this paper a small rodent-like tooth from the Wealden of Hastings, belonging to Sir John Evans, K.C.B., is described. It is probably the front tooth of one of the mammalian genera found in the Purbeck Beds, as may be gathered from American specimens.

April 12, 1893.—W. H. Hudleston, Esq., M.A., F.R.S., President, in the Chair.

The following communications were read:—

1. "On some Palæozoic Ostracoda from Westmoreland." By Prof. T. Rupert Jones, F.R.S., F.G.S.

In 1865 the Author determined for Prof. Harkness some fossil Ostracoda which he had obtained from the Lower Silurian rocks of S.E. Cumberland and N.E. Westmoreland, and subsequently other specimens mentioned by Harkness and Nicholson in 1872. In 1891 Prof. Nicholson and Mr. Marr submitted a series of similar microzoa from the same district; and the Author now endeavours to determine their specific alliances, and revises the list of those previously collected. He has to notice about eleven forms of *Primitia*, *Beyrichia*, *Ulrichia*, *Æchmina*, and *Cytherella*—several of them being closely allied as varieties, but all worthy of study as biological groups, such as have been illustrated from other regions by writers on the Ostracoda, with the view of the exact determination, if possible, of species and genera, of their local and more distant or regional distribution, and of their range in time.

2. "On some Palæozoic Ostracoda from the Girvan district in Ayrshire." By Prof. T. Rupert Jones, F.R.S., F.G.S.

This paper aims at the completion of the palæontological account of the Girvan district, so far as the Ostracoda are concerned; and follows up the researches indicated in the 'Monograph of the Silurian Fossils of the Girvan District in Ayrshire,' by Nicholson and Etheridge, vol. i., 1880.

In about a dozen pieces of the fossiliferous shales, submitted for examination some few years ago, the writer finds nearly thirty specimens of *Primitia*, *Beyrichia*, *Ulrichia*, *Sulcuna*, and *Cypridina*, which show interesting gradations of form, not always easy to be defined as specific or even varietal, but valuable as illustrating modifications during the life-history of individuals, thus often leading to permanent characteristics of species and genera. Like those formerly described in Nicholson and Etheridge's 'Monograph,' the specimens have all been collected by Mrs. Elizabeth Gray, of Edinburgh.

3. " On some Bryozoa from the Inferior Oolite of Shipton Gorge, Dorset.—Part II." By Edwin A. Walford, Esq., F.G.S.

As we pass backward in time, the characters of the two sub-orders Cheilostomata and Cyclostomata merge. The accessory organs of the genus and species described in this paper illustrate this statement. The genus is named *Pergensia*, and the following new species are described:—*P. nidulata*, and vars. *major* and *minima*, *P. porifera*, *P. amphoralis*, *P. jugosa*, *P. bi-gibbosa*, and *P. galeata*. The genus is, however, placed in the sub-order Cheilostomata, thus recognized for the first time in the Jurassic Series.

MISCELLANEOUS.

On the Circulatory Apparatus of Mygale cæmentaria, *Walck.* By M. Marcel Causard.

The circulatory apparatus of the Araneida Tetrapneumones has hitherto been very little studied. So far as I am aware, the only authors who have dealt with this subject are Dugès, who, in the illustrated edition of Cuvier's 'Règne Animal,' has figured the heart of the mason *Mygale* (*Nemesia cæmentaria*), and M. Blanchard, who, after having briefly described the results obtained from the investigation of *Mygale* (*Theraphosa*) *Blondii*, in the 'Comptes Rendus de l'Académie,' t. xxxiv. 1852, gave a representation of the circulatory apparatus of this spider in his 'Organisation du Règne Animal' (Arachnides, pls. xv. & xvi.).

Since I had not at my disposal any of the large American species of *Mygale*, I had to content myself with our humble mason *Mygale* of Provence. In the present communication I shall concern myself only with that portion of the circulatory apparatus which is contained in the abdomen, that is to say with the heart and the vessels which open into or issue from it.

The heart of the mason *Mygale* greatly resembles that of the rest of the spiders. Enveloped by a pericardium it is situated in the dorsal portion of the abdomen, immediately beneath the integument. Its anterior region is attenuated to form the aorta, which penetrates into the peduncle and passes on to ramify within the cephalothorax. Its posterior portion exhibits a corresponding diminution in size, and then terminates with a bifurcation. In transverse section it is not circular, but shows an angle in its lower part, since the heart is as it were carinate on its inferior face. Four pairs of lateral eminences are to be observed upon this organ. The *anterior* pair, which correspond to the curvature of the heart, are but slightly marked; the following pair, which I shall call the *intermediate* ones, are much more prominent, as are also the third (*median*); finally the *posterior* pair, situated near the extremity of the heart, are much less pronounced. Each of these eight eminences is perforated by an aperture, forming a communication between the pericardiac cavity and the interior of the heart. There are accordingly four pairs of these apertures, while the Araneida Dipneumones only possess three pairs, and less in a few very rare cases. The number four has, moreover, been stated by M. Blanchard for *Mygale Blondii*. The anterior apertures are placed at the sides of the heart; the intermediate ones are a little further advanced towards the dorsal face; and, lastly, the median and posterior pairs are almost entirely dorsal, and in these cases the two apertures of the same pair are separated one from another, in the median line, only by a somewhat narrow strip of tissue. Like the corresponding eminences, the intermediate and median apertures are much more developed than the anterior, and above all than the posterior pair. The two edges of each aperture are constituted by powerful bundles of muscular fibres, which sharply define them.

According to M. Blanchard, the heart of *Mygale Blondii* is divided into five chambers. In the mason *Mygale* this division into chambers does not exist, any more, in fact, than in the Araneida Dipneumones. On examining the interior of the heart, we observe that the two lips of each aperture are turned back in such a way as to make a noticeable projection on the inside of the heart when they are applied together. The internal angles of the two apertures of the same pair are only united together, on the interior of the organ, by a slightly projecting raphe, which is produced by the muscles which encircle these orifices; on the floor of the heart a similar seam is even much less distinct. The arrangement here described is that of the intermediate and median apertures; it is even much less pronounced in the case of the anterior and posterior ones. Neither do we find the *valvular folds*, which, according to Dugès, should conceal the origins of the vessels. The heart therefore forms only a single chamber, exhibiting four enlargements.

As regards the vessels, Dugès confines himself to stating that "the heart gives off branches in front and at the sides." M. Blanchard figures four pairs of *pneumo-cardiac* vessels, which bring the blood from the lungs to the heart, and three pairs of arteries issuing from the heart. There exists only two pairs of pneumo-cardiac vessels, or pulmonary veins; these are constituted by prolongations of the pericardium. Those of the anterior pair collect the blood from the anterior lungs and open into the pericardium opposite the anterior apertures of the heart; those of the posterior pair receive the blood from the posterior lungs and discharge at the level of the intermediate apertures. Further back many prolongations of the pericardium are seen, but these only form ligaments uniting the heart to the dorsal integument.

As for the vessels which carry the blood away from the heart, we may distinguish the following. At the level of the median cardiac apertures there arises, on the inferior face of the heart, a pair of large lateral arteries which ramify abundantly and irrigate the anterior portion of the abdomen. At their origin they are separated one from the other by two hypocardiac ligaments. Below the posterior apertures there arise, like the foregoing, two other lateral arteries of rather narrow diameter, and, between the bases of these, there detaches itself from the heart a capacious trunk which takes a vertical direction. It soon gives rise behind to a branch which I consider as corresponding to the caudal artery of the other Araneida; then, having reached the upper surface of the intestine, near the posterior portion of the rectal sac, this large artery divides into two branches, which pass one to the right and the other to the left of the alimentary canal, and ramify in order to bathe the posterior region of the abdomen.—*Comptes Rendus*, t. cxvi. no. 16 (April 17, 1893), pp. 828–830.

On further Evidences of Deuterosaurus *and* Rhopalodon *from the Permian Rocks of Russia.* By H. G. Seeley, F.R.S.

The author endeavours to separate the Labyrinthodont remains, distinguished by having teeth anchylosed to the jaw, from such as belong to animals having a Theriodont type of dentition. The genera founded upon cranial fragments which show the Theriodont type are *Deuterosaurus*, *Rhopalodon*, and *Dinosaurus*. The skull in *Deuterosaurus* is described from new materials, which make known the structure of the palate and other cranial structures. The palate is of Plesiosaurian type. The back of the skull is a vertical plate, and the brain-cavity rises in a long vertical tubular mass to the parietal foramen. The quadrate bones descend below the foramen magnum in a way that is best compared with Plesiosaurs.

The articular end of the lower jaw is identified among bones figured by von Meyer.

The skull of *Rhopalodon* is nearly complete, and has a general resemblance to the skull of the South-African Dicynodont *Ptychognathus*. The orbit is defended with a sclerotic circle of bones. Whereas in *Deuterosaurus* there is only one molar tooth, in *Rhopalodon* there are apparently eight molar teeth, which have the posterior edge finely serrated.

The vertebræ are known from isolated and connected specimens which indicate a larger number than usual of rib-bearing presacral vertebræ, which appear to be not fewer than nineteen, and may have numbered twenty-six. The sacral vertebræ are deeply cupped, and the sacral ribs are developed as in *Nothosaurus* and *Pareiasaurus*. The sacral ribs form part of the articular face of the first sacral vertebra. The pelvis is imperfectly known; the ilium is not so extended as in Dicynodonts, and conforms to the type of *Phocosaurus*, which is regarded as Theriodont. The pubis and ischium are united together on the Dicynodont plan, but are only moderately developed.

The scapular arch is completely known, and is formed of scapula, coracoid, and pre-coracoid as in *Dicynodon* and *Pareiasaurus*. The humerus and bones of the fore limb were relatively short, and only fragments have been preserved which appear to be referable to ulna and radius.

The hind limb is known from several examples of the femur, which resembles that of *Pareiasaurus* in the proximal end, but at the distal end is more like the type described as *Saurodesmus*.

The tibia is known from its proximal and distal ends; it has a general resemblance to that of *Pareiasaurus*, but is more slender. These types are regarded as constituting a distinct group, named Deuterosauria, which is in many respects intermediate between the Placodontia and Theriodontia, but in skull structure appears also to approach Nothosaurs and Plesiosaurs.—*From the Proceedings of the Royal Society*, June 10th, 1893.

On a Terrestrial Leech from Chili. By M. Raphael Blanchard.

The discovery of a species constituting a transition between two groups of animals which were previously quite distinct deserves to attract in a special manner the attention of naturalists. This is why we think it our duty to report to the Academy the existence of a Hirudinean which is clearly intermediate between the Glossiphonidæ and the Hirudinidæ.

The animal in question is a land-leech, which is distributed in the south of Chili, between latitudes 40° and 43°, in the provinces Valdivia and Chiloe. In 1871 it was briefly described by Grube under the name *Hirudo brevis*; but it may be said that this author failed to recognize any of the remarkable characters which the creature exhibits and which give it a high importance from the point of view of the genetic connexion of the different species. This leech cannot be retained in the genus *Hirudo* as it has recently been defined by the investigations of Whitman and ourselves. We create for it the new genus *Mesobdella*; this name serves to recall the fact that the species which we are discussing is intermediate between two different groups. In future, therefore, it should be designated *Mesobdella brevis*, Grube.

As contracted by alcohol the animal is 16 millim. in length and 4·5 millim. in width; the posterior sucker is circular and 2 millim. in width. The body is pyriform in appearance, as in the majority of the Glossiphonidæ, but it is not so decidedly flattened as in the case of the latter. At the first glance we scarcely hesitate, however, to consider this leech as a Glossiphonid, for the regular repetition of the segmentary papillæ and of the nephridial pores on every third annulus clearly indicates that the somite is actually composed of three annuli; moreover the number of the annuli only amounts to sixty-two, and the intestine bears eight pairs of large lateral cæca, of which the last pair is continued for a considerable distance backwards.

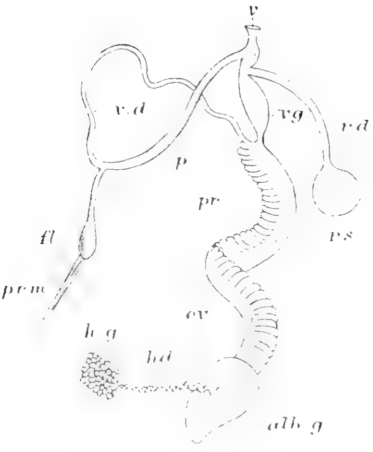
On the other hand, our species possesses ten large black eyes, the general appearance of which recalls in a striking manner those of the genus *Hæmadipsa*, the land-leeches of Malaysia; the first four pairs of eyes are still contiguous one with another, owing to the reduction of each of the first three somites to a single annulus; but the fourth and the fifth pairs are separated by one annulus, in consequence of the reduction of somite iv. to two annuli. In other words, the eyes of *Hæmadipsa* are borne by the annuli 1, 2, 3, 4, and 7, while those of *Mesobdella* are found upon the annuli 1, 2, 3, 4, and 6 *. This fact already indicates a great tendency towards the shortening of the somites. As a matter of fact the somites i.–iii. are each composed of a single annulus; somite iv. has two annuli; somites v.–xxii. possess three annuli each; somite xxiii. has two annuli; and somite xxiv., which is the last, has a single annulus. A remarkable fact is that the coalescence of the body is accentuated to such a degree that somites xxv. and xxvi., which are functionally less important than those of the anterior extremity, have disappeared without leaving the least trace behind them.

The apertures of the genital organs occupy their normal situation; the testis opens upon somite x., between the annuli 21 and 22, the ovary upon somite xi., between the annuli 25 and 26.

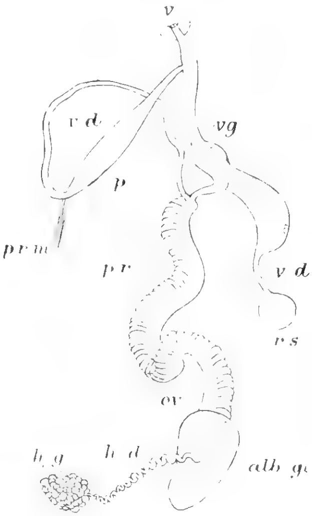
The segmentary papillæ are disposed precisely as in the Hirudinidæ; they form eight longitudinal rows on the dorsal surface, and those of the inner lateral row are in a direct line with the eyes of the last pair. This character forms a further connexion between *Mesobdella* and the Hirudinidæ. Lastly, it may be added that our species has no proboscis, but possesses three little jaws, situated exactly as in the Hirudinidæ, and each armed with from fifty-five to sixty teeth.

To sum up what has been stated: owing to its ambiguous characters *Mesobdella brevis* connects in a remarkable manner the Glossiphonidæ with the Hirudinidæ. Among the latter it is nearest allied to the Hæmadipsinæ both by its mode of life as well as by the arrangement of its eyes; but it is clearly distinguished from them, as well as from all the other Hirudinidæ, by the high degree of coalescence attained by its somites. The existence of this intermediate form shows that the two families which have here been considered are derived from a common stock, from which the Glossiphonidæ have apparently diverged less than the Hirudinidæ.—*Comptes Rendus*, t. cxvi. no. 9 (Feb. 27, 1893), pp. 446, 447.

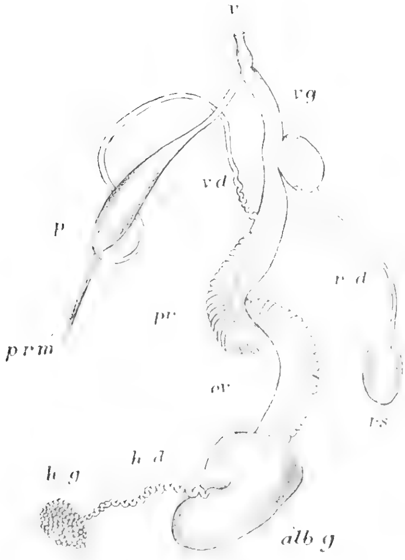
* The eyes appear to be arranged in the same manner in *Cyclobdella glabra*, Weyenbergh, from the Argentine Republic; but otherwise there is no resemblance between this species and *Mesobdella*.



1 × 2½



2 × 3



3 × 3

4 × 3.

F.W. Crispe del. ad nat.

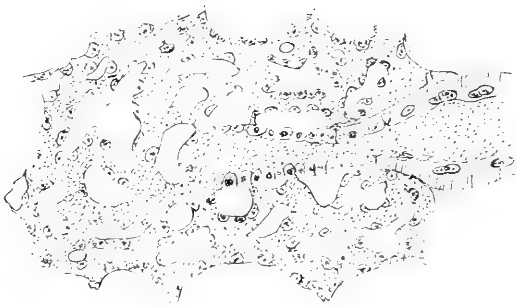
Mintern Bros. lith.

1.

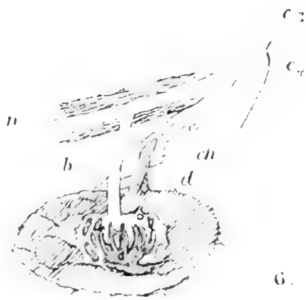
2.

3.

4.



5.



6.

H.M.Bernard del.

Mintern Bros. lith.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 68. AUGUST 1893.

XX.—*A Contribution to the Study of Neotropical Scorpions.* By R. I. Pocock, of the British (Nat. Hist.) Museum.

[Plates V. & VI. A. figs. 13–15.]

The following paper is based upon the Scorpions contained in the collection of the British Museum.

Part I.

Synopsis of the Genera of the Broteas *Group.*

a. The maxillary lobes of the second pair of walking-legs wider than the sternum; stigmata elongate; the soles of the feet furnished beneath with two series of setæ .. *Broteas*, C. Koch. Type *Herbstii*, Thor.

b. The maxillary lobes of the second pair not wider than the sternum; stigmata circular or oval.

a[1]. The lower surface of the feet studded with setæ and not compressed and spined.

a[2]. The feet short, robust, and furnished beneath with two sometimes rather irregular series of setæ .... *Broteochactus*, g. nov.* Type *nitidus*, sp. n.

* The type of this new genus is a small, dark-coloured, shining, robust scorpion from Trinidad. It will be fully described and figured in my paper upon the West-Indian Scorpions shortly to be published in the Journ. Linn. Soc. I also refer to the genus *Broteochactus* the species Karsch has described as *Chactas delicatus*.

b^2. The feet long and slender and thickly clothed beneath with irregularly arranged long hairs .... *Hadrurochactas*, g. nov. Type *Sclateri*, sp. n.

b^1. The lower surface of the feet compressed and armed with a median series of short spines.

a^3. The anteocular portion of the carapace not mesially sulcate, the ocular tubercle elongate in front, *i. e.* the sulci which embrace it laterally do not unite in front of it; lateral eyes not prominent.

a^4. The anterior border of the carapace not emarginate; the anteocular portion sloped downwards and forwards.................. *Teuthraustes*, Simon. Type *atramentarius*, Sim.

b^4. The anterior border of the carapace deeply emarginate; the anteocular portion nearly horizontal. *Heterochactas*, g. nov. Type *Gervaisii*, sp. n.

b^3. The anteocular portion of the carapace horizontal and mesially sulcate; the anterior lateral eye usually very prominent...................... *Chactas*, Gervais. Type *lepturus*, Thor.

Genus Broteas.

Broteas Gervaisii, sp. n. (Pl. V. fig. 1.)

Allied to *B. Herbstii*, Thorell.

Carapace coarsely granular laterally, the area surrounding the tubercle and the anteocular portion finely and closely punctured.

Tergites shining, smooth, but finely and closely punctured throughout, at most weakly and sparsely granular posteriorly; the last smooth, polished, and punctured in front, coarsely granular behind.

Sternites smooth, polished, densely and very finely punctulate.

Tail rather more than three and a half times as long as the carapace, like that of *B. Herbstii*, but with the inferior surface of the first segment smooth, polished, finely punctulate, with the median keels almost obsolete; the median lateral keel present on all the segments, but anteriorly abbreviated on the second to fourth and posteriorly on the fifth, the segments lower than in *Herbstii* and less strongly excavated above, with the superior intercarinal spaces more granular.

Palpi and legs smoother than in *Herbstii*, finely and closely punctured.

Pectines with 8 or 9 teeth.

Measurements in millimetres.—Total length 62, of carapace 9, of tail 37; width of first segment 5, length 3·5; width of fifth and of vesicle 3·5, length of fifth 8·8.

Two female specimens in the Museum collection ticketed "? China," a locality which is without doubt erroneous.

This species has an interesting history. On p. 232 of the Act. Mus. vol. iv., Gervais, in connexion with his description of *Broteas maurus*, refers to a scorpion in the British Museum collection which is ticketed China and is very near to his *maurus*. This scorpion, there can be little doubt, is the one that I have here described and dedicated to the distinguished French zoologist. One of the specimens bears an old label upon which is written "*Scorpio subnitens*, Gervais, MS., ? China." The scorpion figured by Prof. Lankester in the Trans. Zool. Soc. vol. xi. pl. lxxx., as *Broteas subnitens*, Gervais, is *Teuthraustes atramentarius* of Simon.

This new form *Gervaisii* may be at once recognized from the *Broteas* that I identify as *B. Herbstii* by having the lower surface of the first caudal segment smooth, polished, and with obsolete median keels. Of the last-named form the British Museum has upwards of a dozen specimens of varying age and sex from different parts of British Guiana. Upon the identity of *Herbstii* of Thorell, however, there seems to me to be some doubt. The name was applied by Thorell to the scorpion described as *maurus* of Linnæus by De Geer and later authors. But it seems to me to be very doubtful if all these authors have described the same species as *maurus*; for instance, Herbst's figure of *maurus* seems to me to represent a totally different form.

C. Koch, however, in 1838 described as the type of *Broteas* a species he named *maurus*, which came from Cayenne (French Guiana). It is highly probable therefore that this species of Koch's is identical with my examples from British Guiana, and for this reason I identify these as *B. Herbstii*, being unable to ascertain the characters of *B. maurus* of De Geer, *i. e.* the true *Herbstii*. Why Mons. Simon should assert that *B. Herbstii* comes principally from La Plata, seeing that both C. Koch and Gervais especially mention Cayenne and Guiana as localities, I am unable to surmise. According to Simon's description (Ann. Soc. Ent. Fr. 1877, p. 240) his *Herbstii* has the anterior caudal segments smooth and punctured *above* between the keels, which are almost absent on the first. If, however, in this description for *dessus* we read *dessous*, it would apply well to my *B. Gervaisii*; but as the description stands it is not applicable either to my

Herbstii or my *Gervaisii*. But in the present unsatisfactory state of our knowledge of the names of the species of the genus I do not care to propose another new name on the chance of this species of Simon's proving distinct.

As for *B. granulatus* of Simon (*loc. cit.* p. 241), a name which, by the way, this author alters into *granulosus* in the Ann. Soc. Ent. Fr. 1880, p. 382, it appears to me to indicate a form which is very doubtfully specifically distinct from my *Herbstii*, for some of the British Guiana specimens are so densely and closely sculptured with anastomosing punctures, that the whole of the upper surface is rugose.

The remaining species of the genus, *paraensis*, is unknown to me.

HADRUROCHACTAS, gen. nov.
(Pl. V. figs. 5, 5 *a*.)

Allied to *Broteochactas*, Pocock (*cf. suprà*), but differs principally in that the distal segment of the legs is elongate and thickly clothed beneath with long irregularly arranged hairs.

As additional characters I may mention that in both the species of *Broteochactas* known to me the hands are very wide and more or less compressed internally, whereas in *Hadrurochactas* they are rounded and not internally compressed.

Hadrurochactas Sclateri, sp. n.

Colour piceo-castaneous, with flavous or fusco-flavous legs and a pale line down the middle of the back.

Carapace smooth, only very minutely granular at the sides, the median sulcus deep behind the ocular tubercle and granular, shallow in front of it and smooth; the ocular tubercle deeply sulcate behind, the eyes on it separated by a space that about equals a diameter, the lateral eyes separated by a distance less than a diameter.

Tergites nearly smooth, sparsely granular behind and laterally; the last more coarsely granular and furnished with two tubercles on each side.

Sterna entirely smooth and polished.

Tail about four times the length of the carapace, very robust; segments 1–3 wider than long, the fourth as long as wide, the fifth about one fourth longer than wide, much narrowed behind; the segments also high, the height of the third being greater than its length; the superior and superolateral keels developed and denticulate, the former elevated posteriorly and terminating in an enlarged denticle, the latter strong and complete, terminating in front with a rounded tubercle and behind with an acute tooth in the first three segments; these three segments granular and obsoletely carinate laterally; the inferior and infero-lateral keels entirely absent on segments 1–4, which are smooth and polished, the fourth being merely weakly granular beneath; the fifth segment deeply excavated above and widely so behind, with elevated granular lateral edges, the lateral surface weakly granular, the lower surface thickly and coarsely granular, convex and not carinate, the lateral keels merely represented by a series of few coarser granules behind; *vesicle* depressed, narrower than the fifth segment, carinate at the side, coarsely serially but not closely granular below; a median series of small spiniform granules beneath the aculeus, the posterior of these the largest; the aculeus lightly curved from the base.

Palpi moderately robust; the humerus with its upper surface smooth, the anterior and posterior keels weak and weakly granular, the anterior surface also very feebly granular and defined below by a weakly granular keel; *brachium* smooth and rounded above and behind, its anterior surface defined by a keel above and below; *manus* wider than the brachium, smooth, rounded, not carinate, with scarcely even a trace of keel to define the hand-back; the length of the hand-back greater than the width of the hand, but less than the length of the movable digit; digits slender, moderately elongate.

Legs slender, elongate, smooth, with two spurs at the base of the feet and the distal end of the posterior surface produced into a short acute process, just in front of which there is a long series of short minute spinules.

Pectines moderately long, furnished with 10–11 teeth.

Measurements in millimetres.—Total length 26·5, of carapace 4, of tail 16, width of first caudal segment 2·8, of fourth 2·6; length of segments 1+2 3; width of the vesicle 2, width of brachium 1·3, of hand 2; length of hand-back 2·5, of movable digit 3·5.

Loc. British Guiana (*W. L. Sclater*).

Two adult female specimens.

HETEROCHACTAS, gen. nov.

(Pl. V. fig. 6, 6 *a*.)

The anterior border of the carapace rather deeply and abruptly emarginate in the middle line, with its lateral portions rounded and the anterior lateral eye scarcely at all prominent. The ocular tubercle prolonged in front almost as far as the anterior emargination; the anteocular area therefore is not mesially grooved.

This genus resembles *Chactas*, except that in *Chactas* the ocular tubercle is short and terminates in front in a point from which a deep groove runs forwards to the (usually) shallow emargination of the anterior border; the anterior lateral eyes too are generally very prominent. It also very closely resembles *Teuthraustes*, of which the British Museum has several examples, referred to *atramentarius*, from Ecuador; but in this last genus the anteocular region of the carapace is much more strongly sloped downwards and forwards and the anterior border is not or scarcely emarginate.

Heterochactas Gervaisii, sp. n.

Colour piceous, with ferruginous legs and vesicle and redder feet.

Carapace nearly as long as the first three caudal segments, nearly smooth above, somewhat thickly granular at the sides, the median sulcus not continued in front of the ocular tubercle; the anterior border somewhat deeply emarginate in the middle, rounded at the sides; the anterior lateral eye not prominent; median eyes small, separated by a distance about equal to three diameters.

Tergites nearly smooth, at most obsoletely granular, the last finely and closely granular, with two tubercles on each side.

Sternites smooth and polished.

Tail about three and a half times as long as the carapace; the anterior four segments smooth beneath and not keeled, marked with a few coarse punctures; the upper surface scarcely excavated and very feebly granular, the fourth and fifth segments entirely flat, the superior and supero-lateral keels present and finely granular, as also are the spaces between them; the tail narrowed posteriorly, the second segment a little wider than long, the third a little longer than wide, the fifth more than twice as wide as long, finely granular above, flat in its posterior two thirds, its edges squared and granular, its sides and lower surface also finely granular, with a posteriorly abbreviated weak median lateral keel and granular anteriorly weak inferior keels; *vesicle* large, higher and considerably wider than the fifth segment, granular below and at the sides, flat and sulcate above; vesicle short.

Palpi robust, not large; *humerus* granular above and in front and carinate; *brachium* not denticulate nor granular, punctured both finely and coarsely; *manus* not carinate, convex above, its width a little greater than the length of the hand-back, sculptured above with large and very fine punctures which, towards the inner edge, pass into granules; the movable digit longer than the width of the hand; a tooth on the immovable as in *Ch. amazonicus.*

Legs with minutely granular femora.

Pectines short, with only six teeth.

Measurements in millimetres.—Total length 52, of carapace 8·5, of tail 27; width of first segment 4, of second 3·5; length of second 3·4, of fifth 8, width 3; width of vesicle 3·8, height 3; width of brachium 3, of hand 6+; length of hand-back 5·5, of movable digit 8.

Two ♀ examples from Cuença, in Ecuador (*Fraser Coll.*).

Of all the known species of *Chactas*, *Heterochactas Gervaisii* comes nearest to *Ch. Whymperi*, which has the anterior border of the carapace conspicuously notched in the middle.

Genus Chactas.

The following is a synopsis of the species of this genus that are known to me. (To be used with caution.)

a. All the segments of the tail, *including the first*, furnished with the normal number of well-developed granular keels; the upper surface of the trunk and the external surface of the legs coarsely granular .... *æquinoctialis* (Karsch).

b. The lower surface of at least the first caudal segment not furnished with granular keels.

- a^1. The upper surface of the palpi and carapace coarsely granular; vesicle large, impressed below; brachium without an upper internal basal tooth; the proximal tooth on the immovable digit enlarged .... *Whymperi*, sp. n.
- b^1. The legs nearly or quite smooth externally, the vesicle less globular and not impressed below.
  - a^2. The third and fourth caudal segments clearly carinate below, the second weakly carinate; the carapace more coarsely granular at the sides; the brachium with an enlarged tooth; the immovable digit not basally dentate.
    - a^3. The upper surface of the abdomen finely and closely granular; the caudal keels stronger .... *lævipes* (Karsch).
    - b^3. The upper surface of the abdomen smooth and polished; the caudal keels weaker .... *Simonii*, sp. n.
  - b^2. The second and third caudal segments

smooth and not (or scarcely) carinate beneath; the fourth scarcely keeled, being at most weakly granular.

- a^4. The body, limbs, and tail densely and closely punctured; with a large tooth at the base of the immovable digit and no tooth on the brachium. *amazonicus*, Sim
- b^4. The trunk, limbs, and tail not densely punctured; with at most a small tooth on the immovable digit.
  - a^5. The fourth caudal segment granular beneath; the brachium with a large anterior tooth.
    - a^6. Vesicle smooth above and below; tail shorter .... *chrysopus*, sp. n.
    - b^6. Vesicle granular above and below; tail longer .... *Karschii*, nom. nov.
  - b^5 The anterior four caudal segments entirely smooth and polished beneath; the brachium with at most a small tooth.
    - a^7. The upper caudal keels very distinct and granular; the spaces between them also granular; the last tergite laterally distinctly granular; hand not keeled .... *Keyserlingii*, sp. n.
    - b^7. The upper caudal keels weak, and at most weakly granular; the last tergite also smoother.
      - a^8. The hand keeled; the superior caudal keels a little stronger and feebly granular .... *lepturus*, Thor.
      - b^8. The hand not keeled in ♀, scarcely so in the ♂; the superior edges of the anterior caudal segments smooth and rounded............ *Van Benedenii*, Gerv.

Chactas Van Benedenii, Gervais.

Chactas Van Benedenii, Gervais, Arch. Mus. iv. p. 232, pl. xii. figs. 40, 41.

The British Museum has two examples of this species, both of which were obtained in Colombia by Mons. Goudot; both are from Ibaque and both bear tickets, affixed either by Gervais or Goudot, upon which the specific names are written.

One example is a male and shows the extraordinary elongation of the palpi that Gervais has figured. The hand-back is longer than the movable digit and is more than twice as long as the width of the hand. In the female the palpi are much shorter and more robust. The carapace is minutely granular at the sides, but the rest of the trunk is entirely smooth in both sexes. The anterior four segments of the tail are smooth beneath and the superior edges are rounded and at most minutely granular. The brachium is smooth above and behind, and the manus is also smooth and only indistinctly costate. The pectines are larger in the male than in the female, and are furnished with nine teeth in both sexes. The female measures about 52 millim. in length, the carapace being 7·8 and the tail 30.

Whether or not *Chactas Fuchsii* of Berthold is the same species as *Van Benedenii* I have not been able to satisfy myself. I may point out, however, that the relative measurements of the caudal segments in *Fuchsii* apply exactly to the female of my *Van Benedenii*, and that what Berthold says of these measurements in his *Van Benedenii* is not true of mine. Moreover the median eyes in the latter are not grey, but the colour of clear amber. If, however, Berthold has correctly determined the sexes of his species, the female of *Fuchsii* certainly differs from that of *Van Benedenii* in having the finger (by which presumably the movable finger is meant) much shorter than the hand ($2\frac{1}{2}:4\frac{1}{2}$), that is, shorter by nearly its own length; and in the male of *Fuchsii* the finger is only by a third of its own length shorter than the hand. Berthold asserts, moreover, that the carapace of his species is entirely smooth, which is not strictly the case in *Van Benedenii*.

Of the meagre description of *Ch. brevicaudatus* of Karsch very little can be made. Very possibly the species may be the young of *Van Benedenii* or *Fuchsii*.

Chactas lepturus, Thorell.

Chactas lepturus, Thorell, Ac. Soc. Ital. Sci. Nat. xix. p. 266.

The specific name given to this species by Thorell was upset in favour of *Thorellii* by Karsch, who alleges that the *Scorpio lepturus* of Palisot de Beauvois is also a *Chactas*, although belonging to a different species from that which received the same name from Thorell.

Karsch bases his assertion as to the generic position of *lepturus*, Pal. Beauv., upon a specimen in the Berlin Museum, which he believes, for unstated reasons, to be Beauvois's type. It seems a pity, however, that a more favourable selection of the type was not made; for, seeing that Beauvois asserts that his species had eight eyes and his figure shows that the tail is only as long as the trunk and the carapace is as long as the anterior three segments, whereas Karsch's specimen has six eyes, with the tail nearly one third longer than the trunk (30 : 21) and the carapace shorter than the anterior three caudal segments, it is hardly likely that Karsch's belief will meet with many supporters. If the type in question is in the Berlin Museum at all, it will probably, I think, be found amongst the specimens in that institution which were identified as *Opisthacanthus elatus* (Gerv.) by Peters.

But since *Scorpio lepturus* of Beauvois, with its eight eyes, is probably not a *Chactas* at all, Thorell's name *lepturus* can stand for the species to which it was applied, with *Thorellii*, Karsch, as a synonym; while for the species of *Chactas* which Karsch described as *lepturus* of Beauvois, I propose the name *Karschii*, in memory of this author's contributions to the elucidation of the species of this genus.

The British Museum has a single specimen of a scorpion from New Granada (Colombia) which I identify as *lepturus* of Thorell. It appears to be young, since it measures only 35 millim. in length, the tail being 15·5 and the carapace just under 5; the anterior three caudal segments taken together measure 5·5.

The carapace is mostly smooth, being finely granular only at the sides; the tergites are smooth and polished, the last being weakly granular laterally, with two tubercular crests on each side.

The superior keels of the tail are scarcely developed, being represented principally by a large posterior tubercle; the supero-lateral keels, too, are weak and only very feebly granular.

The hands of the palpi are considerably longer than wide, finely granularly rugulose and carinate above.

The pectinal teeth are 7 on each side.

Chactas amazonicus, Simon.

Chactas amazonicus, Simon, Ann. Soc. Ent. Fr. (5) x. p. 384 (1880).

Described from Pevas (Peru). The Museum has two examples (♂ ♀) from Moyabamba, in the same country.

The male is considerably more granular than the female, and has a longer and stouter tail, this organ being more than three and a half times the length of the carapace, while in the female it is less than three and a half times the length.

Very characteristic of the species is the tooth at the base of the immovable digit and the notch on the movable to receive it—features which occur in both sexes. The palpi of the male do not appear to be longer than in the female.

Chactas lævipes (Karsch).

Chactas lævipes, Karsch, Mitth. Munch. ent. Ver. 1879, p. 131.

The species that Dr. Karsch described as *Broteas lævipes* is a *Chactas.* The British Museum has a single male example of it.

Chactas æquinoctialis (Karsch).

Chactas æquinoctialis, Karsch, *t. c.* p. 130.

This species, described as a *Broteas,* is also a *Chactas.* The Museum has a male example from Porto Cabello.

Chactas Keyserlingii, sp. n.

Colour pitch-black; legs, lower surface, and vesicle just tinted with ferruginous.

Carapace smooth and polished above, distinctly granular at the sides, the anterior border evidently emarginate and the longitudinal furrow deep, as long as the first and second caudal segments and one third of the third; distance between the median eyes rather greater than a diameter, that between the lateral about equal to a diameter.

The *tergites* smooth and polished, the last smooth only in front and in the middle of its upper surface, the rest being distinctly granular.

Sternites entirely smooth and punctured.

Tail weak, about three and three quarter times as long as the carapace, narrowed posteriorly, the second segment as long as wide; the upper surface of the segments smooth and sulcate in the middle, conspicuously granular (subserially on the fourth) at the sides, the superior and supero-lateral keels present and distinctly granular, as is the interval between them; the lower surface of these segments smooth and polished, the fourth only obsoletely keeled at the sides; the fifth segment more than twice as long as wide; its upper surface sulcate in front, flat behind, and in front distinctly granular at the sides, the edges rounded, granular, the lateral and lower surfaces also granular, the median lateral keel present only in front; the infero-lateral and median keels distinct and granular; *vesicle* serially granular below and at the sides and very sparsely so above, flat and sulcate above, as wide as the fifth segment.

Palpi elongate; the humerus and brachium granular and carinate, the latter with one or two small denticles above and below at the base of its anterior surface; *manus* long and slender, not twice as wide as the brachium, its width a little more than half the length of the hand-back, which itself equals the length of the movable digit; the manus convex above, not keeled, granular internally and minutely reticulato-granulate above; the digits not dentate.

Legs almost entirely smooth; the lower edge of the femora granular.

Pectines short, with 7 teeth.

Measurements in millimetres.—Total length 53, of carapace 7·5, of tail 27; width of first segment 3·4, of fifth 2·5; width of brachium 2·5, of hand 4; length of hand-back and of movable digit 7.

Loc. Colombia. Two female examples, one collected by M. Goudot, the other from the collection of the late Count Keyserling, in honour of whom I name the species.

This species is nearly related both to *Ch. Van Benedenii*, Gervais, and to *Ch. lepturus* of Thorell. From the former it may be recognized at once by having the superior caudal keels evident and denticulate, and by having the humerus, brachium, and manus and last tergite granular; moreover, in the female of *Van Benedenii* the tail is longer and the palpi are more robust, the width of the hand as compared with the length of the hand-back being as 5 : 7·3.

From the Museum example that I identify as *lepturus*, Thorell, *Keyserlingii* may be recognized by having the hand unkeeled, the palpi and last tergite more granular, the upper surface of the tail more deeply excavated and more granular, and the superior and supero-lateral keels better developed and more granular.

Chactas Simonii, sp. n.

Colour piceo-ferruginous, legs paler.

Carapace smooth on the summit of the prominences, granular over the rest of its surface, nearly as long as the anterior three caudal segments; the median eyes of average size, separated by a space that is rather greater than a diameter; the distance between the lateral eyes about equal to a diameter; the anterior lateral eye prominent.

Tergites smooth, the last finely granular, with two tubercles on each side.

Sternites smooth and polished.

Tail less than three and a half times the length of the carapace, narrowed posteriorly, the second segment as long as wide, the upper surface of the segments nearly flat and smooth, the superior and supero-lateral keels developed and granular, the former with enlarged terminal granule; the inferior lateral keels present too on all the segments, and finely granular at least on the fourth; the inferior median keels entirely obsolete on the first, just appearing on the second, still stronger on the third, plainly visible and granular on the fourth, this segment consequently having eight distinct granular keels; the fifth segment flat above behind, granular at the sides, with squared granular edges; lateral surface also granular, with indistinct median lateral keel, the lower surface with three inferior granular keels, and the intervening spaces also serially granular; *vesicle* moderately large, wider than the fifth segment, and almost as wide as the second; its height is about equal to the width of the fifth; thickly granular beneath, smooth above; aculeus more than half the length of the vesicle.

Palpi elongate; the humerus granular above, the brachium granular above, smoother behind, with a conspicuous bifid denticle above at the base of the anterior surface; *manus* rather narrow, not twice the width of the brachium, indistinctly keeled above and marked with very short series of minute granules; the length of the hand-back much greater than the width of the hand, the digits long, the basal tooth on the immovable digit scarcely larger than the rest.

Legs nearly smooth, the femora of the last pair only very weakly granular.

Pectines short, with 6–7 teeth.

Measurements in millimetres.—Total length 53, length of carapace 8·5, of tail 27, of fifth segment 7·5, width 2·2; width of vesicle 2·8; width of brachium 2·7, of hand 4·5; length of hand-back 7, of movable digit 8.

Two female specimens from Venezuela.

Chactas chrysopus, sp. n.

Colour piceo-ferruginous; legs flavous.

Carapace as long as the anterior three caudal segments, very smooth, very minutely granular at the sides; the front border with a shallow emargination; the median eyes large, the distance between them about equal to a diameter; the anterior lateral eye large and very prominent; the posterior smaller and separated from it by a distance about equal to its own diameter.

Tergites entirely smooth, the last only very minutely granular at the sides, with two tubercles on each side.

Sterna entirely smooth and polished.

Tail about three and a half times the length of the carapace, the third segment as long as wide, the first and second segments entirely smooth beneath, the third obsoletely carinate but not granular, the fourth furnished with the normal weak granular keels; the superior lateral keels present and finely granular on the anterior four segments, the superior keels present and finely granular on the third and fourth segments, but the superior edges of the first and second rounded and scarcely granular even on the second; the upper surface of the anterior three segments mesially excavated, of the fourth nearly flat, of the fifth flat behind, with rounded and only feebly granular edges, and granular on the lateral surface, where there is a trace in front of a median lateral keel, the lower surface with the normal granular keels; the *vesicle*, as wide as the fourth segment, smooth above and below, only minutely granular at the sides.

Palpi robust, the humerus, brachium, and manus finely granular above; *brachium* with a bifid tubercle on the upper edge of the inner surface at the base; the *manus* wider than the brachium, length of hand-back much greater than width of hand and nearly as great as the length of the movable digit; the *manus* convex above and almost entirely without keels; the proximal tooth on the immovable digit rather larger than the rest, but there is only a minute corresponding notch on the other digit.

Legs smooth.

Pectines with 6 teeth.

Measurements in millimetres.—Total length 43, of carapace 7, of tail 23; width of brachium 3, of manus 5; length of hand-back 7, of movable digit 7·5.

Loc. —— ? A single female example.

In some respects, such as the carination and granulation of the tail and carapace and the structure of the palpi, this species seems to approach closely *Ch. Karschii*, Pocock (*cf. suprà*); but it certainly differs in having the vesicle smooth above and below, also a very much shorter tail and a smaller number of pectinal teeth. These last two characters I might have looked upon as merely of sexual importance, were it not that the similarity in the relative measurements of the segments of the palpi points to the identity of sex between the type of *Karschii* and of *chrysopus*.

Chactas Whymperi, sp. n.
(Pl. V. figs. 7–7 *b*.)

Colour black; legs ferrugino-piceous; feet and vesicle ferrugino-flavous.

Carapace nearly as long as the anterior three caudal segments, the frontal border very distinctly emarginate in the middle, the grooves behind, in front of and at the sides of the ocular tubercle, rather deep; the whole of the upper surface studded with rounded tubercles, the median eyes small, the distance between them greater than a diameter; the distance between the two principal lateral eyes about equal to a diameter, a minute third eye situated above and behind the posterior large eye.

Tergites polished, obsoletely granular or tubercular behind, the last more distinctly granular, with two posterior tubercles on each side.

Sterna entirely smooth, punctured.

Tail rather robust, narrowed posteriorly, the segments with nearly straight parallel sides, the second a little wider than it is long, the fourth segment nearly flat above, those in front of it shallowly sulcate; the superior and supero-lateral keels strongly developed, granular, with a prominent posterior tooth; the upper surface of these segments granular at the sides, the first segment also granular in the middle; the first and second segments neither keeled nor granular below, smooth and punctured, the third also almost entirely smooth below, only very obsoletely keeled and lightly rugulose; the fourth more distinctly keeled and irregularly tubercular, with a distinct inferior lateral keel; the fifth segment flat and weakly granular above, with squared granular edges, a distinct granular median lateral keel in the anterior half of the segment, the three inferior keels distinct and subdenticulate, the spaces between them granular, the segment more than twice as long as wide; the *vesicle* large, wider than the fifth segment, smooth and mesially grooved above, somewhat coarsely punctured below and at the sides, impressed at the base of the vesicle, which is long, nearly straight, and curved in its distal half.

Palpi robust, thickly and coarsely granular above, with the normal keels developed; the *brachium* without the superior tooth on its anterior surface; *manus* robust, carinate above and below, the carinæ studded closely with granules, which extend on to the intercarinal spaces; the upper surface convex, the width of the hand almost equal to the length of the hand-back and rather greater than the height of the hand, the length of the movable digit considerably greater than that of the hand-back.

Femora of the legs finely and closely granular, the rest of the segments nearly smooth.

Pectines furnished with 5–6 teeth.

Measurements in millimetres.—Total length about 54, of carapace 8·5, of tail about 29; width of first segment 3·9, of fifth 3; width of brachium 3, of manus 5·6; length of hand-back 6, of movable digit 8.

Two female examples from Milligalli (Ecuador), collected by Mr. Edward Whymper.

Part II.

Caraboctonus, gen. nov.

(Pl. V. fig. 8.)

Allied to *Hadrurus*, and presenting all the characters of this genus, except that the lower surface of each foot is furnished with a single distally bifurcating series of close-set tufts of fine hair, each like the tip of a camel's hair paint-brush. Moreover the presence of this "scopula" is accompanied by a decrease in the size and sharpness of the inferior claw. In *Hadrurus* the inferior claw is long and sharp and the lower surface of each foot is furnished with a single series of short close-set spines.

Type *C. Keyserlingii.*

I also refer to this genus *H. charcasus* of Karsch, of which the Museum has an example from Bolivia, and a second species from Callao, which is probably synonymous with either *H. maculatus* of Thorell or *H. robustus* of Boeris. Whether or not *H. Paaschi* and *parvulus* of Karsch belong to this genus I am unable to say.

Caraboctonus Keyserlingii, sp. n.

Colour a uniform piceous, olivaceo- or brunneo-piceous tint, the legs, palpi, and caudal vesicle redder.

The *carapace* with its interocular region smooth, polished, and sparsely punctured, the rest of it thickly granular, the anteocular portion not mesially sulcate, the margin lightly convex, the posterior region deeply sulcate mesially and at the sides. The tubercle undivided, a little in advance of the middle, the distance between the eyes greater than a diameter. The three lateral eyes about equidistant from each other, the posterior much smaller than the other two, the distances between the eyes about equal to the diameter of the little one.

Tergites without keels, finely granular, the granules coarser posteriorly and along the hind margin, the last coarsely granular and indistinctly quadricostate.

The anterior sterna smooth and highly polished; the last granular, with four granular keels.

Tail robust and moderately long, a little more than four and a half times the length of the carapace, the segments with nearly straight parallel sides; the first segment about twice as wide as long, the third a little wider than long, the fourth longer than wide, the fifth less than twice as long as wide; the upper surface of the tail smooth, moderately excavated, the superior keels marked by a series of rounded tubercles, the superior lateral keel granular on the first segment, and represented on the second, third, and fourth in front by a small shelf-like process and behind by a single tubercle; the first segment coarsely granular at the sides and below, the granules on the lower surface arranged in four longitudinal posteriorly converging rows or keels; the second segment nearly smooth and polished at the sides, granular and keeled beneath like the first; the third and fourth segments smooth and polished laterally and below, sparsely punctured, without trace of keels; the fifth segment with its upper surface widely excavated behind, the sides granular in front, smooth and punctured behind, the lateral surface smooth and punctured, smooth in front, thickly punctured behind; the median keel just visible, the lateral keels absent in front, granular behind. *Vesicle* large, much wider than high, nearly as wide as the fifth segment, with a very conspicuous process on each side at the base, smooth and nearly flat above, thickly and finely granular beneath, the aculeus very short and slightly curved.

Palpi robust, of median length; *humerus* coarsely granular in front and above at the base; *brachium* above, behind, and below smooth, polished, not carinate, the anterior surface very finely granular and bounded above and below by a series of larger granules, one of which in the upper series has the form of a sharp tubercle; *manus* much wider than the brachium, rounded, entirely smooth and polished, punctured but not granular; digits short, the movable a little shorter than the carapace and a little longer than the hand-back.

Legs finely granular in front.

Pectines short, with from 10–12 teeth, with the lamellæ of the intermediate series broken up into only a few rounded sclerites.

Stigmata small and slit-like.

Measurements in millimetres of largest specimen.—Total length 55, of carapace 7, of tail 34; width of first segment 5, length 3; length of fifth 7·5, width 4·5; width of brachium 2·2, of manus 4; length of hand-back 4·8, of movable digit 6.

Loc. Coquimbo, Chili, and Brazil.

The Museum has four examples in alcohol from Coquimbo collected by Dr. Cunningham, one, ticketed Chili, in the collection of the late Count Keyserling, to whose memory I dedicate the species, and one small dry one in the Museum collection, ticketed, though I doubt with accuracy, Brazil.

One of the examples from Coquimbo has larger pectines than the others and appears to be a male; the tail of this is unfortunately gone, but the palpi show no differences from those of the adult female described.

Two others from Coquimbo and the one from Brazil are young, and it is interesting to note that in them the palpi are much yellower and the hands much thinner than in the adults.

Characteristic of this species are the granular keels upon the last sternite and upon the first and second caudal segments.

Part III.

Fam. **Bothriuridæ.**

Bothriurus bonariensis (C. Koch).

Broteas bonariensis, C. Koch, Die Arachniden, x. p. 12, fig. 762, ♂.
Broteas erythrodactylus, id. tom. cit. p. 16, fig. 764, ♀.
Chactas Haversii, Butler, Cist. Ent. i. p. 323 (1874).
Chactas literarius, id. ibid.
Telegonus vittatus, Gervais, Arch. Mus. iv. p. 227 &c. pl. xi. fig. 30.
Bothriurus vittatus, Thorell, Act. Soc. Ital. xix. pp. 168 &c.; but in all probability not synonymous with *Scorpio vittatus* of Guérin, Voyage de la 'Coquille,' Arachnides, p. 50.

This species is extremely abundant in Uruguay and Rio Grande do Sul, whence the British Museum has received upwards of fifty examples. We also have a specimen from Corrientes, and two ticketed Moyabama (Peru). This last locality, however, may be doubtful.

The colour of the adult is mostly piceous or rufo-piceous, but in the young there is a fine flavous median dorsal band and a wide longitudinal stripe on the under surface of the tail; moreover the interocular area and the legs may be fulvous.

I have never seen either an adult or a young of either sex approaching the colouring that is ascribed to *Scorpio vittatus* of Guérin. Dr. Thorell has made the same observation. This fact renders it probable to my mind that Gervais fell into error in his identification of *vittatus*.

In *vittatus* the anterior and posterior borders of the carapace and the posterior borders of the tergites are said to be black, and a similar coloration is presented by *Scorpio Gervaisii* of Guérin (Icon. Règne Animal, Arachnides, p. 10), and by

Broteas nigrocinctus of C. Koch (Die Arachn. x. p. 14, fig. 763); so that until evidence is forthcoming that these transversely banded forms, which, if conspecific, must be called *vittatus*, are the same as what C. Koch described as *Broteas bonariensis*, I think it is wiser to adopt the latter name for the species that Thorell described as *vittatus*.

The form *rugosus* described by Thorell as a variety of this species is, I think, probably a distinct species.

Bothriurus coriaceus, sp. n.
(Pl. V. fig. 12.)

♂. *Colour*: carapace blackish, clouded or variegated with ferruginous; tergites black, with a red stripe along the hinder border; tail ferruginous above, the lower surface of the segments nigro-lineate, the black lines expanding and fusing behind into a transverse vitta; palpi ferruginous; legs and ventral surface flavous.

Allied to *B. bonariensis*.

Upper surface of the trunk finely and closely granular throughout; *the sterna also closely and finely granular throughout, the anterior ones smoother; the stigmata elongately ovate.*

Tail smooth above and below, the lower surface of the first segment obsoletely keeled beneath; the superior and supero-lateral keels and the space between them granular on the first segment; the supero-lateral keels obsolete on the third, being merely represented in front and behind by a tubercle; the superior edges of the fifth smooth or granular only in front. The inferior lateral keels on the fifth are present and denticulate on the posterior two thirds of the segment, and the median keel is almost as long and also denticulate; between them on each side there is an oblique series of denticles which defines in front the posterior area; the vesicle is narrow pyriform, not depressed below, but lightly depressed above.

Palpi as in *B. bonariensis*, but with the manus a little less robust.

Pectines with from 15–18 teeth.

The first pair of feet with a single pair of spurs at the apex, the second with two pairs, the third and fourth with a median pair also.

Total length up to 48 millim.; length of carapace 6, of tail 28.

Loc. Chili.

The Museum has four examples of this species (3 ♂ and 1 ♀), two being ticketed merely Chili, the others (1 ♂ and 1 ♀) Coquimbo.

This species differs from *B. bonariensis* in very many characters, *e. g.* in having finely granular sterna, smaller and more oval stigmata, the fifth caudal segment with inferior lateral denticulate keels, at least in the posterior two thirds of the segment, &c.

It further undoubtedly differs from Thorell's *B. d'Orbignyi* (Guér.) in the keeling of the fifth caudal segment and in having finely granular sterna. I am not confident that Guerin's *d'Orbignyi* is the same as Thorell's. Guérin, however, describes his species as being *lisse et luisant* and as having twenty-six pectinal teeth. In these two particulars this form from Chili appears to differ from it.

Bothriurus Keyserlingii, sp. n.
(Pl. V. figs. 9, 9 *a*.)

Allied to *B. bonariensis.*

Carapace smooth above, very finely granular at the sides.

Tergites very finely granular, the last more coarsely so.

Tail like that of *B. bonariensis* for the most part, but slightly less robust, with the *first segment furnished beneath with four smooth and rather irregularly shaped keels*, and the posterior segment coarsely granular in its posterior half, with the area which is so clearly defined in *B. bonariensis* developed only as in *B. coriaceus.*

The *palpi* as in the female of *B. bonariensis.*

The fifth sternite of the abdomen furnished with four smooth keels.

Length about 40 millim.

A single dried (probably ♀) example in the late Count Keyserling's collection, ticketed Chili or Peru.

Most nearly related to *B. coriaceus*, which it resembles in the structure of the fifth caudal segment, but easily to be recognized by presence of four keels on the last abdominal sternite and upon the first caudal segment.

Bothriurus asper, sp. n.
(Pl. V. fig. 10.)

Young male. Colour fuscous, with a distinct median fulvous dorsal band on the tergites; the legs, palpi, and lower surface of the tail irregularly variegated with flavous spots and bands.

Carapace finely and closely granular throughout, except on the summit of the ocular tubercle, which is smooth and polished; this tubercle obscurely sulcate above; the eyes large, the distance between them being about equal to a diameter.

The whole of the exposed portion of the tergites thickly granular like the carapace, the last with two sets of larger granules on each side. The *sterna* finely and closely granular, the last without trace of keels.

Tail moderately robust, rather more than four times the length of the carapace, parallel-sided, the third segment about as long as wide; minutely and closely granular throughout; a few larger granules in the region of the superior and superolateral keels on the anterior three segments, these keels being marked posteriorly by small tubercles; the supero-lateral keel absent on the fourth segment; the sides and lower surface of the segments without keels; the fifth segment mesially sulcate, widely excavated behind; the lower surface with an obsolete median keel, the posterior semiovate area not very clearly defined, the two inwardly curved oblique series of granules not coalescing in the middle line as in *B. bonariensis*, the middle of this area tubercular. *Vesicle* flat above, scarcely granular, subserially granular below.

Palpi: humerus coarsely granular above and in front; *brachium* weakly granular above, its upper inner edge carinate; *manus* longer than wide, very finely and closely granular above and below.

Legs very finely granular externally, the penultimate segment armed with acute spines; the foot furnished beneath with a single series of long white hairs, the first not spined beneath, the rest armed with from two to three pairs of spines.

Pectines large, furnished with 20 teeth; the genital operculum acutely produced behind.

Stigmata small, ovately elongate.

Measurements in millimetres.—Total length 24, length of carapace 3, of tail 14.

A single example from Iguarassu, collected by G. A. Ramage.

Somewhat resembling *B. coriaceus* in the development of the area on the lower surface of the fifth caudal segment; but the whole animal, and especially the lower surface of the tail, is more noticeably granular, and the hairs upon the bottom of the feet are much longer.

Bothriurus signatus, sp. n. (Pl. V. fig. 11.)

♀. *Colour* brunneo-fuscous, with a pale median dorsal band; variegated with black patches, the lower surface of the trunk pale-coloured, the lower surface of the tail and of the last abdominal segment with an irregular transverse black band; the palpi reddish, concolorous or nigro-variegated.

Carapace smooth and highly polished, only very feebly granular laterally, its anterior border lightly emarginate, the ocular tubercle just in front of its middle.

Tergites polished, very finely and closely granular postero-laterally and mesially, the last furnished with four abbreviated tubercular keels.

Sternites smooth, the last with four smooth abbreviated keels.

Tail about five times the length of the carapace, parallel-sided from the second segment, the third segment a trifle wider than long, the fourth a trifle longer than wide; the upper surface of the tail smooth, the superior and supero-lateral keels present on the anterior three segments, but smooth on the second and third; the lower surface of the first furnished with four smooth keels, the internal of which are furnished with a single large setiferous pore; the second segment similarly but less strongly keeled below, the third and fourth not keeled below; the upper edges of the fifth squared granular in front, but the lower surface of the fifth with a weak median posteriorly granular keel, the lateral obliquely curved series of granules not completely circumscribing the normal area, which is granular in the middle. *Vesicle* thickly granular beneath, smooth and flat above, not quite as wide as the fifth segment.

Palpi very smooth and polished, scarcely granular, and not carinate; *manus* moderately robust, its width about two thirds the length of the movable digit, about twice the width of the brachium; the hand-back a little shorter than the movable digit.

Legs smooth and polished, the penultimate segment furnished with a few spines, the feet adorned below with a single row of stoutish curved stiff setæ, those of the first pair not spined beneath, those of the second pair having a single pair of spines, while the third and fourth have three pairs of spines.

Pectines moderately long, furnished with 12–14 teeth.

Stigmata small and oval.

Measurements in millimetres.—Total length 45, of carapace 5, of tail 25; width of second segment of tail 3; width of brachium $1\frac{1}{2}$, of manus 3+; length of hand-back 3·8, of movable digit 4·8.

♂. Distinguished by very well-marked sexual characters. The upper side of the body and palpi are not smooth and highly polished, but finely and closely granular. The tail is a little more robust and is narrowed posteriorly; the vesicle is much narrower and much smoother beneath than in the female, and its upper surface is marked by an oval depressed yellow spot. The lower surface of the last abdominal sternite and of the first and second segments of the tail is not keeled. In the palpi the humerus is more granular, the manus is much wider, its width as compared with the brachium being as $1\frac{1}{2}$ is to $3\frac{4}{5}$; and there is a strong spicular tooth on the inner side of it at the base of the movable digit.

Pectines much larger, furnished with 13–16 very long teeth.

Loc. Theresopolis (Brazil). Several specimens of both sexes.

Phoniocercus, gen. nov.
(Pl. VI. A. figs. 13, 13 *a*.)

Allied to *Cercophonius*.

The anterior border of the carapace conspicuously emarginate in the median line; the tubercle in front of the middle of the carapace and sulcate.

The median teeth on the digits of the chelæ arranged in a single series and of tolerably large size.

The lower surface of the feet not furnished with a median series of whitish hairs, as in *Cercophonius* and *Urophonius*, but naked along the middle line, and armed on each side of it with a few long setiform spines.

Phoniocercus pictus, sp. n.

Colour ferruginous, much variegated with black.

Carapace mostly blackish, variegated behind and at the sides; *tergites* with a lateral flavous patch, a >-shaped flavous mark on each side, and three flavous spots in the middle; *sterna* flavous, irregularly clouded with black; *tail*, including the vesicle, variegated above and below; *cheliceræ* black apically; *palpi* blackish, hands reddish, variegated with black lines; *legs* deeply variegated with black.

The *carapace* nearly smooth, extremely closely and finely granular in the depression below the median eyes; the longitudinal sulcus which traverses the carapace and crosses the tubercle finely granular and distinctly transversely striate; the anterior border of the carapace somewhat deeply emarginate in the middle; the ocular tubercle in advance of the middle.

The *tergites* almost entirely smooth and polished, the sixth finely granular mesially and posteriorly, the seventh very finely granular throughout, with two nearly obsolete more coarsely granular crests.

Sterna smooth, polished, punctured.

Tail less than five times the length of the carapace, moderately robust; the second and third segments wider than long, the fourth slightly longer than wide, the fifth as wide as the second; the vesicle as wide as the fifth; the upper surface mesially narrowly sulcate, finely granular on the first and second; the superior and supero-lateral keels irregularly granular; the sides of the segments also irregularly granular; the lower surface of the first smooth (with four punctures), of the second, third, and fourth rather obscurely keeled, the keels stronger on the fourth than on the third, and on the third than on the second, all of them irregularly granular or subtubercular; the fifth segment with its upper surface flat behind, the edges squared and irregularly roughened, with traces anteriorly of a superior lateral keel; the inferior lateral keels, as stated above, entirely obsolete, unless they are represented by a series of granules on each side of and close to the median granular keel; the lateral part of this segment coarsely granular; the vesicle and aculeus longer than the fifth segment and as wide, the aculeus not half as long as the vesicle, which is granular beneath.

Palpi smooth, not keeled nor granular, studded with large piliferous tubercles; *manus* wider than the brachium, rounded, subcostate, the length of the hand-back less than that of the movable digit, but considerably more than the width of the hand; the median teeth of the digits forming a single series, which is slightly curved on a level with the teeth of the external row.

Legs quite smooth; the lower surface of the feet furnished with from three to four pairs of spines, which terminate distally in longer slender hair-like points.

Pectines rather short, furnished with ten teeth; the intermediate series of lamellæ about 6 or 7 in number.

Stigmata small and slit-like.

Measurements in millimetres.—Total length 33, of tail 18, of carapace 4; width of first caudal segment 2·6, of fifth 2·2.

Loc. ——?

A single example, ticketed "? W. coast of Africa," and named *Cercophonius chilensis*, Molina, belonging to the collection of the late Count Keyserling. There can be very little doubt that this is also a Neotropical form.

Urophonius, gen. nov.

(Pl. VI. A. figs. 14, 14 *a*.)

Closely allied to *Cercophonius*.

The median series of teeth on the digits of the chelæ of larger size and set in two irregular rows.

The ocular tubercle situated in the middle of the carapace.

In *Cercophonius*, of which *squama*, Gervais, is the type, and, so far as I know, the sole representative—a species which occurs both upon the west coast of South America and in South-east Australia—the teeth of the median series are represented by a host of close-set granules, arranged apparently without order in from three to five rows; and the ocular tubercle is placed in front of the middle of the carapace.

I select as the type of this genus the species described below as *Jheringii*; but I also refer to it a specimen in the British Museum from Coquimbo which I identify as *Cercophonius brachycentrus* of Thorell.

These two species further differ from *C. squama* in having the lower surface of the tail coarsely granular beneath in front, the lower surface of the feet furnished with long white hairs, and from five to six pairs of spurs upon the lower surface of the feet of the two posterior pairs. In *C. squama* the last sternite of the abdomen and the anterior segments of the tail are not granular, and the lower surfaces of the feet in question are clothed below with short hairs and armed with only two pairs of spines.

Urophonius Jheringii, sp. n.

Colour flavous, nigro-maculate; the carapace with its anteocular portion black in the middle, flavous at the sides; the tergites fuscous at the sides, with a fuscous spot on each side of the middle line; four clearer flavous spots along the hinder border; segments of the tail irregularly fuscous above and at the sides, especially posteriorly; vesicle flavous; upper surface of the legs, cheliceræ, and palpi banded or spotted with black; digits ferruginous.

Carapace exceedingly finely granular above at the sides; the anterior border almost straight, but the posterior border with a distinct median notch; the ocular tubercle in the middle, grooved, like the area behind and in front of it.

Tergites almost entirely smooth, minutely granular laterally and posteriorly, not mesially depressed, the last with two abbreviated coarsely granular keels on each side.

Sternites smooth and polished, minutely punctulate, the last tubercular.

Tail slender, about five times the length of the carapace; the second segment as long as wide and wider than the fifth, the segments with lightly convex lateral outlines; the superior and superior lateral keels smooth and rounded on all but the first segment, where they are feebly granular or tubercular; the lower surface of the anterior three segments irregularly tubercular, the first more coarsely so than the second and the second than the third, the inferior lateral keels visible but smooth or nearly so; the fifth segment with smooth and rounded upper edges and a posteriorly flat upper surface, the three inferior keels weak anteriorly, irregularly granular in the posterior half of the segment; the *vesicle* slender, very finely granular beneath, smooth and flat above; the aculeus very lightly curved.

Palpi moderately slender, without keels and granules, marked with large ocelliform setiferous pores; *manus* wider than the brachium, the movable digit considerably longer than the hand-back, which is itself much longer than the width of the hand; the six larger teeth of the internal series separated from the smaller teeth of the median series, which are arranged in two irregular rows; the large teeth of the external series, about five in number, contiguous with those of the median series.

Legs smooth, the penultimate segment hairy beneath, spined; the last segment furnished beneath with long white hairs, this segment not spined beneath in the feet of the first and second pairs, but armed with five or six pairs of spines in the legs of the third and fourth pairs.

Pectines armed with 13–14 teeth, with the intermediate laminæ composed of about nine or ten pieces.

Stigmata small, slit-like.

Measurements in millimetres.—Total length 30, of carapace 3·4, of tail 17; width of the first segment 2·2, of the fifth 1·8.

A single female specimen from Rio Grande do Sul (*Dr. H. von Jhering*).

This species resembles *C. brachycentrus* of Thorell in having the lower surface of the anterior caudal segments thickly granular. It may be recognized by its smoothness and by the absence of granules and keels on the palpi, &c.

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. *Broteas Gervaisii*, sp. n. Foot of posterior limb.
Fig. 2. *Broteochactas delicatus* (Karsch). Foot of posterior limb.
Fig. 3. *Broteochactas nitidus*, sp. n. Foot of posterior limb.
Fig. 4. *Teuthraustes atramentarius*, Simon. Foot of posterior limb.
Fig. 4 *a*. Ditto. Carapace from above.
Fig. 4 *b*. Ditto. Carapace from the side.
Fig. 5. *Hadrurochactas Sclateri*, gen. et sp. n. Foot of posterior limb.
Fig. 5 *a*. Ditto. Carapace from above.
Fig. 6. *Heterochactas Gervaisii*, gen. et sp. n. Carapace from above.
Fig. 6 *a*. Ditto. Carapace from the side.

Fig. 7. *Chactas Whymperi*, sp. n. Foot of posterior limb.
Fig. 7 *a*. Ditto. Carapace from above.
Fig. 7 *b*. Ditto. Immovable digit.
Fig. 8. *Caraboctonus Keyserlingii*, gen. et sp. n. Foot of posterior limb.
Fig. 9. *Bothriurus Keyserlingii*, sp. n. Last abdominal somite and first caudal segment from below.
Fig. 9 *a*. Ditto. Fifth caudal segment from below.
Fig. 10. *Bothriurus asper*, sp. n. Fifth caudal segment from below.
Fig. 11. *Bothriurus signatus*, sp. n. Fifth caudal segment from below.
Fig. 12. *Bothriurus coriaceus*, sp. n. Fifth caudal segment from below.

PLATE VI. A.

Fig. 13. *Phoniocercus pictus*, gen. et sp. n. Dentition of digit.
Fig. 13 *a*. Ditto. Foot of posterior limb.
Fig. 14. *Urophonius Jheringii*, gen. et sp. n. Dentition of digit.
Fig. 14 *a*. Ditto. Foot of posterior limb.
Fig. 15. *Cercophonius squama* (Gerv.). Dentition of digit.
Fig. 15 *a*. Ditto. Foot of posterior limb.

XXI.—*Descriptions of Twenty new Species of Terrestrial and Fluviatile Mollusca from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plate III.]

IN the following paper, the seventh of a series of contributions towards the elucidation of the South-African Molluscan land-fauna, we deal more particularly with new forms of the genus *Ennea*, which are, critically speaking, more than usually attractive, presenting as they do so increasingly numerous an assemblage of nearly allied though apparently distinct species.

1. *Helix* (*Macrocyclis*) *Quekettiana*, sp. n. (Pl. III. fig. 1.)

H. testa ampla, profunde umbilicata, depresso-conoidali, olivaceo-cornea, subpellucida; anfractibus quatuor, longitudinaliter arcte obliqui-liratis, liris sericatis, anfractu ultimo rapide et effuse accrescente, ad basin lævi, viridescente nitidissimo; apertura effuso-lunari, labro simplici, ad marginem columellarem paullum reflexo.

Long. 18, lat. 30 mill.

Hab. Pietermaritzburg (*J. F. Quekett, Esq.*).

A very handsome addition to *Macrocyclis*; much of the same build as *bullacea* (Pfr.), but larger and in every way a more striking species.

Three specimens, in magnificent condition.

The colour olivaceous horny, subpellucid in texture, in form effuse and depressed, slightly conical towards the apex; whorls four in number, beautifully closely longitudinally lirate, the liræ giving a silky appearance to the whorls. Below, the last whorl is quite smooth, olive-green, and very shining. The umbilicus is narrowly profound, mouth lunar; lip simple, thin, slightly reflexed at the columellar margin.

Discovered by Mr. Quekett, the active Curator of the Maritzburg Museum.

2. *Achatina scævola*, sp. n. (Pl. III. fig. 2.)

A. testa sinistrorsa, tenui, subpellucida, pallide ochracea, oblongo-ovata; anfractibus septem, ventricosulis, longitudinaliter brunneo-flammulatis, superne microscopice granato-striatulis, striis transversis, infra, anfractu ultimo sublævigato: columella leviter contorta, truncata, fusca; apertura oblonga, labro tenui.
Long. 2·35, lat. 1·25 inch.

Hab. Transvaal (*Mr. Bowker*). In Coll. Edgar L. Layard, Esq.

This shell, collected by Mr. Layard's nephew, Mr. Bowker, in the Transvaal, is, though in damaged condition, so peculiar, that we agree with its owner it is worthy of description. Nothing we have seen in the National or other collections exactly corresponds with it, though it does not at first sight seem to possess any extraordinary characters excepting in being sinistral.

The shell is thin, pale ochraceous, with longitudinal darker brown flames; whorls seven, microscopically granato-striate, the striæ transverse, the last whorl appearing almost smooth, though the above-mentioned striations are still with a lens traceable for, at all events, some little distance below the suture. The whorls are slightly ventricose, lip simple; columella slightly contorted, fuscous, and strongly truncate.

3. *Achatina penestes*, sp. n. (Pl. III. fig. 3.)

A. testa ovato-pyramidali, supra, et præsertim ad apicem, multum attenuata; anfractibus sex, sub lente granato-decussatis, ad suturas impressis, anfractu ultimo rapide accrescente, ad basin læviore, longitudinaliter irregulariter ruguloso; apertura ovato-oblonga, columella ad basin contorquente, truncatula.
Long. (sp. maj.) 1·30, lat. ·75 inch.

Hab. Pretoria (*Wotton*).

Two specimens, neither in very good condition.

The shape is peculiar, ovate-pyramidal, the last whorl rapidly increasing, somewhat effuse, the other whorls small in proportion; the surface, excepting that of the basal half of the last whorl, which is smoothish though longitudinally wrinkled, granato-decussate.

This appears to be a very distinct new form.

4. *Stenogyra Crawfordi*, sp. n. (Pl. III. fig. 4.)

S. testa tenuissima, vitrea, attenuata, cylindrica; anfractibus quinque, lævigatis, ventricosis, sub lente tenuissime longitudinaliter striatulis, anfractu ultimo producto; apertura oblonga; peristomate simplici, recto, marginem apud columellarem paullum incrassato.

Long. (sp. maj.) 4·50, lat. 1·50 mill.

Hab. Van Staaden's River (*J. Crawford, Esq.*).

A smoothish glassy species, to which we cannot assign a place as the young of any South-African form with which we are acquainted, several of the specimens before us being apparently full-grown.

5. *Buliminus* (*Pachnodus*) *maritzburgensis*, sp. n. (Pl. III. fig. 5.)

B. testa anguste umbilicata, omnino pellucida, læte cornea, tenuissima, pyramidali, ad apicem attenuato-conica; anfractibus sex, ventricosulis, ad suturas impressis, ultimo apud peripheriam subangulato, effuso; apertura rotunda; peristomate tenui, apud marginem columellarem multum reflexo, umbilicum obtegente.

Long. 14, lat. 9 mill.

Hab. Pietermaritzburg (*H. Burnup, Esq.*).

A very pretty transparent, horny, pyramidal species, six-whorled, attenuate towards the apex, the last whorl shouldered, somewhat broadened; whorls ventricose and impressed at the sutures, narrowly umbilicate; mouth roundish; peristome thin, simple, and much reflexed triangularly at the columellar margin, covering the umbilicus.

Allied to *B. conulus*, Reeve, from which, however, it will be found on comparison to be quite distinct.

6. *Buliminus transvaalensis*, sp. n. (Pl. III. fig. 6.)

B. testa anguste umbilicata, conico-pyramidali, corneo-pellucida, ad basin depressa; anfractibus sex, ultimo in medio angulato,

undique longitudinaliter sub lente oblique tenuissime striatis; apertura rotunda, labro tenui, simplici, ad marginem columellarem late triangulatim reflexo.
Long. 6, lat. 3·10 mill.

Hab. North Transvaal (*Col. Bowker*).

Two specimens of a small horny, subpellucid, acuminate species; whorls six, last whorl angled towards the middle; mouth round, lip simple, broadly triangularly reflexed at the columellar margin.

This shell is unlike any other South-African species of the genus.

7. *Buliminus* (*Pachnodus*) *jejunus*, sp. n. (Pl. III. fig. 7.)

B. testa ovato-conica, angustissime umbilicata, robusta, pallescente; anfractibus quinque, lævibus, undique strigis fulvo-brunneis oblique et irregulariter decoratis, ultimo in medio angulato, apud angulum transversim linea brunnea zonulato, labro simplici, ad marginem columellarem reflexo.
Long. (sp. maj.) 8, lat. 4·50 mill.

Hab. North Transvaal (*Col. Bowker*).

Five specimens of a neat small shell: form conically ovate, angled towards the middle of the last whorl; shell thick, whitish cinereous, with longitudinal, somewhat irregular brown streaks or flames; in four out of the five specimens there is a brown transverse zone at the angle of the last whorl.

The general appearance of the shell somewhat reminds one of *B. punctatus*, Anton.

8. *Ennea Crossleyana*, sp. n. (Pl. III. fig. 8.)

E. testa parum rimata, abbreviata, cylindriformi, subpellucida, albocinerea; anfractibus sex vel septem, longitudinaliter oblique costulatis, costulis infra suturas moniliformibus; apertura oblonga; peristomate albo, nitido, reflexo, plica parietali conspicua, labiali tridentata, basali minore, simplici, interna infra marginem columellarem nitida, mammæformi, valde intrante.
Long. 5·50, lat. 2 mill.

Hab. Pietermaritzburg (*Burnup*).

Several specimens of a very pretty and conspicuous *Ennea*. The tridentate labial tooth is noteworthy; the texture is semipellucid, and the whorls below the sutures have one transverse row of beaded granulation.

We have much pleasure in associating with this species the name of Mrs. Crossley, in whose garden the specimens were first collected.

9. *Ennea drakensbergensis*, sp. n. (Pl. III. fig. 9.)

E. testa parum rimata, abbreviato-cylindriformi, cinerea; anfractibus sex, ventricosulis, undique confertim longitudinaliter recti-striatis; apertura rotunda; peristomate albo, nitido, quadri-plicato, plica parietali acinaciformi, conspicua, dente labiali crasso, simplici, basali minore, plica columellari interna mammæformi, perintrante.

Long. 4, lat. 2·25 mill.

Hab. Pietermaritzburg.

A shortly cylindrical shell, cinereous, with six whorls; whorls ventricose, adorned with somewhat straight longitudinal striæ; mouth roundish ovate, lip white, incrassate, reflexed, four-plaited, the labial and basal teeth being simple, the sutural (or parietal) large and deep-seated, the columellar internal and nipple-shaped.

One specimen.

10. *Ennea euthymia*, sp. n. (Pl. III. fig. 10.)

E. testa subrimata, abbreviata, cylindrica, incrassata, olivaceo-cinerea; anfractibus septem, ventricosis, ad suturas impressis, undique longitudinaliter oblique densistriatis; apertura rotunda; peristomate albo-nitente, reflexo, plicis vel dentibus sex munito, plica parietali magna intrante, labialibus duabus simplicibus, dente basali et columellari labialium instar, subtus hunc plica interna mammæformi, valde perintrante.

Long. 4·50, lat. 2 mill.

Hab. Pietermaritzburg.

A pretty little species, possessing in its peristomatal processes a marked contrast to other species of the genus from South Africa. The mouth is roundish, lip white, reflexed, furnished with six teeth or plaits—the parietal being large, scimitar-shaped; the two labial teeth or plaits, the basal, and the columellar are all similar and simple. Below this latter is an internal plait, white, nipple-shaped, and large.

11. *Ennea maritzburgensis*, sp. n. (Pl. III. fig. 11.)

E. testa parum rimata, tenui, subdiaphana, nitida; anfractibus sex vel septem, lævigatis, infra, juxta suturas solum, oblique striatulis; apertura ovata; peristomate albo-nitente, reflexo, plicis vel dentibus quinque munito, plica parietali acinaciformi, intrante, dentibus labialibus duobus, simplicibus, dente basali simplici, parvo, plica columellari interna valde ad imam faucem penetrante.

Long. 3·50, lat. 1·10 mill.

Hab. Pietermaritzburg (*Quekett*).

A charming little subpellucid species; whorls six, smooth, excepting just below the sutures, where there is a trace of the oblique longitudinal striation so general a feature in the shells of this genus. The mouth is furnished with five teeth or plaits, three of them being quite simple, while the parietal is scimitar-shaped and penetrating, the columellar also very deep-seated.

Three specimens.

12. *Ennea polita*, sp. n. (Pl. III. fig. 12.)

E. testa lævi, tenui, pellucida, vitrea, dolioliformi, cylindrica, apice obtusissimo; anfractibus septem, lævibus; apertura ovata; peristomate vix reflexo, quinqueplicato, plica parietali et labiali magnis perintrantibus, dente labiali bifurcato, dente basali minore, simplici, plica columellari valde intrante, conspicua.

Long. 3, lat. 1·20 mill.

Hab. Tharfield (*Miss Mary L. Bowker*). In Coll. Edgar L. Layard, Esq.

A small pellucid, shining, smooth species, barrel-shaped; whorls seven, plain and smooth; mouth ovate, lip reflexed, white, five-plaited, of which the parietal, labial, and columellar plaits are conspicuous and deep-seated; the basal tooth small and simple; the labial tooth bifid.

Five specimens.

13. *Ennea pulchella*, sp. n. (Pl. III. fig. 13.)

E. testa rimata, pellucida, tenui, dolioliformi, nitida, apice obtuso; anfractibus septem, ventricosulis, infra suturas granato-marginatis, undique longitudinaliter striis obliquis decoratis; apertura subrotunda; peristomate albo, reflexo, incrassato, plicis vel dentibus quinque munito, plica parietali magna, acinaciformi, intrante, dentibus duobus labialibus simplicibus, basali parvo simplici, plica columellari perintrante, conspicua.

Long. 6, lat. 2·85 mill.

Hab. Chase Krantz, Maritzburg (*Burnup*).

A very pretty shining species. It is shortly cylindrical, pellucid, seven-whorled; whorls slightly ventricose, delicately longitudinally striate; close below the sutures there is a transverse pellucid line, the intermediate space being minutely granate; the aperture is roundish; peristome white, thickened, furnished with five plaits or teeth, of which the two labial and the one basal are ordinary and simple, the parietal or sutural plait being large and deep-seated, and the columellar also conspicuous.

Two specimens.

Its nearest ally is *E. regularis*, M. & P., from which, however, it differs in having one whorl more, in the form of the aperture, and in the detail of the dentition.

14. *Ennea socratica*, sp. n. (Pl. III. fig. 14.)

E. testa profunde rimata, recta, cylindriformi, crassa, brunneo-cinerea; anfractibus octo, apud suturas impressis, undique longitudinaliter oblique crassistriatis; apertura curta, subrotunda; peristomate albido, reflexo, ad basin incrassato, triplicato, plica parietali et labiali valde intrantibus, conspicuis, columellari interna simplici.

Long. 8, lat. 3·25 mill.

Hab. Pietermaritzburg.

A large form, of which we have only seen one specimen. Deeply rimate, eight-whorled; whorls incrassate, obliquely coarsely longitudinally striate, impressed at the sutures; mouth subrotund, lip furnished with three plaits, all deep-seated and conspicuous; peristome thickened internally at the base. The mouth seems small in proportion to the length of the shell, but there does not appear to be any malformation. More specimens are, however, desirable.

15. *Ennea tharfieldensis*, sp. n. (Pl. III. fig. 15.)

E. testa parum rimata, oblonga, cylindrica, albo-cinerea; anfractibus sex vel septem, ventricosulis, apud suturas impressis, undique longitudinaliter crassistriatis; apertura oblonga; peristomate producto, albo-nitente, incrassato, reflexo, quinqueplicato, plica parietali prominente, conspicua, plica labiali multum incrassata, aditum intrante et occludente; basali interna mammæformi; columellari magna, incrassata; quinta denique inter columellarem parietalemque interna, minore.

Long. 4·50, lat. 2 mill.

Hab. Tharfield. In Coll. Edgar L. Layard, Esq.

Several specimens of a form we cannot exactly place with any described species, though much of the same build externally as several others. The peristome is five-plaited, of which two are quite internal, the remaining three conspicuously incrassate.

Allied to *E. crassidens*, but not a form of that species.

16. *Ennea Vandenbroeckii*, sp. n. (Pl. III. fig. 16.)

E. testa obeso-cylindrica, cinerea, apice obtuso; anfractibus octo, undique longitudinaliter oblique striato-costatis; apertura ovato-rotunda; peristomate albo, reflexo, quinqueplicato, plica parietali conspicua, incurvata, labiali simplici, dentibus basalibus duobus simplicibus, plica columellari interna mammæformi.
Long. 7, lat. 3·50 mill.

Hab. Natal (*ex Coll. Vandenbroeck*).

Marked by Mr. Vandenbroeck as *E. Gouldi* (Pfr.), which it certainly is not. A bluntly cylindriform obese shell, with the whorls striato-costulate longitudinally; mouth round, five-plaited or toothed. In form allied to *E. Dunkeri*, Pfr.

Two specimens.

17. *Ennea vanstaadensis*, sp. n. (Pl. III. fig. 17.)

E. testa rimata, longa, cylindriformi, delicatula, succinea; anfractibus sex vel septem, undique confertim longitudinaliter tenuistriatis; peristomate albo, incrassato, nitente, plicis vel dentibus quatuor munito, plica parietali conspicua, prominente, intus extensa, dente labiali bifurcato, basali minore, simplici, plica columellari mammæformi, valde intrante.
Long. 5·50, lat. 1·75 mill.

Hab. Van Staaden's River (*J. Crawford, Esq.*).

Four specimens, of which the one we have taken as the type is completely cylindriform, prolonged, seven-whorled; the other three are somewhat shorter, but the mouth and tooth-processes are exactly the same.

18. *Succinea Bowkeri*, sp. n. (Pl. III. fig. 18.)

S. testa pertenui, læte ochracea; anfractibus tribus vel quatuor, ultimo rapide accrescente, subeffuso, apicali parvo, medio perventricoso, parvo; apertura ovata, labro tenuissimo, simplici.
Long. 13·50, lat. 9 mill.

Hab. Malvern (*Col. Bowker*).

We are unable to exactly match this shell with any known forms, though it approaches two Sandwich-Island species, both endemic. It does not appear either to be a variety of the ubiquitous *S. putris*, and we have therefore ventured to describe it. The species of this genus unfortunately are not only liable to much variation, but also offer no very salient points for characterization.

Two specimens, exactly similar.

19. *Planorbis Bowkeri*, sp. n. (Pl. III. fig. 19.)

P. testa pallide cinerea, altiuscula, parum nitente, sublævigata; anfractibus quatuor, deplanatis, rapide accrescentibus, disco superiore et inferiore æque excavatis; apertura obliqui-rotundata.
Long. 8·20, lat. 3·40 mill.

Hab. North Transvaal (*Col. Bowker*).

A species not unlike *P. corneus* in miniature. The surface under a lens is found to be very finely, obliquely, longitudinally striate. The whorls are rounded, both the upper and lower disks being equally excavate.

20. *Planorbis Crawfordi*, sp. n. (Pl. III. fig. 20.)

P. testa parva, compressa, obliqui-striata, cinereo-olivacea; anfractibus quatuor, lente crescentibus, discis utrinque subrotundatis, inferiore magis applanato; apertura depresso-lunari.
Long. (sp. maj.) 1, lat. 5 mill.

Hab. Van Staaden's River (*J. Crawford, Esq.*).

A small compressed species, whorls rounded and not angled, somewhat recalling our British *P. albus.*

Three specimens.

N.B.—In our last paper (Ann. & Mag. Nat. Hist. ser. 6, vol. xi., January 1893, pp. 20, 21) the descriptions of *Pupa dysorata* and *Sykesii* were, in part, accidentally transposed.

Of the former the description should read thus:—

Pupa dysorata, sp. n. (Pl. III. fig. 4.)

P. testa minutissima, oblonga, lævi, apice obtuso; anfractibus quinque, tumescentibus, ventricosis; apertura ovali; peristomate albido, paullum reflexo, ad marginem columellarem incrassatum unidentato.
Long. 1, lat. ·55 mill.

Hab. Griqualand East (*E. R. Sykes, Esq.*).

And of the latter:—

Pupa Sykesii, sp. n. (Pl. III. fig. 6.)

P. testa rimata, minuta, cylindrica, diaphana, apice obtuso; anfractibus septem vel octo, ventricosis, undique confertim longitudinaliter tenuicostatis; apertura ovata; peristomate paullum reflexo, dentibus duobus munito, hoc parietali, illo basali, oppositis, inconspicuis.

Long. 1·90, lat. ·75 mill.

Hab. Griqualand East (*E. R. Sykes, Esq.*).

EXPLANATION OF PLATE III.

Fig. 1. *Macrocyclis Quekettiana.*
Fig. 2. *Achatina scævola.*
Fig. 3. —— *penestes.*
Fig. 4. *Stenogyra Crawfordi.*
Fig. 5. *Buliminus maritzburgensis.*
Fig. 6. —— *transvaalensis.*
Fig. 7. —— *jejunus.*
Fig. 8. *Ennea Crossleyana.*
Fig. 9. —— *drakensbergensis.*
Fig. 10. —— *euthymia.*
Fig. 11. *Ennea maritzburgensis.*
Fig. 12. —— *polita.*
Fig. 13. —— *pulchella.*
Fig. 14. —— *socratica.*
Fig. 15. —— *tharfieldensis.*
Fig. 16. —— *Vandenbroeckii.*
Fig. 17. —— *vanstaadensis.*
Fig. 18. *Succinea Bowkeri.*
Fig. 19. *Planorbis Bowkeri.*
Fig. 20. —— *Crawfordi.*

XXII.—*On some Ethiopian* Pentatomidæ *of the Group* Halyinæ. By E. Bergroth, M.D.

The object of this paper is to give descriptions of some new or imperfectly known genera and species of Halyinæ. This group, which includes some of the most conspicuous Pentatomidæ, has its headquarters in Australia, but it is also well represented in Africa, although many of the species are doubtless still undescribed.

1. *Dalpada Cambouei*, Fallon.

Halys Cambouei, Fallon, Rev. d'Ent. x. 5 (1891).

Subovata, supra straminea, sat dense subacervatim nigro-punctata, subtus testacea, lateribus capitis, pectoris ventrisque nigris, in capite et pectore vittam angustam rufescentem includentibus, maculis marginalibus segmentorum ventralium semicircularibus pallidis. Caput pronoto longius, elongato-triangulare, basi nigro-bimaculatum, jugis tylo multo longioribus et ante hunc contiguis, apice obtusis, lateribus nonnihil ante apicem obtuse angulato-eminulis, ocellis mox pone lineam inter angulum posticum oculorum fictam sitis, bucculis antice rotundatis, rostro apicem segmenti secundi ventris attingente, antennis (apice mutilis) fuscis, articulis duobus basalibus flavo-strigatis, primo angulum anteapicalem jugorum haud superante, tertio secundo perpaullo longiore. Pronotum mox ante medium transversim impressum, marginibus lateralibus anticis leviter sinuatis, ante sinum inæqualiter denticulatis, angulis lateralibus levissime eminulis, rectis. Scutellum apice obtuse subangulatum. Pectus ad acetabula postica macula nigra notatum, orificiis in sulcum longum leviter curvatum continuatis. Corium pone medium macula parva lævigata pallida notatum, margine apicali leviter rotundato; membrana cinerea, venis fuscis. Abdomen dorso fusco-testaceum, connexivo nigro, fascia media segmentorum testacea, ventre parce fusco-punctulato. Pedes antici nigri, dimidio basali femorum horumque dimidio apicali supra et subtus, annulo submediano et obsoletiore subbasali subapicalique tibiarum atque articulis duobus primis tarsorum superne testaceis (pedes posteriores desunt).

Long. ♂ 10·5 mm.

Madagascar.

This species differs from the typical *Dalpadæ* in having the bucculæ rounded anteriorly and the ocelli a little nearer to the base of the head. It is allied to *D. capitata*, Dist., but is much smaller, differently coloured, and with the third antennal joint longer.

Mons. Fallon's type is here described.

ANOLCUS, gen. nov.

Corpus depressum. Caput conicum, supra transversim convexiusculum, apice obtusum, parte anteoculari latitudine longiore, lateribus teretibus, ante oculos haud sinuatis, tylo jugis paullo longiore, ocellis in linea inter basin oculorum ficta positis, a linea media capitis quam ab oculis paullo magis distantibus, bucculis humilibus, antice in angulum acutum elevatis, postice ultra medium oculorum haud productis, rostro basin ventris attingente, articulo primo bucculas vix superante, secundo tertio parum longiore, quarto tertio fere duplo breviore, tuberculis antenniferis ab oculis et apice jugorum æque longe distantibus, antennis quinque-articulatis, articulo basali apicem capitis non attingente. Pronotum apice leviter sinuatum, basi subrectum, angulis basalibus obtuse rotundatis, marginibus lateralibus anticis serrulatis. Scutellum parte apicali angustum, frenis medium scutelli perpaullo superantibus. Mesosternum medio carinatum, carina lata depressa. Orificia in sulcum mediocrem continuata. Corium scutello longius; membrana laxissime reticulata, venis circiter quattuor areolas sex (duas basales, quattuor apicales) formantibus instructa. Abdomen subtus haud sulcatum, spiraculis ad marginem anticum segmentorum approximatis, a margine postico et laterali æque longe distantibus. Femora subtus prope apicem spinulosa; tibiæ supra sulcatæ, anticæ triquetræ.

This genus is allied to *Dalpada*, A. & S., but is at once distinguished, *inter alia*, by the peculiar neuration of the membrane.

2. *Anolcus campestris*, sp. n.

Ovatus, pallide stramineus, supra acervatim obscure virescenti- vel fusco-cinereo-punctatus, subtus concoloriter punctulatus. Caput pronoto subæquilongum, supra et subtus vittis sex obscure virescentibus ornatum, vittis superioribus extimis ad angulum anticum oculorum oblique interruptis, vittis binis interioribus medio coalitis, interstitiis inter vittas elevatis, lævibus, articulo ultimo rostri nigro, antennis medium abdominis paullo superantibus, gracilibus, nigris, articulo primo diametro verticali oculi æquilongo, pallido, extus nigro-strigato, articulis tribus ultimis basi flavidis, secundo primo plus quam duplo longiore, tertio et quinto secundo subæqualibus, quarto ceteris paullo longiore. Pronotum longitudine duplo et dimidio latius, angulis apicalibus obtusis, angulis lateralibus leviter angulato-eminulis, marginibus lateralibus anticis pone medium profunde sinuatis, ante sinum serrulatis, marginibus lateralibus posticis prope angulos laterales obtuse angulatis, disco medio præsertim latera versus transversim leviter impresso, margine cuncto, linea longitudinali media, linea intra marginem lateralem anticum postice cum hoc conjuncta ac lineis aliquot irregularibus lobi antici per lobum posticum oblique curvatim continuatis lævibus. Pectus sat dense punctulatum, vitta laterali viridi-ænea callos nonnullos pallidos includente et macula parva ad acetabula postice viridi-ænea ornatum, mesosterno medio maculis duabus oblongis lævibus nigris signato. Hemelytra apicem abdominis attingentia, corio basin segmenti sexti connexivi attingente, margine apicali extus obtuse angulato, angulo apicali recto, epipleura ad basin macula ænea et pone hanc serie subtili punctulorum instructa, membrana lacteo-subhyalina, macula ad angulum basalem internum et venis nigris. Abdomen rotundato-ampliatum, dorso nigrum, connexivo pallido, segmentis medio dilute ferrugineo-punctulatis, ad basin et apicem fascia viridi-cinerea notatis, angulis apicalibus levissime prominulis, ventre leviter convexo, parce subtilissime punctulato, lateribus extra spiracula concoloria punctulis remotis fuscis dispersis, puncto minuto fusco ad angulum apicalem segmentorum, macula majore extra spiraculum segmenti primi, macula minuta extra et intra spiraculum segmenti secundi intraque spiracula segmentorum ceterorum viridi-ænea, segmento sexto feminæ medio quam lateribus duplo longiore, angulis apicalibus subrectis. Pedes straminei, femoribus parte apicali viridi-nigro-conspersis, subtus prope apicem utrinque spinulis perpaucis pallidis armatis, tibiis anticis supra ad basin et apicem et paullo pone medium nigro-notatis, lateribus nigro-strigatis, tibiis posticis supra ad basin et apicem vitta viridi-nigra, subtus linea purpurea notatis (tibiæ mediæ desunt).

Long. ♂ 11 mm.

Mozambique; Rikatla. Coll. Montandon.

3. *Cœnomorpha Schioedtei*, sp. n.

Ovalis (♂) vel subovata (♀), straminea, fusco-punctata, punctis smaragdineis interspersis, purpureo et smaragdineo picta, partibus pallidis parcius, partibus purpureis et smaragdineis crebre punctatis. Caput pronoto medio paullo longius, apicem versus leviter angustatum, vittis duabus superioribus approximatis et vitta inferiore anteoculari smaragdineis, jugis apice valde oblique truncatis, rostro basin vel medium segmenti ventralis quarti attingente, antennis nigris, articulo primo subtus basin versus, annulo apicali articuli secundi et basali articuli quarti pallide flavis, articulis secundo et tertio paullo variabilibus, subæquilongis vel secundo tertio longiore, quarto secundo longiore (quintus deest). Pronotum maculis aliquot anterioribus et maculis basalibus septem obscure smaragdineis ornatum, macula basali media parva angusta, marginibus lateralibus anticis vix sinuatis, ab apice paullo ultra medium pallidis, angulis lateralibus leviter prominulis, rectis vel acutiusculis. Scutellum macula magna basali latera non attingente obscure purpurea postice utrinque in vittam brevem subsmaragdineam prolongata signatum, angulis basalibus smaragdineis. Pectus medio fuscum, pleuris smaragdineo-maculatis. Hemelytra apicem abdominis attingentia, corio parte basali excepta purpurascente, macula subbasali, macula magna media totam latitudinem occupante maculisque tribus apicalibus obscure smaragdineis, membrana subæneo-fusca. Abdomen dorso rubiginosum, segmentis connexivi basi et apice fascia smaragdinea ornatis, angulis apicalibus acute prominulis nigris, ventre vittis duabus latis mediis nigris vel fuscis per segmenta quinque prima extensis in maculas interdum dissolutis notato, parce fusco-punctato, latera versus densius smaragdineo-punctato, limbo laterali pallido impunctato, angulis basali et apicali segmentorum nigrinis, spiraculis fuscis, segmento sexto quinto medio paullo (♀) vel duplo (♂) longiore. Pedes pallide testacei, femoribus minute fusco-punctatis, subtus remote minute spinulosis, tibiis nigris, leviter virescentibus, annulo medio pallido, articulo ultimo tarsorum nigro.

Long. ♂ 14·5 mm., ♀ 17 mm.

Gaboon. Coll. Fallon.

Allied to *C. variegata*, P. B., but differently and much more richly coloured, with the head distinctly longer.

4. *Cœnomorpha segregata*, sp. n.

Ovata, supra ochracea, nigro-conspersa et parcius punctata, signaturis pronoti postice subvittiformibus, subtus infuscata, pallido-conspersa, densius punctata. Caput pronoto medio æquilongum, apicem versus levissime angustatum, supra lineis duabus mediis longitudinalibus antice abbreviatis et linea utrinque basali obliqua nigris, jugis apice leviter oblique late truncatis, rostro apicem segmenti tertii ventralis attingente, antennis nigris, articulo primo apice excepto obscure testaceo, secundo et tertio sulcatis, hoc illo longiore, quarto tertio longiore, quinto tertio perpaullum longiore, pallide flavido, apice leviter fuscescente. Pronotum lateribus parum sinuatum, angulis lateralibus acutiusculis, levissime prominulis. Hemelytra apicem abdominis leviter superantia, corio macula magna media nigra notato, membrana fusca, paucinervi. Abdomen sat fortiter rotundato-ampliatum, macula angusta oblonga marginali segmentorum pallida, segmentis connexivi basi et apice nigrinis, angulis apicalibus leviter prominulis, ventre sat fortiter convexo, sulco medio obsoleto, spiraculis nigris antice callo parvo pallido terminatis, segmento quinto medio ad basin gibboso-elevato, segmento sexto maris quinto medio haud duplo longiore, angulis apicalibus obtusiusculis sed haud rotundatis, segmento genitali maris apice medio profunde sinuato. Pedes sordide testacei, femoribus minute fusco-punctatis, subtus remote minute spinulosis, tibiis nigris, mediis annulo medio pallido signatis (pedes postici desunt).

Long. ♂ 15·5 mm.

Gaboon. Coll. Fallon.

Differs from all the other species in the more convex venter with indistinct furrow, and in having (at least in the male) the fifth ventral segment gibbous at the base.

Adelolcus, gen. nov.

Corpus supra modice, subtus sat fortiter convexum. Caput supra planiusculum, parte anteoculari latitudine longiore, lateribus ante oculos leviter sinuatis, deinde parallelis, jugis apice oblique subrotundato-truncatis, tylo jugis perpaullo longiore, ocellis pone lineam inter basin oculorum fictam sitis, bucculis humilibus, antice rectangulatim leviter elevatis, rostro coxas posticas superante, articulo primo postice bucculas subæquante, secundo tertio longiore, quarto tertio breviore, antennis ab apice capitis quam ab oculis fere duplo longius distantibus. Pronotum marginibus lateralibus anticis integrum, anguste reflexum, angulis posticis rotundatis. Scutellum parte apicali sat angustum, frenis post medium extensis. Prostethium postice subrectum; mesosternum medio carinatum; sulcus orificialis oblique antrorsum longe extensus, rectus, apice acutus, area evaporativa ampla, usque ad angulum anticum mesopleuræ oblique extensa. Corium scutello longius, margine apicali recto, prope angulum apicalem levissime sinuato; membrana simpliciter nervosa. Abdomen subtus per segmentum secundum late levissime sulcatum, angulis posticis segmentorum leviter prominulis. Femora antica subtus obsolete denticulata; tibiæ omnes supra planæ, marginatæ.

The structure of the rostrum, the straight hind margin of the propleuræ, the different structure of the orificia, and the much larger *area evaporativa* distinguish this genus from *Cœnomorpha*, Dall. From *Scribonia*, Stål, it is separated by the non-pilose body and the absence of the large sericeous spots to the venter. From both these genera it differs in the non-serrate lateral margins of the pronotum and the very short and shallow ventral furrow. It is apparently also allied to the Indian genus *Nevisanus*, Dist., but is at once distinguished by the structure of the rostrum and by having the antennæ inserted much nearer to the eyes.

5. *Adelolcus solitarius*, sp. n.

Ovatus, flavo-testaceus, sparsim fusco-punctatus, supra nigro-variegatus et conspersus, corio parte basali excepta incarnato. Caput subtus prope marginem lateralem vitta viridi-nigra ænescente notatum, rostro apicem segmenti secundi ventris attingente, piceo, articulo ultimo nigro (antennæ desunt). Pronotum medio capite paullo longius, marginibus lateralibus anticis parum sinuatis, pone medium nigris, angulis lateralibus leviter prominulis, subrotundatis, marginibus lateralibus posticis ad marginem costalem corii obtuse angulatis. Hemelytra apicem abdominis parum superantia, membrana fusca. Pectus ænescens, mesosterno medio piceo-ferrugineo. Abdomen hemelytris latius, connexivo detecto, hujus segmentis fascia media dilutiore notatis, ventre medio fere impunctato, lateribus leviter ænescente, limbo laterali nigrino, macula media marginali segmentorum pallide flava, segmento sexto medio macula nigro-picea signato. Pedes brunnei, tibiis nigrinis, annulo lato medio flavido ornatis.

Long. ♀ 17·5 mm.

Gaboon. Coll. Fallon.

6. *Memmia excurrens*, sp. n.

Subovata, sat dense punctata, nigra, margine laterali anteoculari et vittis tribus posticis capitis, margine apicali (utrinque breviter abrupto) pronoti, linea media longitudinali pronoti et scutelli, margine hujus pone frena, margine laterali basali et margine apicali corii, callo majusculo prope angulos basales scutelli et pone medium corii, callis sparsis minoribus pronoti scutelli coriique pallide flavis, marginibus lateralibus prothoracis, fascia media extus dilatata segmentorum connexivi, acetabulis, limbo postico pleurarum, macula magna metapleuræ, ventre medio maculaque laterali subsemicirculari segmentorum ventralium rufo-testaceis, segmento sexto ventrali et lobis genitalibus fuscis. Caput subæque longum ac latum, remote pilosulum, tylo et jugis longitudine æqualibus, bucculis modice elevatis, postice quam antice haud altioribus, rostro apicem segmenti secundi ventris attingente, articulo tertio secundo distincte longiore, antennis subtiliter puberulis, nigris, articulo secundo primo vix triplo longiore, tertio secundo circiter sexta parte breviore (art. quartus deest). Pronotum utrinque prope latera profundius impressum, marginibus lateralibus anticis levissime sinuatis, ante medium crenatis, angulis lateralibus obtusis, subrotundatis, parum prominulis, angulis posticis obtuse rotundatis. Scutellum ad angulos basales fovea impressa præditum. Corium basin segmenti sexti connexivi attingens; membrana subfusco-hyalina, venis obscurioribus. Abdomen hemelytris nonnihil brevius, angulis posticis segmentorum levissime prominulis. Pedes nigri, vitta supera femorum, plus quam dimidia parte basali femorum posteriorum carinisque superis lateralibus tibiarum a basi ultra medium testaceis.

Long. ♀ 14 mm.

Gaboon. Coll. Fallon.

Allied to *M. vicina*, Sign., but the colour-markings are different, the third antennal joint is much longer, the lateral lobes of the head are shorter, and the lateral margins of the pronotum slightly but distinctly sinuated.

The genus *Memmia* was hitherto known only from Madagascar.

Macropelta, gen. nov.

Caput subhexagonum, parte anteoculari apicem versus angustata, jugis tylo paullo longioribus, apice distantibus, oculis valde exsertis, breviter stylatis, ocellis pone lineam inter basin oculorum fictam positis, rostro coxas posticas subattingente, articulis secundo et tertio longitudine subæqualibus, antennis quadriarticulatis, articulo primo apicem capitis parum superante, secundo ceteris longiore. Pronotum lateribus ante medium serratum, angulis posticis acute lobulato-prominulis. Scutellum perlongum, abdomine paullo brevius, corio longius, lateribus ante medium sinuatis, frenis medium scutelli haud attingentibus. Prosternum apice medio profundius arcuato-sinuatum; mesosternum medio longitudinaliter impressum, in fundo impressionis carinatum; orificia auriculata. Abdomen subtus sulco levi longitudinali instructum. Femora subtus spinulosa.

This genus is at once distinguished from *Memmia*, Stål, by the scutellum, which is longer than the corium and sinuated before the middle (as in *Brachymenum*, Mayr), and by the frena, which do not reach the middle of the scutellum. In *Memmia* the scutellum is considerably shorter than the corium and sinuated much behind the middle, and the frena reach much beyond the middle of the scutellum. There are also the following differences of minor importance:—The first antennal joint scarcely passes the apex of the head, the second joint is strongly pilose, the eyes are very prominent and shortly petiolate, the hind angles of the pronotum are acutely lobed (as in the genera *Peltasticus*, Dall., *Aleria*, Stål, and *Paraleria*, Reut.). These characters, together with the unspotted connexivum, give this genus quite a different facies. The genus *Memmia* is more nearly allied to *Atelocera* than to *Macropelta*: in all three genera the females have two large sericeous patches on the venter.

7. *Macropelta Cowani*, Dist.

Memmia Cowani, Dist. Ent. Month. Mag. xix. 108 (1882).

I have received this insect from Antananarivo (Madagascar).

8. *Nealeria asopoides*, Stål.

On examining an example of this species agreeing to some extent with Stål's description I find that the tarsi in this genus are biarticulated as in *Paraleria*. I propose to call Stål's genus *Nealeria*, as the name *Aleria* is preoccupied by Marshall for a genus of Hymenoptera.

ZAPLUTUS, gen. nov.

Corpus oblongo-ovatum. Caput exsertum, pone oculos extus et paullo sursum valde prominulos basin versus levissime angustatum, parte anteoculari subconica, latitudine basali longiore, jugis tylo longioribus, apice acutis, hiscentibus, recurvis, marginibus lateralibus nonnihil ante oculos spina longa acuta extus antrorsum sursumque producta ac paullo ante apicem dente extus et sursum vergente armatis, ocellis pone lineam inter basin oculorum fictam sitis, ab oculis quam a linea media capitis paullo longius distantibus, bucculis humilibus, antice in dentem elevatis, postice ultra oculos parum productis, rostro gracili, coxas posticas longe superante, articulo primo bucculas parum superante, secundo primo vix duplo longiore, tertio secundo longiore, quarto secundo breviore, antennis gracilibus, quinque-articulatis, ab apice capitis quam ab oculis paullo longius insertis, articulo basali apicem jugorum haud attingente. Pronotum apice capite cum oculis angustius, marginibus lateralibus anticis ante medium denticulatis, angulis lateralibus in spinam validam acutam extus et oblique sursum productis, angulis posticis obtusissimis, disco ante medium transversim impresso. Scutellum parte apicali angustum, apice recurvum, frenis sat longe post medium scutelli extensis. Propleuræ margine postico rectæ; mesosternum tenuiter carinatum; orificia auriculata. Corium scutello longius; membrana venis longitudinalibus instructa, vena una alterave furcata. Abdomen subtus usque ad apicem segmenti quinti profunde sulcatum, angulis apicalibus segmentorum acute sublobato-prominulis. Pedes longiusculi, graciles, femoribus inermibus, tibiis supra planis et marginatis.

This magnificent genus must be placed in the vicinity of *Solenogaster*, Reut., from which it is, however, easily distinguished by the structure of the head &c.

9. *Zaplutus madagascariensis*, Fallon.

Atelocera madagascariensis, Fallon, Naturaliste, xi. 120 (1889).

Supra smaragdineus, dense punctatus, callis oblongulis irregularibus flavidis dispersus, pronoti margine apicali pone spatium interoculare et marginibus lateralibus anticis flavidis, capitis macula ante medium, spinis anteocularibus dentibusque anteapicalibus, pronoti macula utrinque antica, fascia basali utrinque angustata et abbreviata apiceque spinarum lateralium ac scutelli macula oblonga laterali media fuscis, clavo et parte plus quam dimidia interiore corii albo-cinereis, fusco-maculatis, remote inæqualiter punctatis, dorso abdominis rufo-testaceo, connexivo viridi-nigro, fascia segmentorum submediana lata flavo-testacea ornato; subtus flavo-testaceus, inæqualiter punctatus, mesosterno medio carina excepta fusco, vitta laterali capitis pectorisque lata et ventris angustiore smaragdinea, vitta pectorali in maculas ferme dissoluta, vitta ventrali macula magna laterali flavo-testacea in quoque segmento notata. Caput pronoto longius, bucculis et vitta adjacente pallidis, nigro-punctatis, rostro testaceo, antennis nigris, apicem versus levissime incrassatis, basi articulorum omnium et apice articuli secundi pallescentibus, articulis secundo, tertio quartoque subæquilongis, quovis primo longiore, quinto quarto paullo longiore. Pronotum longitudine sua fere triplo latius, marginibus lateralibus anticis sat profunde sinuatis, ante sinum rotundatis. Scutellum pone frena pallido-marginatum, parte basali nonnihil elevata rugam latam ad apicem emittente. Hemelytra apicem abdominis attingentia, corio basin segmenti quinti connexivi paullo superante, margine apicali levissime rotundato, membrana cinerea, ad angulos basales et medio infuscata, venis fuscis. Abdomen subtus disco acervatim, latera versus densius nigro-punctatum, segmento sexto macula magna nigrescente notato. Pedes testacei, annulo lato subapicali femorum, annulis duobus et apice tibiarum articuloque ultimo tarsorum fusco-nigris.
Long. ♀ 17 mm.

Madagascar.

I have described Mons. Fallon's type specimen.

Tammerfors, Finland.

XXIII.—*On some* Coreidæ *of the Order Rhynchota.* By W. L. Distant.

Ochrochira.

Ochrochira, Stål, En. Hem. iii. p. 39 (1873).

The description of this genus is to be sought in Stål's "Conspectus generum" of his division "Mictaria." The type is *Myctis albiditarsis*, Westw., and the genus is difficult to differentiate without an examination of that species, which I now possess.

The following species may now be added to *Ochrochira*:—

Ochrochira biplagiata.

Mictis biplagiata, Walk. Cat. Het. iv. p. 22. n. 51 (1871).

Ochrochira nigrorufa.

Physomerus nigrorufus, Walk. Cat. Het. iv. p. 60. n. 7 (1871).

Ochrochira fuliginosa.

Discogaster fuliginosa, Uhler, Proc. Ac. Phil. 1860, p. 225.
Menenotus tuberculipes, Motsch. Bull. Soc. Mosc. xxxix. 1, p. 187 (1866).
Mictis japonica, Walk. Cat. Het. iv. p. 23. n. 53 (1871).

Stål, who had evidently either not seen the species or only a female example, writes (En. Hem. iii. p. 51), "Ad *Elasmomiam* vel genus affine referendus." In the male sex, however, the posterior tibiæ are distinctly toothed or angularly ampliated near centre, whereas in the description of *Elasmomia* we read, "tibiis posticis marium subtus in dentem vel angulum haud ampliatis."

Ochrochira pallescens.

Prionolomia pallescens, Dist. Ent. Month. Mag. xxv. p. 230 (1889).

Ochrochira aberrans.

Prionolomia aberrans, Dist. Ent. Month. Mag. xxv. p. 230 (1889).

Allied to *O. palliditarsis*, Stål, but with a narrower pronotum or with the pronotal angles less dilated &c.

Ochrochira nigrovittata.

Prionolomia nigrovittata, Dist. Ann. & Mag. Nat. Hist. (6) vol. iii. p. 419 (1889).

Anoplocnemis Westwoodi.

Myctis annulicornis, Westw. in Hope, Cat. ii. p. 13 (1842) (nom. præocc.).
Anoplocnemis annulicornis, Stål, En. Hem. iii. p. 49. n. 27 (1873).

The specific name "*annulicornis*" was used by Germar in 1837 for his *Cerbus annulicornis*, which belongs to the genus *Anoplocnemis.* I have therefore renamed Westwood's species as above. It is closely allied to Germar's species, but differs by the different colour of the antennæ. Specimens are contained in the South-African Museum and in my own collection which were taken at Cape Town and other parts of the Cape Colony.

Anoplocnemis Montandoni, sp. n.

Head, pronotum, and scutellum piceous, corium very dark castaneous, all thickly and ochraceously pilose; a short fascia at base of lateral margin to corium and a broad central fascia to scutellum ochraceous; membrane cupreous; abdomen above black, with two central ochraceous spots beyond middle and the segmental margins also paler; body beneath with the head, sternum, and legs piceous, the abdomen and tarsi castaneous, all thickly and ochraceously pilose; a castaneous spot between the intermediate and posterior coxæ; antennæ castaneous, the apical joint ochraceous.

Long., ♂ 21–24, ♀ 23 millim.

Hab. East Africa, Mpwapwa (*Coll. Dist.*); Mozambique, Kikatla (*Coll. Montandon*).

Allied to *A. scutellaris,* Dall., but separated by the different colour of the upper surface of the abdomen, the tarsi, and the apical joint of the antennæ, the absence of the pale lateral fascia on each side of the body beneath, and by the length of the apical joint of the antennæ, which is considerably longer than the second joint, and not only slightly longer, as in *A. scutellaris.*

Dalader parvulus, sp. n.

Fuscous; antennæ and femora black; tibiæ, tarsi, and body beneath mottled with testaceous; a central narrow longitudinal line to pronotum and the apex of the scutellum pale brownish.

Long., ♂ 20; lat. pronot. angl. 8 millim.

Hab. Burma, Ruby Mines.

Allied to *D. planiventris,* Westw., but differing by its smaller size, darker colour, the apical joint of the antennæ black, the third antennal joint less widely and abruptly dilated, &c.

Elasmogaster unicolor, sp. n.

Pale uniform greyish brown, somewhat coarsely rugulose; antennæ with the first, second, and third joints subequal in length (fourth joint mutilated); membrane almost reaching the apex of the abdomen, the lateral margins of which are widely dilated; rostrum almost reaching the anterior coxæ.

Long., ♂ 17; max. lat. abd. 9 millim.

Hab. East Africa, Nyassa (*Cotterell*).

Differing from *E. africanus*, Dall., the only other described species of the genus, by the pale uniform colour, thus strongly contrasting in the markings of the body, legs, rostrum and antennæ, &c.

Homœocerus Wealei, sp. n.

Reddish ochraceous, body beneath and legs somewhat paler; lateral angles of the pronotum strongly and subacutely produced; lateral margins of the abdomen dilated and directed upwardly; antennæ with the basal joint longest, second joint a little longer than the third or fourth, which are subequal in length; pronotum, scutellum, and corium with coarse brown punctures; extreme lateral edge of the abdomen above ochraceous; membrane pale shining brown; rostrum with the second joint a little longer than the third and subequal in length with the fourth joint.

Long. 14–15; lat. pronot. angl. 5 millim.

Hab. South Africa (*M. Weale*); East Africa, Zanzibar.

This species appears to find a systematic position between the *H. dilutus*, Stål, and *H. productus*, Stål. To the first it is allied by the dilated abdomen, to the second by the produced pronotal angles.

XXIV.—*The Origin of the Organs of* Salpa. By W. K. Brooks*.

The Salpa Embryo.—Stated in a word, the most remarkable peculiarity of the Salpa embryo is this—It is blocked out in follicle cells, which form layers and undergo other changes which result in an outline or model of all the general

* From the 'Johns Hopkins University Circulars,' vol. xii. no. 106, pp. 93–97. An abstract of Chapter XIV. of 'A Memoir on the Genus *Salpa*,' which is now in the press.

features in the organization of the embryo. While this process is going on the development of the blastomeres is retarded, so that they are carried into their final positions in the embryo while still in a very rudimentary condition.

Finally, when they have reached the places which they are to occupy they undergo rapid multiplication and growth, and build up the tissues of the body directly, while the scaffolding of follicle cells is torn down and used up as food for the true embryonic cells.

No other animal presents us with an embryonic history quite like that of Salpa, although other Tunicata show something similar but very much less pronounced. In the chapter of my memoir "On the Morphological Significance of the Salpa Embryo," I attempt to show how the life-history of Salpa has come about, but we must now confine ourselves to the facts.

An imaginary illustration may help to make the subject clear. Suppose that while carpenters are building a house of wood, brickmakers pile clay on the boards as they are carried past, and shape the lumps of clay into bricks as they find them scattered through the building where they have been carried with the boards. Now, as the house approaches completion, imagine that bricklayers build a brick house over the wooden framework, not from the bottom upwards, but here and there, wherever the bricks are to be found, and that, as fast as parts of the brick house are finished, the wooden one is torn down. To make the analogy more complete, however, we must imagine that all the structure which is removed is assimilated by the bricks, and is thus turned into the substance of new bricks to carry on the construction.

Salensky ("Neue Untersuchungen," &c., Naples Mittheilungen, i., 1882, and "Embryonalentwicklung der *Pyrosoma*," Zool. Jahrb. iv. and v., 1891) has discovered and minutely described the migration of the follicle; but he has failed to trace the history of the blastomeres, and believes that these degenerate and disappear, and that the embryo is built up of follicle cells. I find that all the follicle cells are ultimately used up as food, and that the true embryo is formed from blastomeres after the analogy of the rest of the animal kingdom.

The Aggregated Salpæ.—During their development the aggregated Salpæ undergo complicated changes of position, which render the interpretation of sections very difficult, and as both Salensky (Morph. Jahrb. 1877, iii.) and Seeliger (Jena. Zeitschr. 1885) have totally failed to understand these changes, their accounts of the origin of the aggregated Salpæ have no permanent value.

I pointed out in 1886 (' Studies from the Biol. Lab., Johns Hopkins Univ.,' 1886, pp. 398–414) that the Salpa chain is morphologically a single row of Salpæ, all in the same position, with their dorsal surfaces proximal or towards the base of the stolon and their right sides on its right. The account of the origin of the aggregated Salpæ which is given in this memoir is simply an amplification and expansion of the statement which in 1886 I made briefly and in outline.

The stolon is bilaterally symmetrical, its plane of symmetry is fundamentally identical with that of the solitary Salpæ, and the rudiment of each aggregated Salpa is bilaterally symmetrical in the same plane, although the secondary changes begin very early, and convert the single row into a double row, which comes to consist of a series of right-hand Salpæ and a series of left-hand ones placed with their dorsal surfaces out, their ventral surfaces towards the ventral surfaces of those in the opposite row, and with the left sides of those on the right and the right sides of those on the left towards the base of the stolon. In order to illustrate these secondary changes of position, let us represent the series of Salpæ by a file of soldiers, all facing the same way. Now imagine that each alternate soldier moves to the right and the others to the left, to form two files, still facing the same way. Now let them face about, so that the backs of those in one row are turned towards the backs of those in the other row. They will now represent two rows of Salpæ in their secondary positions.

To make the illustration more perfect, suppose that, instead of stepping into new places the soldiers grow until they are pushed out by mutual pressure, and suppose that their heads, growing fastest, form two rows, while their feet still form one row, and suppose furthermore that, as each soldier rotates, his feet turn first, and that the twisting runs slowly up his body to his head, which turns last. We must also imagine that these various changes all go on together, and that while they are taking place each soldier not only grows larger but also develops from a simple germ to his complete structure.

Salensky regards the stolon as two rows of rudimentary Salpæ; and while Seeliger correctly states that they at first form a single row, he has failed to discover the rotation, and believes that they arise on the stolon in their final positions, and he has therefore failed as completely as Salensky in his efforts to trace the origin of their organs.

The Ectoderm of the Salpa Embryo.—At an early stage of segmentation some of the blastomeres move upwards and pass out of the follicle on the middle line of the dorsal surface, where the two layers of the follicle are continuous with each other. I have given reasons for believing that this is the spot which was once occupied by the blastopore. These ectodermal blastomeres thus become extra-follicular, although they are covered for a time by the capsule of epithelium, which Salensky has called the "Ectodermkeim." They give rise by cell-division to the ectoderm, which spreads from the dorsal middle line downwards and outwards over the embryo, pushing off and replacing the cells of the capsule. The ectoderm has a growing edge, like that of meroblastic embryos, and it does not close in completely on the ventral middle line until after birth.

Salensky ("Neue Untersuchungen," Mitth. a. d. Zool. Station zu Neapel, i., 1882) has figured the migration of blastomeres to an extra-follicular position on the dorsal surface of the embryo in several species, although he regards them as discarded blastomeres and derives the ectoderm from other sources. They are clearly shown in *Salpa pinnata* in his plate xii. fig. 26, in *Salpa pectinata* in his pl. xxiii., and in *Salpa fusiformis* in his plate xxiv. fig. 3, where they are marked by the letters *Eckb*, which might be supposed to stand for "ectodermal blastomeres" if he did not tell us explicitly on p. 389 that the ectoderm of this species is derived from the epithelial capsule ("Epithelhügel").

The ectodermal blastomeres seem to be more conspicuous in *Salpa fusiformis* than in other species, for Salensky says (p. 345) that while the epithelial capsule ("Ectodermkeim") is generally separated very sharply from the embryonic cell-mass, it is at one end of the embryo so intimately related to the follicle cells ("gonoblasts") that it is difficult to determine the boundary between them, *and the blastomeres which lie directly at this spot* are covered only by the epithelial capsule ("Ectodermkeim"). At a later stage he says (p. 350) that the epithelial capsule ("Ectodermkeim") contains cells which differ greatly among themselves in both size and form. Some of them are similar in appearance to the cells of the epithelial capsule, as already described, at an earlier stage, and differ from them only in being more flattened. "*The others* (*Eckb*) *are very much larger and very different in structure, and contain a nucleus which is very similar to that of the blastomeres. The appearance of these cells suggests that they are blastomeres which have passed out from the cell-mass.*'

Salensky believes that the ectoderm of *Salpa democratica* is derived from the oviduct, and that in all other species it is derived from the epithelial capsule (" Epithelhügel," " Ectodermkeim ") ; but I think all will agree that his position is untenable until he has traced the history of these extra-follicular blastomeres and has proved that they take no part in its formation.

I have shown that they do give rise to the ectoderm and that the epithelial capsule is a transitory structure which is lost as the ectoderm replaces it.

The Ectoderm of the Stolon and that of the Aggregated Salpæ.—All agree that the ectoderm of the stolon is derived directly from the ectoderm of the embryo. In one minor point my observations show that the older accounts are incorrect. It is usually stated that the ectoderm of the stolon is *pushed* out into a tube by the growth of the other constituents of the stolon, and Seeliger says (" Die Knospung der Salpen," Jena. Zeitschr. 1885, p. 13) that it is an evagination (" Ausstülpung ") from the ectodermal epithelium of the embryo. This is not literally true, for the ectoderm itself takes a most active part in the formation of the stolon. This is marked off on the body of the embryo by a fold of ectoderm, which pushes backwards from its tip to its base, so that it is folded off from the body of the embryo rather than pushed out, and, in the young stages of *Salpa pinnata* at least, its differentiation from the body of the embryo is chiefly due to the active growth of this ectodermal fold.

The ectoderm of the aggregated Salpæ has been correctly held to be directly derived from the ectoderm of the stolon by all students except Todaro. My own observations show also that the multiplication of the ectoderm cells is the chief agent in the segmentation of the stolon, that the nerve-tube and the perithoracic tubes are cut up into vesicles by the growth of the ectodermal folds, and that these are the chief agents in the segmentation of the endodermal tube and the genital rod.

The Nervous System of the Embryo.—Little can be said of this without illustrations. The caudal nervous system is represented by scattered blastomeres, which soon degenerate and disappear. The ganglion is formed as an invaginated fold of the somatic layer of the follicle, and the ganglionic blastomeres pass into it from the ectodermal ridge and become completely folded in among the follicle cells. The ganglionic rudiment soon loses its connexion with the somatic layer and unites with the visceral follicle cells in the region of the roof of the anterior end of the pharynx.

The Nerve-Tube of the Stolon.—This is formed from the ectoderm on the middle line of the upper surface of the stolon at the point where its ectoderm folds upon itself to become continuous with that of the embryo. The straight stolon of *Salpa pinnata* is so favourable for studying its origin, and the evidence that it is ectodermal is so simple and clear in this species, that it does not seem necessary to devote much space to the discussion of the observations which have been made on twisted stolons like that of *Salpa democratica*, where it is very difficult to study the young stages by sections. The connexion between the nerve-tube and the endoderm is shown only by very young stolons and for only a short time, and the two structures are quite independent in older stolons.

Of the various writers on the subject, Kowalevsky ("Beiträge," &c, Nachr. d. k. Gesellsch. der Wissensch. zu Göttingen, 1868, 19) seems to regard it as mesodermal in origin. Salensky, in his paper on the budding of Salpa (Morph. Jahrb. 1877, iii.), says nothing about its origin. Todarro ('Sopra lo svilluppo,' &c., 1875) derives it, as he does all the other organs of the stolon, from a single germoblastic cell; but I have already shown that his germoblastic cell is a migratory placenta-cell, and all recent writers have justly rejected his account of the stolon. Seeliger believes that in the stolon of *Salpa*, and also in the buds from the ascidiozooids of *Pyrosoma*, it is mesodermal in origin, and that it is derived from an indifferent mass of mesoderm, which, in the young stolon, fills all the space between the ectoderm and the endodermal tube, and becomes differentiated into the nerve-tube and other organs of the stolon.

I have not found at any stage anything in the straight simple stolon of *Salpa pinnata* corresponding to his indifferent mesoderm, although I have studied it in serial sections in the three rectangular planes, and I do not hesitate to affirm that Seeliger has been misled through the selection of a most unfavourable species.

As I have not myself studied *Pyrosoma*, I am not in a position to make any comment on his account of this animal, although Salensky ("Embryonalentwicklung der Pyrosoma," Zool. Jahrb. v., 1891) has recently shown that the ganglia of the four primary ascidiozooids which are produced from the stolon of the cyathozooid, as well as the ganglion of the cyathozooid itself, are derived from the ectoderm.

The Ganglia of the Aggregated Salpæ.—The nerve-tube arises as a solid rod, but it soon acquires a lumen. As the ectodermal folds grow inwards and mark out the bodies of the Salpæ they cut the tube up into a series of ganglionic vesicles, one for each Salpa, with cavities which are segments of the lumen of the tube. The presence of the ectodermal folds and the growth of the ganglia soon cause crowding and pressure, and the ganglion becomes flattened in the axis of the stolon and elongated transversely. As the oral ends of the pharyngeal pouches grow up to the level of the ganglion, and push in between it and the ectoderm, the crowding becomes still greater and the single series of ganglia breaks up into two rows, which move to the right and left alternately as they grow, and the ganglion of a right-hand Salpa soon comes to lie far away from that of the left-hand Salpa with which it was at first in contact. It is convenient to speak of this change as a "migration" of the ganglion; but there is actually no migration, for the ganglion of each Salpa lies from the first in its final position on the middle line, dorsal to the oral end of the pharynx, and the apparent migration is the result of secondary changes in the position of the bodies of the Salpæ, and is not due to any change in the relation of the ganglion to other organs of the body.

Both Salensky and Seeliger have figured and described the "migration" of the ganglion; but as they have failed to discover the rotation of the bodies of the Salpæ, they regard it as an actual migration, and have completely misunderstood its true relation to the other organs of the body.

My sections show that the "subneural gland" or "ciliated funnel" is an outgrowth from the pharynx and that its intimate relation to the ganglion is secondary. Seeliger believes that the ganglionic rudiment gives rise to both the ganglion and the ciliated funnel, although he admits (p. 20) that his observations are not conclusive.

The Perithoracic Tubes and the Atrium or Cloaca of the Salpa Embryo.—It is not possible to describe the history of these structures intelligibly without figures. They arise as involutions of the somatic layer of the follicle, and they attain to their final form before the blastomeres begin to replace the follicle cells; so that there is a stage when the complete perithoracic system is outlined in cells which do not come from the fertilized egg, but from the follicle.

This system makes its appearance, as it does in the embryos of ordinary Tunicata, as a pair of lateral perithoracic invaginations, although in the Salpa embryo these are formed from the somatic layer of the follicle. They push inwards, penetrate the visceral mass of follicle cells, and meet and unite on the middle line to form the median atrium or cloaca. From the level of the median atrium each perithoracic tube pushes downwards to the region where the cavity of the pharynx is subsequently to be hollowed out in the visceral mass. The two tubes soon lose their communication with the exterior, and the median cloacal aperture is an independent opening which is formed later. After the pharynx is formed each perithoracic tube unites with it to form a gill-slit. Finally, after the perithoracic system is completely outlined its follicular cells degenerate and are gradually replaced by blastomeres.

Our knowledge of the perithoracic system of Salpa in both the solitary and the aggregated form is in great confusion.

Salensky has described the origin of the " gill " and of the median atrium or cloaca of the embryo in a number of species; but the reader of his papers will search in vain for any basis of comparison with other Tunicata, or even for any fundamental unity in his account of the various species of Salpa, and his papers contain internal evidence that he has misinterpreted his observations.

Uljanin holds that the perithoracic structures of *Doliolum* are not homologous with those of the ascidian, and Salensky holds the same view regarding *Salpa*. He says that the " gill " is part of the body-cavity which is shut in by folds in the walls of the pharynx, and that the cloaca is not an independent chamber, but a part of the pharynx which is shut off by these folds. A careful study of his description, especially pages 119, 200, 224, 225, and 229 of his first paper, and pages 114, 139, 160, 163, 338, 339, and 354 of his second paper, will show that his views not only involve this conclusion, but that they would also force us to believe that the " gill " and cloaca of one species of Salpa are not homologous with the same structures in another species; for his account of their origin in *Salpa democratica* and *Salpa pinnata* has almost nothing in common with his account of them in *Salpa africana*, *Salpa pectinata*, and *Salpa fusiformis*.

In his first paper on *Salpa democratica* he says that, like Leuckart, he regards the gill as part of the inner mantle or branchial sac, that in origin it is nothing more than a strongly developed ridge or thickening on the middle line of the dorsal surface of the pharynx, and that on each side of it the cavity of the pharynx is pushed upwards to form a pair of pouches, which soon meet and unite above the cloaca. In this way the gill-ridge is transformed into a rod, and the rod, which is at first solid, becomes tubular by the conversion of its axial cells into blood-corpuscles.

In this account of the origin of the perithoracic structures of *Salpa democratica* the only point of agreement with my own observations on *Salpa pinnata* is his statement that the gill is at first solid, and that its central cells are set free as development progresses. In his second paper he retracts this statement, and says (p. 139) that while his studies of the embryo of *Salpa pinnata* have in other respects confirmed his account of the origin of the cloaca and gill of *Salpa democratica*, they show that the gill is in its origin a hollow diverticulum from the body-cavity. He here describes the cloaca and gill as arising in a totally different way in *Salpa africana* (pp. 160 and 163), *Salpa punctata* (pp. 338, 339), and *Salpa runcinata* (*fusiformis*) (p. 354); for while he says that in these species, as in *Salpa democratica* and *Salpa pinnata*, the cloaca is part of the pharynx, it is separated off by two folds (Taf. xxiv. figs. 7 and 8, *Kestp*) of its lateral walls, which grow towards each other and unite on the middle line to form a horizontal diaphragm, which shuts off the dorsal cloacal division of the pharynx from the ventral chamber. The diaphragm then becomes separated at its sides from the lateral walls of the pharynx, so that a secondary communication is established on each side between the upper and the lower chamber, while the middle portion of the diaphragm becomes the gill.

It will be seen that, according to this account, the "gill" of *Salpa democratica* and *Salpa pinnata* arises as an unpaired median dorsal fold, while he describes it in the other species as arising from a pair of lateral folds; in the first two species the gill-slits or openings by which the two chambers communicate at the sides of the gill are primary, while in the others they are secondary; in the first two the cloaca is a secondary chamber formed by the union of the two pouches from the pharynx, while in the other species it is primary.

It does not seem possible to reconcile these statements with each other, and any attempt to bring all or any of them into accord with my own account seems hopeless. More critical examination will show, however, that his observations are rather imperfect than inaccurate, and that his errors are errors of interpretation.

My own observations show that the perithoracic tubes and atrial chamber are formed before the cavity of the pharynx is hollowed out in the mass of visceral follicle cells, and Salensky has, in these early stages, mistaken them for the pharynx or "primitive digestive cavity." This is well shown by the comparison of the two longitudinal sections of embryos of *Salpa runcinata* which are shown in his plate xxiv. figs. 4 and 9). These figures show clearly that the so-called "Darmhöhle" (*Pmd*) of the younger embryo is the cloaca, and not the pharynx of the older one. This is proved even more conclusively by comparing his fig. 3 of plate viii. with fig. 5, for the chamber which is marked *Pdmh* in the younger embryo is obviously the one which is marked *Kl* in the older one.

The perithoracic tubes are actually shown in many of his figures, notably in his plate vi. fig. 5, *pin*, where they are marked *Drm*. They are also shown in his plate xii. fig. 24, at *Dh*, and their union on the middle line to form the cloaca is shown at *D* in his fig. 25 and at *D* and *Dh* in his fig. 28 A. In the series of sections on his pl. xiii., fig. 31 A shows the two perithoracic tubes cut above the level of the atrium. His figs. 31 B and 31 C show the atrium, and his fig. 31 D shows the two tubes below the level of the atrium but above the level of the pharynx.

Salensky regards these structures as the halves of the primitive digestive cavity, which, he says (p. 114), arises in *Salpa pinnata* as two independent and completely separated halves; and he describes the atrium and gill as arising at a very much later stage in the way which is represented in his plate xiv. fig. 37, and plate xv. fig. 39.

In his plate xxiv., fig. 1 appears to be a section through one of the perithoracic tubes (*Pmdh*) before it has lost its connexion with the surface, and in his description of this figure (p. 346) he says that the triangular primitive digestive cavity is united above to the epithelial capsule ("Ectodermkeim"), and on both sides of the tip are the reflections of the somatic layer of the follicle (follicular wall) already noted, where this passes over into the visceral (gonoblastic) layer.

Salensky correctly describes the manner in which the perithoracic structures (primitive digestive cavity) acquire their first epithelial lining by the migration of the somatic layer of the follicle (follicular wall), and I believe that I have now carried the analysis of his observations far enough to prove that they contain internal evidence of the correctness of my own account.

The History of the Perithoracic Structures of the Aggregated Salpa.—The rudiment of each chain Salpa contains two perithoracic vesicles, a right one and a left one, derived from the right and left perithoracic tubes of the stolon. These vesicles give rise to the perithoracic system and to nothing else. Throughout its whole history the perithoracic system is bilaterally symmetrical, although this symmetry is hidden by the changes which take place in the position of the plane of symmetry during growth.

As the right and left pharyngeal pouches are formed the perithoracic vesicles are folded inwards by the growth of the ectodermal folds of the stolon, so that each one of them lies on the proximal or dorsal surface of its corresponding pharyngeal pouch. While the vesicles are hollow from the first, they have at first no communication with the cavities of the pharyngeal pouches. The first trace of the gill-slit is a fold or diverticulum in the dorsal wall of the pharyngeal pouch. This elongates and soon unites with the wall of the perithoracic vesicle to form a gill-slit. Soon after these are formed the posterior ends of the bodies of the Salpæ begin to push out to the right and left in such a way that the elliptical cross section of the body becomes converted into a wedge, with its narrow edge on the left side of a right-hand Salpa, and on the right side of a left-hand Salpa. The two perithoracic vesicles are differently affected by this change, for while the one nearest the pointed end of the wedge is compressed in the line of the axis of the stolon, the other is not. Thus the left perithoracic vesicle of a right-hand Salpa and the right one of a left-hand Salpa become flattened and elongated towards the middle line, while the other remains more nearly circular in section. Their relations to the morphological middle plane are fundamentally identical, but as the middle plane itself gradually moves outwards there is an apparent asymmetry.

Each perithoracic vesicle now becomes extended towards the middle line, where they unite to form the median atrium or cloaca, to which they contribute equally, although the position of the body is such that sections transverse to the long axis of the stolon might easily be misinterpreted and held to prove that the whole median atrium of a right-hand Salpa arises from the left vesicle alone, and that of a left-hand Salpa from the right one alone. The secondary changes of position are, however, of such a character that it is impossible to describe them in detail without figures.

Seeliger's account of the perithoracic structures of *Salpa democratica* (pp. 18, 48, and 63) serves to show how difficult the study of a simple structure may be made by a slight change of position, for phenomena which can be observed with ease in the straight stolon of *Salpa pinnata* are so obscure in *Salpa democratica* that all the industry and technical skill which Seeliger has devoted to this species has had very little outcome.

His account of the history of the perithoracic system is essentially as follows:—The perithoracic tubes, which he calls the "Seitenstränge," are mesodermal in their origin, and are specialized out of a mass of mesoderm cells which gives rise also to the nerve-tube of the stolon and to the genital rod. The mesoderm passes into the stolon from the body of the embryo in an unspecialized condition, and gradually becomes differentiated into these organs after the stolon is formed. The folds in the ectoderm of the stolon divide the "Seitenstränge" into a series of solid masses at the sides of the stolon between the ectoderm and the endoderm. These bodies are equal in number to the future Salpæ, and not twice as numerous. As each Salpa is constricted off from the tube it carries with it the greater part of one of these masses of cells from one side of the stolon and the lesser portion of the one on the opposite side. These two masses are not bilaterally placed in the body, but are on the middle line, the larger one being dorsal or neural and the smaller one ventral or hæmal. The latter gives rise to the heart and to the eleoblast, while the larger one, on the neural surface, gives rise to most of the mesoderm of the chain Salpa and also to a cloacal vesicle which is median and unpaired.

The vesicle becomes distended, and at two points, one on each side of the middle line, it unites with the wall of the branchial sac, and the cloaca and the branchial chamber thus become connected through the two gill-slits, while a similar union with the ectoderm in the middle dorsal line forms the cloacal aperture. Seeliger's account is perhaps as near the truth as one could hope to get by the study of transverse sections of the twisted stolon of *Salpa democratica*; but a very little study of sections in other planes in more favourable species will show that he has completely failed to understand the subject and that his account has no permanent value.

It is not only irreconcilable with my own observations, but also with our knowledge of *Pyrosoma*, for both Seeliger ('Pyrosoma,' pp. 622–624) and Salensky ('Pyrosoma,' pp. 31–36) state that in this genus the perithoracic system is bilaterally symmetrical, that each bud has two perithoracic vesicles, which are not dorsal and ventral, but right and left, that each of them unites with its own side of the pharynx to form the gill-slits before the two vesicles unite with each other to form the median atrium, and that this arises, as it does in the aggregated Salpa, on the dorsal middle line by the meeting and union of diverticula from the two vesicles, and that the external aperture arises still later, as it does in Salpa, as an independent aperture on the middle line.

The perithoracic vesicles are derived, as I find that they are in Salpa, from the right and left perithoracic tubes of the stolon; but, in the primary ascidiozooids at least, these are continuous with the perithoracic tubes of the primary embryo or cynthozooid, where, according to both Kowalevsky and Salensky (pp. 466, 473–475), the evidence that they arise as paired ectodermal invaginations from the surface of the body is clear and unmistakable.

The Digestive Organs of the Embryo.—The cavity of the pharynx arises in the mass of visceral follicle cells by the degeneration of these cells. Its endodermal epithelium is derived from the blastomeres, and the gut is formed later as a diverticulum from the pharynx.

Salensky's account of the origin of the digestive organs is scattered through the pages of his memoir in such a way that it is hard to review; and as I have shown that he has in the youngest embryos mistaken the two perithoracic tubes for the pharynx, that he has at a somewhat older stage mistaken the median atrium or cloaca for the pharynx, and that he has failed to discover the actual pharynx during its early stages, it is clear that his description has no value.

The Endodermal Tube of the Stolon and the Digestive Tract of the Aggregated Salpa.—The endodermal tube of the stolon is formed as a diverticulum from the ventral middle line of the pharynx of the solitary Salpa, and its communication with the cavity of the pharynx is retained throughout the whole history of the stolon. The thickened side-walls of the endodermal tube are derived from the two endostylic folds of the pharynx of the embryo.

The pharynx of the aggregated Salpa is morphologically bilaterally symmetrical with the middle plane of the stolon, although this fact is obscured by the secondary changes of position. It is formed from two pharyngeal pouches, a right and a left, from the sides of the endodermal tube of the stolon. The oral ends of these pouches grow forwards and quickly meet and unite on the morphological middle line to form the oral end of the pharynx. The aboral ends grow backwards and approach each other on the middle line, and finally unite, although they remain separate very much longer than the oral ends.

In a strict sense the pharynx is not actually, but only apparently double in origin, for the middle section or endodermal tube is not double. Fundamentally it is a single unpaired expansion of the endodermal tube, but at the time when it elongates towards the oral and aboral ends of the body the middle line is occupied by the blood-tubes, and it pushes along the sides of these structures, and does not become complete in the middle line until a much later stage.

The post-pharyngeal gut arises as a blind diverticulum from the aboral end of the right pharyngeal pouch. The part of the diverticulum nearest the pharynx becomes the œsophagus, and the stomach and intestine are developed from its blind end. In all the species I have studied the intestine bends to the left past the stomach, to open dorsally into the median atrium, and the digestive tract assumes the form of a figure 8, which is persistent in most species, although in *Salpa pinnata* the intestine gradually moves downward as development advances, until it finally becomes ventral to the stomach.

As the gut arises, in both right-hand and left-hand Salpæ, from the right pharyngeal pouch, and since the distortions which are produced by pressure and by the changes of position affect the right-hand pouch of a right-hand Salpa just as they affect the left-hand pouch of a left-hand Salpa, and since they affect the other pouches in quite a different way, the history of the gut in a right-hand Salpa is superficially very different from that of a left-hand Salpa, although fundamentally they are exactly alike.

While Salensky, in his first paper on the budding of Salpa, describes the endodermal tube, he says that it takes no part in the construction of the Salpæ, and that their digestive organs are derived from that part of the stolon which I have called the genital rod. Seeliger, a few years later, pointed out Salensky's error, which he has himself admitted in a recent paper ('Pyrosoma,' p. 78).

Seeliger's account of the origin of the endodermal tube and digestive organs is given on pp. 14, 18, 26–34, and 54–62 of his paper on the budding of Salpa. He shows (p. 14) that the endodermal tube of the stolon is derived from the pharynx of the embryo, with which it at first communicates, although he says that this connexion is soon lost; while my observations show that it is persistent at all stages in the history of the stolon of *Salpa pinnata* and *Salpa cylindrica*.

He gives (p. 18) a good description of the segmentation of the side-walls of the endodermal tube, but he says that the endoderm and mesoderm are the active agents in the segmentation of the stolon; while my own observations show clearly that the most active agent is not the endoderm nor the mesoderm, but the ectoderm.

He states correctly that the structures which I have called the pharyngeal pouches arise from the side-walls of the endodermal tube, and that two of them enter into the body of each Salpa; but here the agreement between his account and my own observations ends, although his figures show clearly that the species which he studied, *Salpa democratica*, agrees in all essentials with those which I have studied.

While the two pharyngeal pouches are actually right and left, he regards one as dorsal and the other as ventral, and says that the dorsal one is largest and that it lies from the first on that side of the stolon to which the Salpa belongs, and that it runs through the whole length of the body of the young chain Salpa and opens in its middle region into the horizontal endodermal tube of the stolon, so that a neural and a hæmal part are distinguishable.

His account and figures show that his so-called dorsal pouch is actually the right pouch of a right-hand Salpa or the left pouch of a left-hand one.

In other respects his account of the origin and primary relations of this pouch is correct, although he fails to discover that the history of the second pouch is exactly the same.

He describes the second pouch as ventral and much smaller and as lacking the oral end, and he says that it looses long before the dorsal pouch its connexion with the horizontal tube, and becomes a closed vesicle, and that, as the hinder ends of the bodies of the Salpa diverge from each other, the smaller ventral pouch pushes further backwards than the larger dorsal one, and that the hindermost end of the dorsal pouch gives rise to a diverticulum which grows round the hinder surface of the ovary to unite with the ventral pouch. The dorsal pouch gives rise, he says, to the pharynx, on the ventral surface of which the endostyle is developed, while the œsophagus, stomach, and intestine are formed from the rudiment which has arisen at the posterior end by the union of the two pouches.

It is not necessary to enter into a more minute analysis of his description, for comparison will show that he has been misled by his erroneous conception of the primary position of the buds, and has mistaken the symmetrical right and left pouches for unpaired dorsal and ventral ones.

His more recent account of the origin of the post-pharyngeal gut of *Pyrosoma* ('Pyrosoma,' pp. 23–25) is very similar to what I have found in Salpa; for he says (pp. 615–622) that while it arises as a pair of folds from the pharynx, these soon unite to form an unpaired diverticulum, which afterwards becomes differentiated into œsophagus, stomach, and intestine; that its pharyngeal end becomes the œsophagus, while the intestine arises from its blind end and ultimately acquires an anal opening into the median atrium.

Salensky's account of the origin of the gut in *Pyrosoma* is quite different, however, for he says ('Pyrosoma,' pp. 69–72) that it is bilateral in origin and arises as a pair of folds from the sides of the aboral end of the pharynx, which unite with each other to form a horseshoe-shaped canal. If I understand his description, he holds that the right fold forms the œsophageal portion of the gut and the left one the intestinal portion, and that both open at first into the pharynx, although the intestine soon looses this connexion and acquires a new anal opening into the median atrium.

Baltimore,
April 25, 1893.

XXV.—*Descriptions of Three new Species of the Genus* Iletica (Cantharidæ) *in the Collection of the British Museum.* By Mrs. M. K. Thomas.

[Plate VI. B. figs. 1–3.]

Iletica Waterhousei, sp. n. (Pl. VI. B. fig. 2.)

Head narrowed in front, deeply impressed in the centre; anteriorly black and more finely and thickly punctured than posteriorly, where it is red-brown, glabrous, and very shining; eyes brown; palpi and labrum reddish; antennæ black.

Prothorax red-brown, with black down its centre, broader than long, its outer sides slightly convergent posteriorly; a strongly defined posterior transverse impression; a deep median groove with two foveæ on either side, one large and deep, placed posteriorly, the other small and fainter, situated further forwards and outwards; slightly pubescent anteriorly, glabrous and very shining posteriorly.

Scutellum black, finely punctured and shining.

Elytra half as broad again as the prothorax, long, rather rugose, each elytron with four slightly raised lines, including the sutural ones; anterior halves of elytra deep yellow, with two bands of black, their posterior halves wholly black.

Underside and *legs* covered with short yellow pubescence, the former black with yellow patches on the metasternum, the latter black with red spots on the femora of the posterior pair; abdominal segments yellow and infuscated.

Length 32, breadth 10 millim.

Hab. Sierra Leone (*Coll. Foxcroft*).

Besides the type there are in the British Museum two other specimens which, although they vary somewhat as to coloration, are in all other points so similar to *I. Waterhousei*, that they should apparently be referred to the same species. One is of unknown locality, the other also comes from Sierra Leone.

I have named this and the following species after Messrs. Waterhouse and Gahan, in recognition of the kindness and help I have received from them while studying the collection under their charge.

Iletica Gahani, sp. n. (Pl. VI. B. fig. 1.)

Head slightly narrowed in front, entirely black, shining, very thickly and coarsely punctured, a remarkably deep fovea in the centre of the forehead; eyes black; palpi and labrum tinged with red; antennæ black.

Prothorax rather longer than broad, very shining, black, with a large brownish-red spot on each side; anterior and sides slightly pubescent, posterior finely and sparsely punctured and glabrous; a marked central longitudinal impression with two foveæ on either side, one towards the centre large and deep, the other more anterior, small, and somewhat faint.

Scutellum black, finely and thickly punctured, slightly pubescent.

Elytra half as broad again as prothorax, very rugose, shining, coarsely and thickly punctured, glabrous, each elytron with four well-defined raised lines strongly developed basally, but becoming fainter towards the apex; their basal third reddish yellow, infuscated towards suture and with a black humeral spot; remainder black, with a narrow transverse yellow band just past half the length of the elytron.

Underside and *legs*, including femora, tibiæ, and tarsi, entirely black, clothed with fine yellowish pubescence.

Length 28, breadth 10 millim.

Hab. Dar-es-Salaam, E. Africa.

Iletica castanea, sp. n. (Pl. VI. B. fig. 3.)

Head entirely red-brown, almost glabrous, and very shining, coarsely punctured; the vertex more finely and sparsely punctured; a very marked longitudinal groove down the centre, the groove as deeply impressed posteriorly as anteriorly.

Antennæ and *palpi* red-brown.

Prothorax red-brown, infuscated anteriorly, broader than long, the sides obliquely convergent in front and behind, the base sharply margined, the anterior half transversely depressed, pubescent, and more thickly punctured than on the posterior half, where it is almost glabrous and very shining; median channel not strongly developed, a fovea on either side.

Scutellum red-brown, thickly and finely punctured, pubescent.

Elytra entirely red-brown, immaculate, once and a third wider than prothorax, narrowing slightly towards apex, rugose, with the longitudinal raised lines on the disk well defined at the base, becoming fainter towards the apex; the apices rounded externally.

Underside and *legs*, including femora, tibiæ, and tarsi, entirely and densely clothed with fine, silky, bright golden pubescence; finely and thickly punctured, the tibiæ more coarsely so.

Length 39, breadth 11 millim.

Hab. Siam (*Coll. Mouhot*).

This beautiful species differs from *Iletica testacea,* its nearest ally, in the peculiar sculpture of the head, its entirely uniform chestnut colour, and the golden pubescence of its under surface.

XXVI.—*Contributions towards a General History of the Marine Polyzoa,* 1880–91.—*Appendix.* By the Rev. Thomas Hincks, B.A., F.R.S.

[Concluded from vol. xi. p. 182.]

'Annals,' May 1884 (p. 361) *.

Porella malleolus, sp. n.

Mr. Waters records this species as occurring in New South Wales ('Annals' for July 1889, p. 16). He regards it as a variety of *Smittia Landsborovii,* a view which I confess I am not prepared to accept.

Ibid. (p. 363).

"POLYZOA FROM VICTORIA AND WESTERN AUSTRALIA."

Pedicellinopsis, gen. nov.

This genus was constituted for a ramified Pedicelline species remarkable for its distinctive habit, its specialized muscular

* The paging to the close of the "Appendix" is that of the 'Annals,' and not of the separate copies.

structure, and its highly developed periderm. On further consideration, however, I am satisfied that the peculiarities of this very interesting form have no *generic* value, and that there is not sufficient ground for separating it from *Barentsia*, Hincks, a genus previously established for the reception of an Arctic species (*B. bulbosa*)*.

Mr. Busk has taken the same view ('Challenger' Report, part ii. p. 41). While I agree with him in his decision on this point, I am quite unable to follow him when he proceeds to suppress the genus *Barentsia* in favour of his own *Ascopodaria*, a "provisional" MS. name which he had connected with a species of which no description or figure had been published at the time when the genus *Barentsia* was fully characterized in the 'Annals.' That Mr. Busk had "already proposed to establish" a genus *Ascopodaria* (of which I had no knowledge whatever) before my paper appeared could give it no claim to precedence according to the received laws of zoological nomenclature. In point of fact it never was defined until *Barentsia* had taken a place in the literature of the Polyzoa.

Pedicellina gracilis, Sars, must be associated with the present form in the genus *Barentsia*, as it possesses the basal concentration of muscular force and a partially rigid or chitinous peduncle.

Ibid. (p. 366).

Flustrella dichotoma, von Suhr (sp.).

In his 'Challenger' Report (pt. i. p. 48) Busk removes this species from the genus *Farciminaria*, in which he at first placed it, but still ranks it in his family Farciminariadæ. He adopts the generic name *Verrucularia*, conferred upon it by v. Suhr, who regarded it as a *Fucus*.

My examination of Australian specimens has led me to regard this form as allied to the Ctenostomata rather than to the Cheilostomata. The orifice of the zoœcium closely resembles that of the Flustrellidæ, being bilabiate and, so far as I could determine, agreeing in all essential characters with that of *Flustrella*.

In the latter genus the setose operculum is inconspicuous, and I was unable to detect it in spirit-specimens of the present form.

Whatever may be the exact systematic position of this species, I can see no reason for ranking it amongst the

* Ann. & Mag. Nat. Hist. for October 1880, p. 277, pl. xv. figs. 12–14.

Farciminariadæ, which form anything but a natural group. Indeed, in a natural system such a group could find no place. The characters on which the family is founded are merely zoarial, and the chief point relied upon as a diagnostic is the disposition of the zoœcia round an imaginary axis, so as to form cylindrical branches. Such a family diagnosis would include a miscellaneous and artificial group between whose members there might be little, if any, natural affinity. *Verrucularia dichotoma*, v. Suhr, would be an alien amongst the forms which compose the family Farciminariadæ of Busk.

MacGillivray has noticed the "close affinity" in structure between *Flustrella* and the present form *, and remarks that "it undoubtedly forms a close connecting-link between the two suborders" (Cheilostomata and Ctenostomata); but, "notwithstanding the absence of avicularia and oœcia and the structure of the mouth," he would refer *Verrucularia dichotoma* to the same Cheilostomatous family as *Farciminaria*. No reasons are given in support of this decision, but there is much to be said against it.

The mode in which the zoœcia are disposed and the habit of the zoarium, it is now generally admitted, are not characters which can be relied upon as indications of natural affinity. Agreement in these points is commonly associated with the most significant structural differences. In the present case the two forms in question are distinguished by very different types of orifice and oral operculum. In *Farciminaria* the orifice presents the normal Cheilostomatous character; in *Verrucularia dichotoma* it is distinctly bilabiate, bounded above and below by a chitinous rib, the lower one (probably) connected with a movable lip. This is an important difference, which forbids the union of the two forms in the same family group.

The present condition of my specimens of *Verrucularia* prevents me from completing my study of the structure; but enough has been determined to prove that it must be separated from *Farciminaria*. Provisionally, at least, it may be associated with *Flustrella*, with which it seems to be most closely connected.

Ibid. (p. 368).

Cellaria fistulosa, var. *australis*, MacGillivray.

There is no doubt that this form should be accounted a distinct species, as I have suggested †.

* 'Zoology of Victoria,' vol. ii. p. 348.

† See Waters, 'Challenger' Rep. p. 16, pl. ii. figs. 1–4.

'Annals,' October 1884 (p. 276).

Menipea marginata, sp. n.

This species must be referred to *Caberea rudis* of Busk.

The specimens of it on which my description is founded were to a large extent destitute of vibracula. In the first instance, indeed, I could find no trace of them, and, in the supposed absence of this essential character, was not likely to connect the species with the genus *Caberea*.

My attention having been drawn to the remarkable agreement of the two forms in many of the structural elements, I have made a careful re-examination of the dorsal surface, with the result that I have detected the vibracular grooves in a limited number of cases, and in some of them to all appearance imperfectly developed, whilst in a large number of cases not one was met with upon a branch. Only one or two setæ were observed. My specimens show that the vibracular zooids are liable to be very partially developed, or, in some cases, even suppressed.

Busk describes the aperture as "oval;" it is somewhat contracted above and expanded below. He does not mention the very large size of the marginal cells and of the three spines which they bear. This is a striking feature of the species, as is also the line of large avicularia with broad triangular mandible, each on a distinct area, which alternate with the marginal zoœcia.

Ibid. (p. 279).

CYCLICOPORA, gen. nov.

Cyclicopora prælonga, sp. n.

This species is identical with *Lepralia longipora*, MacGillivray *, which was published in 1882, and his specific name must therefore take the place of the above.

Ibid. (p. 280).

Schizoporella subsinuata, sp. n.

When I described this species I had not met with specimens of it bearing avicularia; but they have since occurred, and instead of the clause in the diagnosis "*Avicularia* none," the

* 'Descriptions of new or little-known Polyzoa,' part ii. p. 6, pl. iii. fig. 18 (1882).

following must be inserted:—"*Avicularia* elongate-oval, rather large, the mandible rounded, irregularly distributed, sometimes placed obliquely above the orifice, sometimes on the lower part of the front wall."

Ibid. (p. 280).

Schizoporella biturrita, sp. n.

Waters identifies this form with *Eschara tuberosa*, Reuss. As I have not had an opportunity of consulting the work in which the latter is described, I accept the identification on his authority. The leading features of the species are the tower-like elevations on each side of the orifice, usually bearing avicularia, and the gigantic umbonate oœcium. The position of the avicularia, as Waters has remarked, is variable; commonly they are placed at the back of the "tower," but frequently at the sides, the pointed mandible directed upward. In the cells bearing oœcia the orifice is larger and has a wider sinus than in those which are not ovicelligerous. The oral arch of the oœcium is remarkable for its size.

The variety in which lateral offsets from the "towers" unite so as to form a bridge over the orifice is much more striking than significant. The structural change is very slight and trivial, though it affects materially the aspect of the species. In all essential characters it agrees entirely with the normal form.

The only specimen of the variety which I possess is from Africa.

At one time I was inclined to regard this species as identical with Busk's "*Gephyrophora polymorpha*" ('Challenger' Rep. p. 167), but the examination of specimens from New Zealand has shown that there are most important differences between them, especially in the position and structure of the oœcium*. It need hardly be pointed out that the bridge across the orifice is a character of no generic significance and that the genus *Gephyrophora* must be abandoned.

The New-Zealand specimens of the latter are of small size (less than half an inch in height), erect in habit, the stems cylindrical, slightly branched, trifid at the upper extremity, the surface smooth and somewhat glossy. The small pointed avicularia are borne on the summit of the lateral elevations, the mandible directed outwards.

* Waters, 'Challenger' Supplement, p. 29.

'Annals,' March 1885 (p. 245).

Diachoris quadricornuta, sp. n.

Jullien's species *D. maxilla* * has been referred to the present form; but in the absence of specimens of the former I should hesitate to identify them.

Ibid. (p. 247).

The footnote may be cancelled; I have already given my reasons for uniting *Diachoris* with *Beania*.

'Annals,' March 1891 (p. 286).

Flustra spinuligera, sp. n.

Though I have treated this form as distinct from *Carbasea rhizophora* of Ortmann, there may, I think, be a question whether it should not rather be regarded as a variety of the Japanese species. There is a remarkable similarity between them in most of the leading characters.

The zoœcia agree in all respects but one. In *F. spinuligera* the margin bears a continuous line of short spines, and within the margin and just below it there is a line of minute denticles; these are wanting in *C. rhizophora*. But the form of the cell, the orifice, the oœcium, and the avicularium are alike in both. When we come to the zoarial characters we meet with some dissimilarity.

The South-African form is unilaminate and erect; the Japanese bilaminate and decumbent, and attached by tubular fibres springing from the dorsal surface.

The marginal spines, as we know, are not very constant among the Polyzoa; the internal denticles might very possibly escape observation. Both unilaminate and bilaminate forms occur within the limits of a species; so that the decumbent habit and the radical appendages would seem to be the most important distinctive characters. Taking into account the perfect agreement of the zoœcia in all the most significant elements, we shall, I think, best represent the relationship between the two by ranking *Flustra spinuligera* as a form of *Flustra rhizophora* †.

* 'Cap Horn,' 74, pl. vii. fig. 3, pl. xi. fig. 4.

† The genus *Carbasea* is founded on a very trivial zoarial character, and, in my judgment, should be abolished or restricted to such of the forms now included in it as may represent a distinct specific type.

Ibid. (p. 289).

Schizoporella concinna, sp. n.

There may be a doubt as to the genus to which this species is referable. At first sight the orifice seems to agree in structure with that which is characteristic of *Schizoporella*; but there are peculiarities which may create a doubt. The sinus is placed in the centre of a thin raised lamina which overhangs the orifice below, taking the place of the lower margin, and *continuous with the sides of the orifice.* Immediately behind this lamina is "the ridge-like elevation of the cell-wall," which is carried up along the sides of the orifice *. The true operculum, which is membranaceous, extends to the top of the basal lamina, where it is crossed by a very distinct hinge-line in connexion with two lateral denticles. A membranous extension of the operculum passes downward behind the raised lamina. In some respects the orifice of this species bears a resemblance to that of *Lepralia*; but as the lamina which carries the sinus seems to be distinctly continuous with the side-walls of the orifice, there seems to me to be no structural difference of any significance between this form and *Schizoporella.*

Ibid. (p. 290).

Schizoporella bimunita, sp. n.

In this species one of the large avicularia on the front wall is not unfrequently absent.

A very fine specimen, obtained by Miss Jelly from Port Elizabeth, is somewhat fan-shaped, borne on a short thick stem; the surface is traversed by rib-like lines, which radiate from the circumference towards the stem. The large oœcial cells form conspicuous groups.

Ibid. (p. 296).

Lepralia lancifera, sp. n.

It has been suggested that this form may be identical with *Hemeschara imbellis*, Busk, described and figured in his 'Monograph on the Crag Polyzoa.' This species had been previously characterized by Milne-Edwards under the specific name *pertusa*; but as this designation had been already

* See 'Annals,' ser. 6, vol. vii. pl. vi. figs. 2, 2 *a*.

applied to another species, Busk's name must displace it. Mr. Waters has obtained *Lepralia imbellis* from the New-Zealand Tertiaries *.

As to the supposed identity of *L. lancifera* and *L. imbellis*, I hesitate to give a decided opinion; but on a careful comparison of Busk's description and figure of the latter with a fine specimen of *lancifera* from South Africa, for which I am indebted to Miss Jelly's kindness, I have noted the following differences between them, which are by no means unimportant. In Busk's diagnosis (which is meagre and insufficient) the cells are merely characterized as "ovate, punctured, especially round the border; subumbonate in front, with an orifice having a straight lower border and simple peristome." It is obvious that there is nothing very distinctive in this description; it would apply to a multitude of forms. One clause of it, however, is certainly inapplicable to *L. lancifera*—"*subumbonate* in front." Probably the most striking feature of the latter is the large umbonate rising of the front wall below the orifice, on which the long lanceolate avicularium is borne. Referring to Mr. Busk's figure, we find no adequate representation of this structure. In *L. lancifera* the zoœcia are bounded by strongly marked raised lines, which are not present in *L. imbellis*. The oœcium of the last-named, as shown in Busk's figure ('Crag Polyzoa,' plate iv. fig. 6), differs widely from that of *lancifera*. The entire absence of all traces of avicularia on the fossil form, except on the suboral umbo, whilst they are present in profusion on the recent species, especially in the neighbourhood of the oœcium, is another difference of some significance. On the whole, without venturing to dogmatize, I am inclined to regard the two forms as probably specifically distinct †.

XXVII.—*New Geometers.*

By Col. C. Swinhoe, M.A., F.L.S., &c.

The species described in this paper will appear in the second volume of the 'Catalogue of Moths in the Oxford University Museum'; and as the publication of this book will be delayed, from unavoidable causes, for some months, the following new species are now published to ensure the types to the Public Museums of London and Oxford.

* "On Tertiary Cheilostomatous Polyzoa from New Zealand," Quart. Journ. Geol. Soc. for February 1887, p. 40.

† Further investigation of the fossil form is much needed.

Family **Euschemidæ.**

Genus Euschema, Hübn.

Euschema scyllea.

♂. Head, body, and wings yellow; antennæ black; thorax with indications of two grey spots in front, but without bands. Fore wings with the apical half black, its inner border extending straight from the centre of the costa to the hinder angle, angled inwards in its centre; the blackish space includes two bluish-white semihyaline macular bands, the first of four and the second of three spots; no markings in the internal half of the wing. Hind wings whitish on the costa; a blackish elongated spot at the end of the cell, and a macular marginal blackish band, the first three spots near the apex large and running into each other, followed by three small spots, the last two curving inwards. Underside as above, except for a spot at end of cell of fore wings, which is slightly visible above through the wing.

Expanse of wings $3\frac{2}{10}$ inches.

Type: India. In O.M.

Allied to *E. militaris*, but very distinct, having no bands on the thorax and no internal bands on either wing.

Family **Geometridæ.**

Genus Herochroma, nov.

Differs from the genus *Pingasa* in the males having simple, not pectinated, antennæ as in that genus.

Herochroma baba.

♂. Wings shaped similarly to *H. viridaria*, Moore; colour of a uniform grass-green, somewhat similar to but brighter than in *H. subtepens*, Walker, xxi. 438, type from Sarawak, but also a common Indian insect. Both wings crossed by an outwardly dentated brown discal line, black marginal lunules at the ends of the veins, a row of submarginal white dots on the veins, a black spot at end of each cell. Underside with the ground-colour greyish white, smeared with dark ochreous, a large black spot at end of each cell, a broad discal band across both wings, and black marginal lunules.

Expanse of wings $1\frac{8}{10}$–2 inches.

Type: Khasia Hills. In B.M.

A long series. Allied to *H. viridaria*, but of an entirely different shade of green colour, and without the bronze tessellations with which that insect is covered and without the reddish-brown bands.

Genus Absala, nov.

♂ ♀. Costa arched, inner margin slightly rounded, more than two thirds length of costa, outer margin nearly as long as inner, slightly rounded, scalloped between the veins in both wings. Hind wings with the apex rounded; venation of both wings normal, except that vein 5 of hind wings is emitted very close to the top of the cell. Antennæ in both sexes bipectinated to the tip with short bristles, slightly shorter in the female than in the male. Hind tibiæ with two pairs of spurs.

Differs from the genus *Pachyodes* (type *hæmataria*, H.-Sch.) in its longer and rounder wings, in the closeness of the origin of vein 5 of hind wings to the top of the cell; the pectinations of the male are similar, but the female of *Pachyodes* has simple antennæ.

Absala dorcada.

♂ ♀. Of a uniform milky-white colour; antennæ reddish ochreous, palpi with bright chestnut-red hairs, fore and middle legs of the same colour, front of head ochreous; wings striated with olive-grey, more densely in the outer portions, forming discal and submarginal bands on the hind wings. Fore wings with a small patch of olive-grey on costa before the middle and four or five large patches at the apex; olive-grey marginal lunules to both wings, and the large black cell-spots of the underside showing through the wings, and a black spot on the hind wings on the space where the spot from the underside can be seen. Underside pure white; base of both wings and thorax and hind legs suffused with bright ochreous; costa of fore wings marked with black, some black patches and black marginal lunules at apex, a large round black spot at end of each cell, one in the first median interspace of fore wings, and two large and similar spots on the disk of the hind wings, one towards the apex and the other near the abdominal margin.

Expanse of wings $2\frac{3}{10}$ inches.

Type: Khasia Hills. In B.M.

Genus Episothalma, nov.

♂. Fore wing more or less falcate, with costa arched before the apex, outer margin excavated below the apex, produced at end of excavation above the middle, from whence it is oblique to the inner angle, which is somewhat acute, scalloped between the veins; inner margin very slightly rounded, nearly straight. Hind wing with the apex rounded, outer margin toothed, with tail-like extremities at terminations of veins 4 and 6.

Allied to genus *Thalassodes*, Guen. (type *quadraria*, Guen.); venation normal, but has fasciculate antennæ in the male, instead of pectinate, as in that genus.

Type *sisunaga*, Walker, xxiii. 550.

Genus Tanaorhinus, Butler.

Tanaorhinus kina.

♂. Of a uniform dark shining green colour; antennæ with the shaft green, pectinations dark grey; palpi black, frons bright ochreous. Wings with pale greenish-white markings; fore wings with a lunular mark at the end of the cell and a lunular band near the base; both wings crossed by a discal band of lunules, with a band of lunular spots adjoining on its outer side and a submarginal line of inverted lunules; cilia white. Underside pale green, the hind wings being slightly tinged with yellow; fore wings with a black spot at the end of the cell; both wings crossed by a black macular discal band somewhat near the margin on the hind wing, the spots are joined together more or less, making the band nearly complete; on the fore wings the spots are smaller, not together, and double as they go upwards; marginal line black, cilia white; body pale greenish grey, legs green, tarsi with black bands.

Expanse of wings $1\frac{8}{10}$–2 inches.

Type: Khasia Hills. In B.M.

Allied to *T. dimissa*, Walker, xxii. 516, but much smaller; can easily be distinguished by the difference in the markings below, the latter having a nearly straight black band from the abdominal margin of hind wings a little beyond the middle to the costa of fore wings near the apex; the submarginal band of *dimissa* also is very differently situated and does not extend up the fore wings.

Family **Idæidæ.**

Genus Synegioides, Swinhoe.

Synegioides diffusifascia.

Synegioides diffusifascia, Swinhoe, Trans. Ent. Soc. Lond. 1892, p. 11 (woodcut).

By some error the type of this genus is put down as *S. diffusaria*, Moore, P. Z. S. 1867, p. 641; this is a slip of the pen, it should have been *sanguinaria*, Moore, with the same reference; the description of the genus and the woodcut were both taken from the latter species.

Genus IDÆA, Treit.

Idæa peralba.

♂ ♀. White glistening; a black dot at end of cell in all the wings, black dots on the outer margins. Wings covered with very minute grey irrorations; costa of fore wings grey, five transverse grey bands, first before the middle and outwardly curved, second medial and sinuous, third, fourth, and fifth close together, the fifth being marginal, and all sinuous. Hind wings with four bands, the first before the middle in continuation of the second band of the fore wings, second, third, and fourth at even distances corresponding to the third, fourth, and fifth of fore wings; fringe long, pure white.

Expanse of wings 1 inch.

Type: Fort Stedman, Shan States. In B.M.

Genus DEFOA, nov.

♂. Fore wings with the costa slightly arched before the apex, outer margin rounded, inner margin straight, four fifths the length of the costa. Allied to the genus *Somatina* (type *anthophilata*, Guen.). Hind wing with vein 7 emitted at end of cell, instead of before it, as in that genus; mid tibiæ with two spurs; hind tibiæ greatly incrassated, a tuft of long hairs from the upper end; hind tarsi obsolete, there being merely a small point at the end of the tibiæ.

Defoa ustata.

♂. Dark olive-grey, patched and suffused with chestnut-brown. Fore wings with a white lunular mark at the end of the cell, margined with brown, a large chestnut-brown patch covering nearly the whole discal space, extending from inner margin nearly to the costa, where it is rounded and margined with dark brown. Hind wings with a similar-coloured but much paler patch, which extends nearly evenly from the abdominal margin to the costa, is striated with black, covers more than half the wing-space, and has a sinuous outer margin near the outer margin of the wing; a small white cell-dot with a brown margin, and marginal lunules to both wings brown. Underside of a uniform pale brownish grey, with black suffusion on lower half of fore wing and costal space of hind wing, which runs down the outer border a short space; fore wing with a black spot at end of cell and a black discal band; hind wings with a similar internal band.

Expanse of wings $1\frac{1}{10}$ inch.

Type: Khasia Hills. In B.M.

Family **Boarmiidæ**.

Subfamily *Caberinæ*.

Genus Microniodes, Hampson.

Microniodes, Hampson, Ill. Typ. Lep. Het. B. M. ix. p. 139 (1893).

Microniodes ocernaria.

♂. Pure white; antennæ ochreous brown, top of head chestnut-brown, frons pure white; body and wings pure white, wings with ochreous-brown lines and bands; fore wings with a costal band, an inner line running from the inner margin near the base towards the end of the cell, where there is a similarly coloured dot, and three submarginal spots at the apex; both wings with a medial band composed of a line outwardly shaded with paler colour from the abdominal margin of hind wings one third from the base to the apex of fore wings; a line from the abdominal margin one third from the anal angle to the apex of fore wings, stopping before the third apical dot; a submarginal rather indistinct angulated line, most distinct on hind wings, and a marginal line; cilia of the same colour, paler than the lines, and with pale tips. Underside pure white, unmarked; costal and marginal lines ochreous brown, cilia as above.

Expanse of wings $1\frac{6}{10}$ inch.

Type: Khasia Hills. In B.M.

Allied to *M. obliqua*, Hampson, which lacks the inner and discal lines and is a larger insect.

Subfamily *Plutodynæ*.

Genus Micronissa, Swinhoe.

Micronissa, Swinhoe, Trans. Ent. Soc. Lond. 1891, p. 483.

Micronissa dephinaria.

♂. White. Fore wings with the costa pale ochreous; wings thinly clothed, crossed by indistinct grey lines—first an antemedial line somewhat distorted, second a medial line, straight on fore wings, sinuous and partly dentated on hind wings, third a discal line dentated on both wings, very indistinct; marginal line brown, a reddish-brown spot on the angle in the second median interspace of the hind wings, edged with pure white on its inner side. Underside pure white, without any markings.

Type: Khasia Hills. In B.M.

This species is the type of the genus *Micronissa*, and was wrongly identified in my paper above referred to as *margaritata*, Moore (*Urapteryx margaritata*, P. Z. S. 1867, p. 612), the type of which is unique, and which, though superficially like this species, belongs to another genus.

Subfamily *Ennominæ*.

Genus Hyposidra, Guen.

Hyposidra kala.

♂ ♀. Of a uniform dark slaty mouse-colour; wings with two transverse brown central bands, both bands indistinct, rather broad, rather close together, and curving slightly outwards, the entire surface above thickly covered with very minute whitish irrorations. Underside as above, the whitish irrorations thickened into a whitish smeared band on the outer margin of fore wings below the apical falcation.

Expanse of wings, ♂ 2, ♀ $2\frac{1}{2}$ inches.

Type: India. In O.M.

Subfamily *Zereninæ*.

Genus Obeidia, Walker.

Obeidia lucifera.

♂ ♀. Head and body ochreous; thorax with brown spots, abdomen with brown bands. Wings white, with a broad band on all the margins, ochreous spotted with brown in some specimens, but the brown prevailing in others; in some specimens, especially in the females, the bands are macular, much as in the Chinese species *O. tigrata*; on the hind wings there is also a brown macular discal band.

Expanse of wings, ♂ $2\frac{7}{10}$, ♀ $2\frac{8}{10}$–3 inches.

Type: Darjiling. In O.M.

Differs from *O. tigrata* in the ground-colour of the wings being pure white instead of dark ochreous, as in that species.

Genus Abraxas, Leach.

Abraxas conferta.

♂. Thorax and abdomen ochreous, with brown spots.

Wings white; fore wings with three broad pale greyish macular bands, first basal, on an ochreous ground-colour, broadly continued on the costa till it reaches the second, which is oblique, has an ochreous central band, and bifurcates towards the costa, one portion going towards the apex, the outer portion of this band joining the marginal band. Hind wings with a faint discoidal spot, some faint spots on the outer and abdominal margins, and a discal curved band of faint single spots.

Expanse of wings 2 inches.

Type: India. In O.M.

Subfamily *Macariinæ.*

Genus Evarzia, Walker.

Evarzia odataria.

♂. Grey, striated with reddish grey; costa of fore wings with some dark reddish-brown marks, some similar marks near the base; both wings with a sinuous irregular antemedial brown transverse line; a discal dark brown straight double band from the abdominal margin of hind wings near the angle to the costa of fore wings one fourth from apex, the space from this band to the margin of a darker and rather purplish shade; a blackish spot on the outside of the central portion of the band on both wings; marginal line black; cilia grey; a black dot at end of cell in hind wings interrupting the antemedial line. Underside greyish white, with brown striations, subbasal and antemedial brown sinuous transverse lines, the outer band broad, not duplex, touching the outer margin in the fore wings below the apex, leaving an upper and a lower marginal patch of white, and touching the margin in the hind wings at the apex, leaving a lower marginal patch of whitish.

Expanse of wings $1\frac{4}{10}$ inch.

Type: Khasia Hills. In B.M.

I have this species also from Darjiling and from Sikkim. It is allied to *E. avitusaria*, Walker, from Sarawak, the type of which is in the Oxford Museum.

Genus Gonodela, Boisd.

Gonodela azataria.

♂ ♀. Pale ochreous brown, irrorated and marked with chestnut-brown and marked here and there with minute patches of whitish; both wings crossed by an indistinct median straight band; a discal dark duplex band from the abdominal margin of hind wings one third from apex to the apex of fore wings, where it bends in on to the outer margin below the apex, and then is elbowed back on to the costa, where there is an angulated mark before the apex and a subapical white dot; submarginal line pale sinuous and marginal line dark and distinct; cilia pale interlined with dark brown; a square whitish spot at the base of the first median interspace of fore wings. Underside paler, suffused with ochreous, both wings crossed by three upright blackish bands, the two white spots on fore wings very distinct.

Expanse of wings $1\frac{1}{10}$ inch.

Type: Khasia Hills. In B.M.

Genus Zamarada, Moore.

Zamarada cosmiaria.

♂. Bright grass-green; antennæ, head, and body brown; a black dot at end of each cell. Fore wings with the costa pale ochreous grey, speckled with chestnut-brown; outer margins of both wings with a chestnut-red band, excavated on its inner side below the middle on each wing, and with a pale sinuous line running through the band. Underside as on upperside, band darker towards apex of fore wings.

Expanse of wings 1 inch.

Type: Khasia Hills. In B.M.

Allied to *Z. scriptifasciata*, Walker, xxvi. 1566, type from Sarawak, and *Z. translucida*, Moore, from Ceylon; wings greener and much better clothed, band very much narrower. In both these species the wings are almost hyaline.

Subfamily *Boarmiinæ.*

Genus Opthalmodes, Guen.

Opthalmodes cordularia.

♂. Green, suffused with white; antennæ brown; top of head green; thorax green, smeared with white in parts; abdomen reddish ochreous, white at the base, with black bands; both wings bright olive-green, striated and smeared with white, this colour prevailing at the base and central portions and along the discal band. Fore wings with the costa marked with black spots and patches, interrupted with white; a blackish lunule, edged inwardly with white, on a dark olive-green space at end of cell; a black patch just beyond centre of inner margin, corresponding to a broad black band on hind wing just before the middle, which is broken and attenuated towards the costa of that wing, and is accompanied on its outer side by an indistinct, dentated, and interrupted black line; an outwardly dentated discal band somewhat near the margin across both wings; this band is marked with deep black in places and is interlaced with white; marginal lunules black, cilia white, with black patches. Underside pure white, a large round black spot at end of each cell, black markings on costa of fore wings, and a black apical patch with its extreme apex white, and a submarginal black broken band.

Expanse of wings $2\frac{2}{10}$ inches.

Type: Khasia Hills. In B.M.

A beautiful species, nearest to *O. diurnaria*, Guen., which it resembles in the markings on the underside.

Genus Pseudocoremia, Butler.

Pseudocoremia dendrellaria.

♂. Pinkish white, thickly striated with brown. Fore wings with a subbasal blackish-brown transverse band, which occurs more indistinctly on the hind wings; a medial broader and similarly coloured band, which is elbowed outwardly below the middle and joins a discal lunulate brown band, which is pale-edged on its outer side and is much curved inwards; the space between the bands with few striations and nearly white, the whole space beyond the discal band brown, with striations; this band is also faintly indicated on the hind wings and is there even with the outer margin, and the space between it and the outer margin is also darker-coloured than the rest of that wing, and there is a submarginal pale dentated indistinct line across both wings; marginal line brown; cilia pale, interlined with brown. Underside pale grey, tinged with ochreous; transverse bands similar, but paler than on the upperside; a broad brown marginal band to the fore wings, an indication of a similar band on hind wings, and a brown spot at the end of the cell.

Expanse of wings $1\frac{5}{10}$–$1\frac{6}{10}$ inch.

Type: Khasia Hills. In B.M.

Family **Larentiidæ.**

Genus Epirrhoë, Hübner.

Epirrhoë pallidaria.

♂. Grey, head and body densely irrorated with brown atoms. Fore wings irrorated with grey atoms; basal portion brown, limited by a darker brown outwardly curved sinuous line at one fifth from base; a broad medial brown band with outwardly curved darker brown borders, the band widening above and containing a dark brown spot at the end of the cell; the pale spaces with indistinct incomplete grey sinuous lines thickening into a band towards the apex. Hind wings unmarked; both wings with a lunulated dark brown marginal line.

Expanse of wings 1 inch.

Type: Kala Paui, Punjab. In B.M.

Genus Coremia, Guen.

Coremia ocyptaria.

♂. Blackish brown. Fore wings with two transverse sinuous deep black lines, antemedial and postmedial, the inner one recurved, the outer one curved outwardly, both of them edged outwardly with grey, prominent and broader towards the costa, where each ends in a deep black prominent patch; veins whitish. Hind wings pale brown, with indications of a darker thin transverse band beyond the middle; cilia of both wings brown, with a basal pale pinkish-grey line. Underside of a uniform pale brownish grey, with an indistinct brown thin band across the disk of both wings.

Expanse of wings $1\frac{1}{2}$ inch.

Type: Khasia Hills. In B.M.

I have it also from Kurseyong; it is closely allied to the genus *Coremia*, but is not quite typical.

Genus Chrysocraspeda, Warren, MS. ined.

Chrysocraspeda cerasina.

♂. Purplish red, with a few red irrorations and silver speckles. Fore wings with a minute dark reddish ringlet at the end of the cell, and with a duplex linear mark in the upper disk. Hind wings with a prominent white lunular mark at the end of the cell and an indistinct sinuous reddish discal line. Both wings with dark reddish-brown marginal bands and luteous cilia.

Expanse of wings $\frac{9}{10}$ inch.

Type: Ceylon. In B.M.

Allied to *C. abhadraca*, Walker; the marginal band darker and narrower, colour uniform, the sinuous discal band in fore wings replaced by a short duplex linear mark, and the cell-spot in hind wings replaced by a prominent white lunule.

MISCELLANEOUS.

Cement-glands and Origin of Egg-membranes in the Lobster. By Francis H. Herrick, of Adelbert College.

The cement-glands have hitherto escaped detection in the lobster (*Homarus americanus*), and consequently the origin of the gluey secretion in which the eggs are immersed at the time they are laid, and by means of which they are attached to the body, has never been accurately determined.

Cano's valuable studies ("Morfologia dell' appareccio sessuale feminile, glandole del cemento e fecondazione nei Crostacei Decapodi," Mittheil. Neapel, Bd. ix.) have called attention to the much-neglected cement-glands of the Decapod Crustacea.

Erdl, in 1843, described three egg-membranes in the egg of the lobster, and regarded the outermost of these as a secretion-product of the oviduct. Bumpus also ('Journal of Morphology,' vol. v. no. 2) attributes the "varnish-like layer," which surrounds the ovum of *Homarus* at the time of oviposition, to a secretion which probably comes from the columnar cells of the oviduct. Lereboullet just escaped the discovery of the cement-glands in 1860, but correctly stated that the cement-substance came from beneath the skin of the underside of the abdomen. The true cause of this secretion was first recognized by Braun in 1875, and the subject has been recently investigated in a large number of Decapods with great clearness by Cano.

When the lobster-embryo is about to hatch it is invested by three membranes, from which it escapes to enter upon its first free-swimming larval stage. The outermost of these is the membrane of attachment. Within this is the chorion, which is now nearly absorbed. This is exceedingly delicate, and is often carried away with the former in the process of hatching. The innermost membrane does not belong to the egg, but to the embryo, which it closely invests. The casting-off of this membrane forms the first moult, and unless it is successfully thrown off the larva dies. The earlier embryonic cuticles, which are formed in the long course of embryonic life, are entirely absorbed at the time of hatching.

The secondary egg-membrane, or membrane of attachment, completely separates from the chorion at the time of hatching, except at one point, which is often opposite the thread-like stalk, with which the outer capsule of the egg is continuous. The outer membrane, which is less elastic than the chorion, is subjected to a high degree of tension, until it finally bursts, splitting into two symmetrical halves along the vertical longitudinal plane of the body of the embryo, beginning at the hinder end and coming off over the head and tip of the abdomen.

When the chorion or primary egg-membrane is removed from the ripe egg by means of hot water, it appears to be covered with small rounded areas, which are possibly the impressions of the follicular cells. No distinct pores could be detected in it, but when wrinkled it appears to be vertically striated, which may argue in favour of their presence.

For some time before oviposition the pleopods appear to be filled with a milky-white substance. This appearance is caused by the distended condition of the cement-glands, to the activity of which the secretion which forms the secondary egg-membrane is due. If the cuticle is removed from a pleopod at this time the tissue is seen to be studded with very minute, round, whitish bodies—the cement-glands. They are most abundant over the posteriorly directed sides of the laminæ, and extend up into the stalk. It is noticed also, in a lobster "in berry," that it is upon this side of the swimmeret that the eggs are mostly attached. I have found the glands in the five anterior pairs of pleopods only; but it is possible that they may occur in the telson, the uropods, and epimeral regions. The glands occur singly or in clusters, and are closely crowded along the thickened edges of the laminæ.

Sections show that the gland is composed of a very delicate sheath of connective tissue and a simple epithelium consisting of tall pyramidal cells. The polygonal base of each cell occupies the periphery, at which a large round nucleus is situated, and the apices of the cells meet near the centre of the gland, the lumen of the organ being at this time very slight. It is almost impossible to detect in sections the opening of the gland to the exterior, but it is quite probable that each gland opens separately. Cano describes these glands in numerous forms as bottle-shaped structures, the necks or ducts of which open to the exterior through pores in the cuticle. Pores can be shown to exist in the lamina of the pleopod by removing the tissue by caustic potash and distending the cuticle with water; but pores of the same kind also exist in the appendages of the male, where no cement-glands occur. I cannot at present say how the pores are distributed on the surface of the cuticle, but it is probable that they are not confined to any particular area.

If the glands are examined shortly after oviposition, they show a remarkable change in structure. The glands are enlarged and the epithelial cells have the appearance of degeneration, their nuclei presenting every stage of fragmentation, from the condition of minute chromatin-particles, which fill almost the entire gland, to deeply stained round granular masses, which are much larger than ordinary nuclei. Under these conditions cell-outlines are very dim and the lumen of the gland is not open.

It seems quite probable that the peculiar gland-like structures which I have described in the immature ovary of the lobster (see these Circulars, no. 88) are concerned with the growth of the ovarian eggs. Numerous follicular cells enter these growing ova at an early stage, and gradually become converted into food-products. Their nuclei break up into very small vesicles, and finally lose all their nuclear characteristics, when their degeneration is complete.—*Johns Hopkins University Circulars,* vol. xii. no. 106, p. 103.

Cleveland, Ohio,
March 21, 1893.

Notes on some Mexican Coccidæ *.

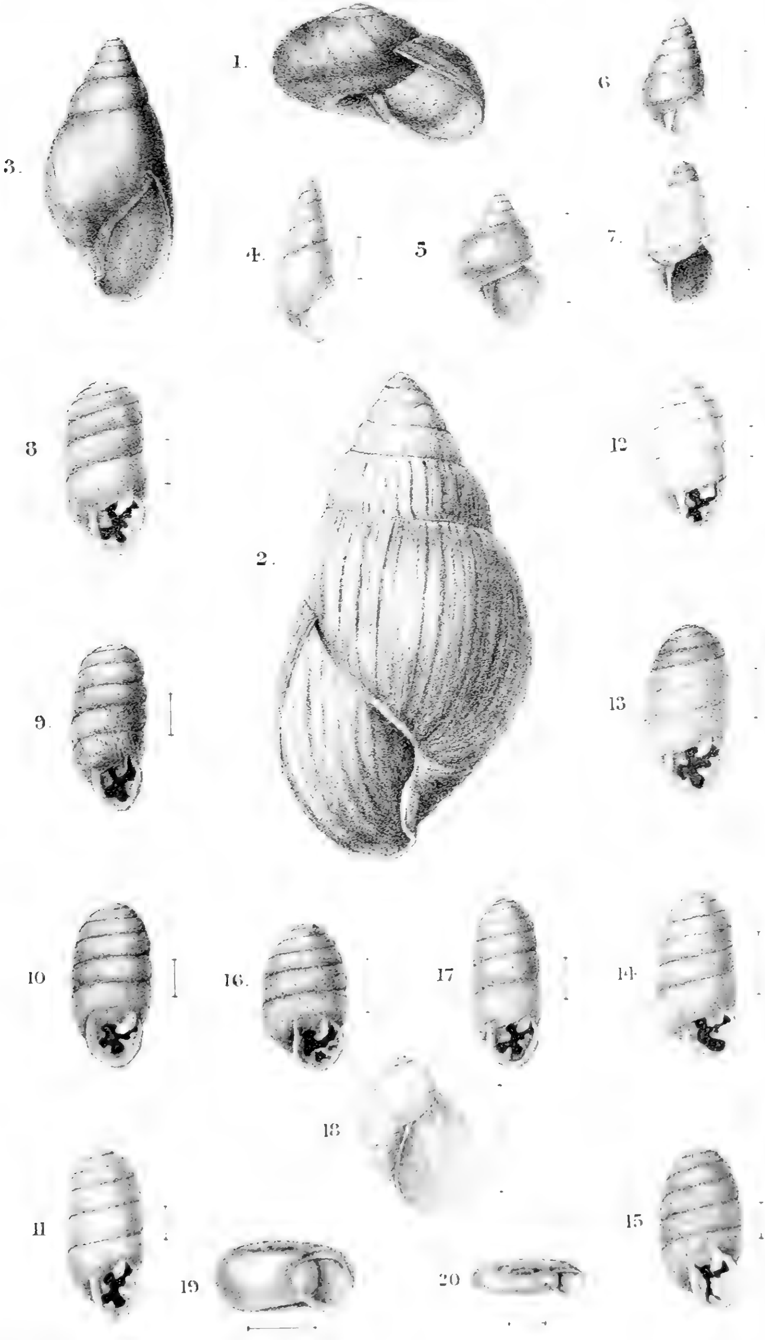
Las Cruces, New Mexico, U.S.A.,
June 21, 1893.

Later studies make it desirable to add a few words. In *Pulvinaria lutea* I remarked on the long bristle on the inner side of the femur. I now believe that this is on the end of the trochanter, as is seen in other species. The trochanter appears to be unusually long and its articulation with the femur difficult to observe. From this correction it follows that the femur itself is shorter than I supposed. The *Ceroplastes* on *Artemisia* was expected to prove identical with one from New Mexico, which has been named *C. artemisiæ* by Dr. Riley, but not described. However, I sent some to Dr. Riley, and hear from him that they are distinct—which is curious, since they live on the same genus of plants in the same zoological subregion. My insect, which is curiously irregular in form, will be called *C. artemisiarum*, sp. n. The other "*Ceroplastes*" alluded to, on a spiny shrub, has a glassy rather than waxy scale and 7-jointed antennæ, wherein it agrees not with *Ceroplastes*, but with the New-Zealand genus *Inglisia*, Maskell. I call it, therefore, *Inglisia nivea*, sp. n. T. D. A. Cockerell.

Las Cruces, New Mexico, U.S.A.,
June 24, 1893.

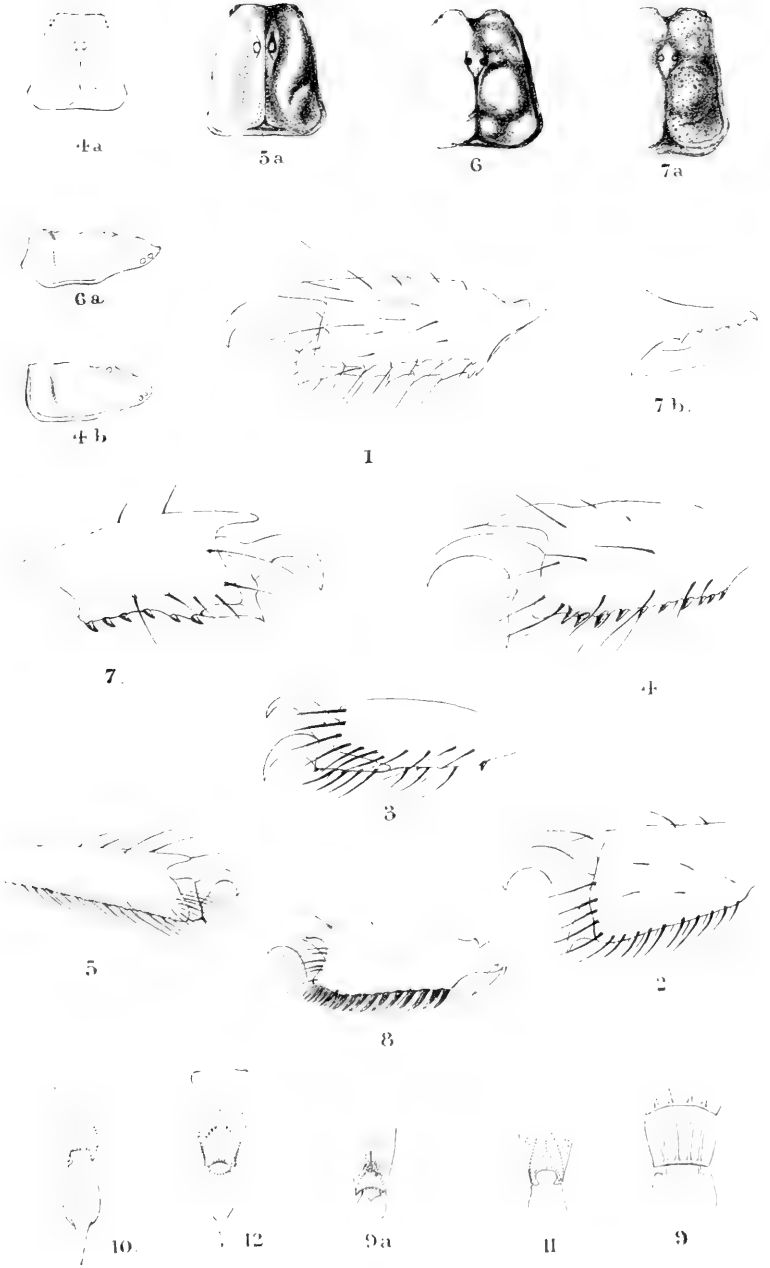
Mr. Robert Newstead, to whom I sent specimens of *Pulvinaria lutea*, remarks that in structure the ovisac agrees not with true *Pulvinaria*, but with the closely allied genus *Lichtensia*, Sign. At the same time he kindly sends me specimens of *L. viburni*, Sign. (the only known species of the genus), which were found at Llandaff, Wales, by Mr. B. Tomlin. *P. lutea* and *L. viburni* differ very greatly in superficial appearance; but, as Mr. Newstead states, they show some generic points in common. Detailed comparisons will be made, and reported on in some future paper. T. D. A. C.

* [The above notes reached us too late for insertion with the paper in our July number.—Eds.]



R. Mintern del. et lith.

Mintern Bros. imp.

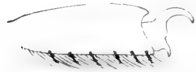


R I P del.

Mintern Bros. lith.

A

13 a



14 a.

15 a

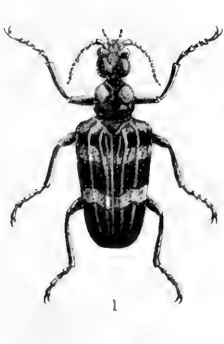
13.

14

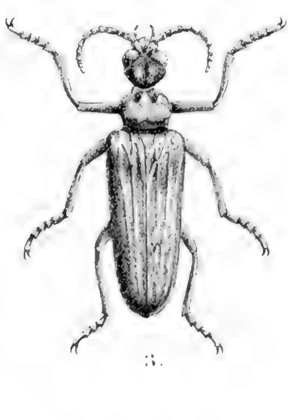
15.

B

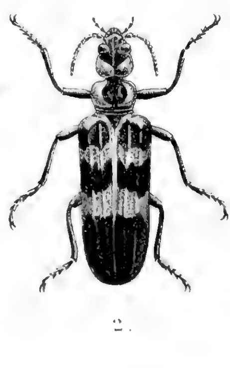
3 a



1



3.



2.

Mintern Bros. lith.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 69. SEPTEMBER 1893.

XXVIII.—*Descriptions of new Coleoptera from New Zealand.* By Captain THOS. BROUN.

THE present contribution contains descriptions of eleven new genera and seventy-four new species. The numbers, such as "No. 1469" for example, refer to my 'Manual of New Zealand Coleoptera.'

Group **Anchomenidæ.**

Dichrochile anthracina, sp. n.

Suboblong, very slightly convex, shining, black; antennæ and palpi piceous, the tips of the latter paler; tarsi rufo-piceous, the anterior with dark spots.

Head rather more than half the width of the thorax, narrowed behind, with exceedingly minute dense sculpture, with a setigerous puncture near each eye. *Labrum* widely and deeply emarginate, the left side more prominent than the right. *Mandibles* stout, the left broader at the base and more incurved at the apex than the other. *Eyes* moderate. *Antennæ* slender, reaching backwards beyond the middle thighs, basal three joints glabrous, third about one third longer than second, but shorter than fourth. *Palpi* elongate, the terminal joints of the labial not thicker than those of the maxillary. *Thorax* about one third broader than long, its sides rounded, rather more narrowed behind than in front; apex medially truncate, the sides directed forwards, so that the anterior angles are not at all rounded off; base widely incurved, without distinct margins in the middle, posterior angles very much rounded; lateral margins more flattened behind than in front, the dorsal groove somewhat indistinct near its extremities; near the apex there is an angulate impression; basal fossæ elongate, situated midway between the middle and the sides; in front of these, but nearer the sides, there are two shallow curvate impressions; the space between each fossa and the hind angle is flattened and feebly punctured; on each side, before the middle, there is a setigerous puncture. *Scutellum* large, subopaque, densely and minutely sculptured. *Elytra* ovate-oblong, obliquely sinuously narrowed posteriorly; base smooth, distinctly marked off, much incurved near each side for the accommodation of the thoracic angles, which, however, do not extend to the shoulders; with deep, regular, apparently impunctate striæ, scutellar grooves distinct; interstices a little convex, moderately broad, the third with two punctures, one is subapical, the other is placed before the middle.

There is but one similar species, *D. maura*; in it the labrum is of the same shape, the eyes are smaller, and the thorax is less transverse and more evidently narrowed posteriorly.

♀. Length $4\frac{1}{4}$, breadth $1\frac{5}{8}$ lines.

Ligar's Bush, Papakura. Two females.

Group **Feroniidæ.**

Pterostichus ithaginis, sp. n.

Elongate-oblong, slightly convex, shining, black; palpi and tarsi piceo-rufous, the three basal joints of the antennæ piceous and glabrous.

Head narrowed behind; eyes moderately prominent; mandibles feebly striate above. *Thorax* only about one sixth broader than long, its apex usually subtruncate, the base medially emarginate; it is very little wider near the front than it is at the middle, its sides very gradually narrowed posteriorly, with a slight sinuosity near the base, hind angles not projecting, rectangular; the surface is very feebly transversely striated, the median furrow is well-marked and hardly at all abbreviated, the basal impressions are well-defined and moderately broad. *Elytra* oblong-oval, shoulders slightly dentiform, apices broadly rounded; their striæ are not deep, they are rather finely and not regularly punctured, interstices nearly plane. *Legs* moderate, posterior femora not angulate below.

Thorax with four setigerous punctures on each side, the last ventral segment with one; scutellum more or less striate at base.

When compared with its nearest ally, No. 1469, it will be seen that it is narrower, the thorax is longer and narrower and much less contracted near the base, and the elytral striæ are not so deep. In *P. pellax* the grooves of the elytra are quite deep and rather broad.

Female.—Thorax of equal length and breadth, appearing elongate, its sides very slightly curved; elytra with more feebly impressed striæ; legs rather slender; last segment with two punctures near each side.

♂. Length $6\frac{1}{2}$, breadth $2\frac{1}{8}$ lines.

Ligar's Bush, Papakura.

Pterostichus obsoletus (No. 1469, var.).

This is very much like *P. hybrida.* The *shoulders* are not dentiform, there being only a slight thickening of the margins there; the transverse line which marks off the base of the elytra from the striæ in allied species is here quite obsolete; the *scutellum* is only indistinctly striate; the *elytra* are narrowed towards the base. The *thorax* is only about one sixth broader than long, and its sides are only moderately curved; its anterior angles are rounded, the posterior are rectangular. The elytral striæ are somewhat irregularly punctured, some of the punctures are much smaller than the others, so that the striæ themselves appear interrupted in some parts.

♂. Length $6\frac{1}{2}$, breadth $2\frac{1}{8}$ lines.

Hunua Range. Two males.

Pterostichus Sharpianus, sp. n.

Oblong, very slightly convex, shining, black; femora piceous; the antennæ, palpi, tibiæ, and tarsi pitchy red.

Head much narrowed behind, the frontal impressions broad and shallow; labrum usually quite transverse. *Eyes* large and moderately prominent. *Antennæ* rather slender, reaching the intermediate femora, their three basal joints glabrous, the fourth not longer than the third. *Mandibles* reddish, smooth. *Thorax* nearly one fourth broader than long; its sides regularly curved from the front angles to behind the middle, slightly but not sinuously narrowed behind, posterior angles rectangular, not at all projecting; the surface faintly striate transversely, the central furrow well-marked but sometimes indistinct near the apex; basal foveæ elongate but not sulciform and not sharply defined; near each hind angle there is a shallow impression, the middle of the base is scored with feeble longitudinal striæ, and the foveæ are more or less minutely punctured; sometimes, however, they are smooth. *Scutellum* estriate. *Elytra* ovate-oblong, shoulders not dentiform; they are narrowed but hardly sinuate behind; their striæ are deep, narrow, and impunctate; the interstices plane, rather broad, without punctiform impressions. *Legs* moderately slender, posterior femora simple.

Male.—Front tarsi with sponge-like soles and lateral setæ, the basal three joints dilated; first subtriangular, second and third cordiform. One setigerous puncture on each side of the last ventral segment; two setæ on each side of the thorax; the middle and hind tarsi more or less grooved above.

This is very different from *Haptoderus maorinus*, Bates, in many respects. *P. oscillator*, Sharp, has sulciform thoracic foveæ, and the third elytral interstices bear two or three large punctures.

♂. Length $4\frac{1}{4}$–$4\frac{1}{2}$, breadth $1\frac{1}{2}$ lines.

Ohaupo, Waikato, three examples; Hunua Range, five.

I have with pleasure named this species in honour of Dr. David Sharp. A typical specimen has been sent to the British Museum.

Group **Bembidiidæ.**

Anillus phyllobius, sp. n.

Subdepressed, slightly nitid, fulvescent; legs pale yellow; with numerous erect, slender, short setæ.

Head comparatively large, narrower than the thorax, distinctly biimpressed on the middle, slightly wrinkled there, with two elongate setæ on each side. *Mandibles* prominent. *Thorax* nearly as long as it is broad, cordiform, widest before the middle, gradually narrowed towards the base, posterior angles quite obtuse; sides finely margined, with a long seta before the middle and another in front of the hind angle; base medially incurved, transversely depressed, without well-marked fossæ; there is an abbreviated central stria. *Scutellum* wanting. *Elytra* oblong, shoulders rounded, apices individually obliquely rounded, with a short broad sutural gap; their sides scarcely curvate, the lateral margins more explanate near the shoulders than they are elsewhere; disk flat, apparently covered with excessively minute brassy scales; there are four or five series of very shallow indistinct punctures on each; these become irregular behind; there are no visible striæ; along the sides a few long slender setæ occur; the broad *pygidium* is uncovered.

Antennæ stout, they reach backwards to the shoulders, pubescent; second joint almost as long and stout as the first, not quite glabrous, 3 to 10 moniliform, third not longer than fourth, only about half the bulk of the second, eleventh largest. *Maxillary palpi* stout, not elongate, the penultimate joint somewhat dilated on the inner side, so as to be subsecuriform, the terminal short and indistinct. *Legs* elongate, with fine setæ; *anterior tibiæ* stout, much bent, and somewhat thickened near the extremity; *tarsi* with small joints, none expanded, claws slender. No *eyes* can be detected.

This is congeneric with No. 1644; it is slightly larger, the thorax is much less contracted behind, and the humeral margins are more distinct and explanate. Dr. Sharp's *Cillenum subcæcum* has a transverse thorax. It bears more resemblance to the European *Anillus cæcus* than to the New Zealand *Cillena*.

Length $\frac{7}{8}$, breadth quite $\frac{1}{4}$ line.

Riccarton Bush, Christchurch. One found by Mr. H. Suter amongst leaves on the ground, May 1893.

Group **Pselaphidæ**.

TYROGETUS, gen. nov.

Body elongate, narrowed anteriorly, slightly convex. *Head* oval. *Antennal tubercles* prominent, almost connate, they extend forwards as far, or nearly as far, as the muzzle. *Maxillary palpi* elongate, nearly as long as the antennæ, first joint small, second curvate, very slender and stalk-like for more than half its length, its apical portion clavate and oviform; third nearly as long as the preceding one, its clavate portion nearly half the whole length, the basal part forms a straight slender stem; fourth about as long as the third, its apical half more gradually and less clavate, this portion appears to be cleft longitudinally, as in *Pselaphus*, the basal part is stalk-like. *Antennæ* 11-articulate. *Tarsi* rather short, basal joint small, second and third about equal; with two small claws, these, however, are so closely applied to each other as to appear like one. *Eyes* small, coarsely facetted, situated at the middle of each side of the head.

This is distinct from *Tyrus*. The hind body is more like that of *Pselaphus*. *Tychus* has but one claw. The Australian genera *Tyraphus*, *Gerallus*, and *Durbos* appear, according to their descriptions, to be very different in some important points.

Tyrogetus optandus, sp. n.

Red, tarsi and palpi yellow; sparingly clothed with short, depressed, yellow setæ.

Head oval, not distinctly punctate, with a small fovea near each eye. *Thorax* longer than broad, moderately convex, more narrowed in front than it is behind, its sides slightly rounded, its middle part but little broader than the head; its surface is without distinct sculpture of any kind. *Elytra* hardly longer than broad, gradually yet considerably narrowed towards the base, which does not exceed the thorax in width; each elytron has a rather broad sutural stria and a less distinct discoidal one; the apex is densely fringed with yellow hairs. *Hind body* longer than the wing-cases, quite as broad, its three basal segments marginate; the first is horizontal and about as long as the other deflexed segments. *Legs* elongate, slender, clothed like the body; femora not clavate; tibiæ straight and simple.

Antennæ elongate, sparsely pubescent, first joint nearly twice the length of the second, rather stouter, both cylindric; joints 3 to 7 differ but little, each is longer than broad; eighth and ninth nearly quadrate, tenth nearly as long as it is broad, distinctly broader than the preceding ones, eleventh large, rather broader than the tenth, oblong-oval.

The channel between the antennal tubercles is very narrow and scarcely reaches the middle of the head.

Length $\frac{3}{4}$, breadth $\frac{1}{4}$ line.

Mount Pirongia. One individual only, a female, I think.

I very much regret that I have but one mounted specimen; the structure of the underside therefore cannot be studied at present.

Euglyptus costifer, sp. n.

Subopaque, chestnut-red; tarsi and palpi yellow; clothed with small, depressed, yellow, scale-like setæ, and also with some slender hairs.

Head punctate, not as large as the thorax; vertex convex, the depression behind the antennal tubercles smooth and shining. *Thorax* rather longer than broad, more narrowed in front than it is behind, widest and obtusely prominent before the middle; its surface distinctly punctate, in front nearly smooth; along the middle there is a broad groove; on each side, but not reaching the apex, there is an elongate foveiform impression; the transverse impression near the base is indistinct. *Elytra* longer than broad, a little narrowed towards the base, which, however, exceeds the thorax in breadth, they are not punctate apparently; on each elytron there are two broad grooves, one near the suture, the other along the middle of the disk; the interstices are costiform, the outer costa at the shoulder is a good deal thickened, and the basal margin appears thick and asperate. *Hind body* rather shorter than the elytra, much narrowed posteriorly, but little deflexed, the basal four segments of nearly equal length, first and second transversely impressed at the base, the depression on the latter not so wide as the other. *Tibiæ* evidently expanded towards the extremity.

Underside castaneo-rufous, sparsely pubescent. *Head* with a few slender outstanding setæ. *Front coxæ* elongate, exserted, and contiguous, placed close to the hind margin of the prosternum; the sinuous carina near each side is distinct. *Mesosternum* in the middle with a rather broad lamina; this has sharp borders, and it is acutely prominent behind. Intermediate coxæ only slightly separated, the *trochanters* short. *Metasternum* convex. *Hind coxæ* but little separated. *Abdomen* slightly transversely convex, with six nearly equal segments; two to five decrease a little in length, the first is covered with yellow pubescence.

Antennæ as long as the head and thorax, red, paler towards the extremity, tenth joint infuscate at apex; second joint smaller than first, with slightly curved sides; third a little longer than broad, narrowed towards its base; fourth to eighth bead-like and differing but little; ninth quite twice the size of the preceding one, narrowed towards the apex, its frontal articulation very narrow, so that it is distinctly marked off from the following one; tenth strongly transverse, its apex closely applied to the eleventh joint, which is narrower, conical, and acuminate.

This, though much like *E. elegans*, differs in many ways. The head is not broader in line with the eyes than it is behind; in *E. elegans* it is so much wider near the eyes that the sides behind are obliquely narrowed. The *eyes* are very small. The elytral costæ, though present in *E. elegans*, are less distinct. The legs of *E. costifer* are shorter and less slender. The tenth antennal joint is distinctly shorter. The supplementary apical segment is wanting.

Length $\frac{5}{8}$, breadth $\frac{1}{4}$ line.

Mount Pirongia. I found two of uncertain sex, one damaged.

Obs. I found what may be considered a varietal form at Ligar's Bush, Papakura. The head is as broad as the thorax and strongly rounded behind; the eyes, though small, are more prominent. There are six abdominal segments. This, as regards the head and eyes, is intermediate between *E. costifer* and the typical species; but in other respects it more nearly resembles the former. I leave it without a name just now, as we do not know the sexual characters in this genus.

TYCHOTYRUS, gen. nov.

Body moderately convex, subovate, rather elongate, pilose. *Head*, including the eyes, nearly as broad as the widest part of the thorax, much narrowed, but parallel-sided, in front. *Eyes* large, convex, with coarse facets, placed near the middle. *Maxillary palpi* quite the length of the head; first joint not extending beyond the side of the mandible; second elongate, its basal half very slender and stalk-like, the other much incrassate and oviform; third short and thick, almost obconical, with a short, slender, basal stem; fourth as long as the second, oblong-oval, but with a slender basal stalk, its extremity provided with an elongate seta.

Metasternum of moderate length. *Front coxæ* contiguous, elongate, exserted. *Middle coxæ* with large circular cavities, separated by the well-developed mesosternal process, their trochanters elongate. *Hind coxæ* moderately widely separated, prominent, their trochanters rather long and thick. *Legs* long and slender. *Tarsi* with subequal terminal joints, the first very short, with two equal claws. *Antennæ* 11-articulate, moderately approximate at the base. *Antennal tubercles* variable, usually large and prominent, with a well-marked intervening channel. *Abdomen* composed of six nearly equal segments.

Dr. Sharp, in his description of *Tyrus mutandus* (Trans. Ent. Soc. 1874, p. 488), remarked that "though its characters agree in the main with those of *Tyrus mucronatus*, in its appearance and form it comes much nearer the genus *Tychus*; and though it cannot be associated with that genus on account of the double claws, it will probably be ultimately referred to a distinct genus." The position of this genus is therefore clearly indicated.

Tychotyrus sternalis, sp. n.

Convex, subovate, rather elongate; shining, red, head, thorax, and hind body sanguineous, tarsi and palpi yellowish; pubescence flavescent.

Head almost as broad as the middle of the thorax, rounded behind; vertex convex, near each eye there is a distinct fovea which seems to be limited in front by a small obtuse elevation; antennal tubercles well-developed, with an obvious channel between them; the sides, behind the eyes, are coarsely ciliate. *Thorax* rather longer than broad, constricted and depressed in front, widest and most convex near the middle, just before the base there is a curved transverse impression; its clothing is rather scanty on the disk but forms a sort of fringe along the sides. *Elytra* as long as broad, a good deal narrowed towards the base, apex truncate; the sutural striæ are well marked and become deeper near the base, inside each shoulder there is a deep elongate impression; they bear fine decumbent hairs and long, erect, slender setæ. *Hind body* as long as the wing-cases, gradually narrowed backwards, its three basal segments of about equal length, with distinct margins, the other two deflexed, its pubescence elongate. *Legs* elongate; *femora* slender near the base, somewhat clavate near the middle: *front tibiæ* nearly straight, with dense fulvous pubescence on the inside towards the extremity; the intermediate slightly arcuate below the middle, densely pubescent near the apex, and finely ciliate externally; the posterior also fringed, straight as far as the middle, and, on the inner face, below the middle, armed with a conspicuous spiniform process, they are a little thickened and curved there.

Antennæ long and stout; basal joint cylindric, thicker, and, on the outside, nearly twice the length of the next one; joints 3 to 6 evidently longer than broad, the fourth slightly shorter than the contiguous ones; seventh quadrate; eighth transverse, of the same width as the preceding one; ninth a little longer than broad; tenth quadrate, but, like the ninth, slightly narrowed towards the base, both these joints thicker than the eighth; eleventh large, oblong-oval, obtuse, with a fovea underneath; the last three joints are more or less distinctly asperate.

Underside chestnut-red, with depressed yellow pubescence. *Head* with a basal depression. *Metasternum* depressed along the middle, the sides of the cavity gradually, but considerably, raised anteriorly, and, just behind the middle coxæ, ending in a thick spiniform protuberant process. *Abdomen* much narrowed posteriorly, rather flat along the middle, with deep sutures, the fifth segment smooth and transversely impressed in the middle, sixth conical, deeply depressed in the centre and carinate behind.

♂. Length 1, breadth $\frac{5}{8}$ line.

Female.—Antennæ rather shorter, joints 3 to 10 slightly reduced as compared with those of the other sex, the eighth joint, however, is not quite as short. Sternum and tibiæ unarmed.

Hunua Range, three different localities; four males and two females.

Tychotyrus curvipes, var.

Colour uniform pale red, tarsi and palpi yellow. The apices of the *elytra* are a little obliquely truncate towards the suture. The *posterior tibiæ* are distinctly and regularly curved from the base to the apex.

♂. Length 1, breadth $\frac{5}{8}$ line.

Hunua Range, Maketu. One specimen.

The genus will include the following species. The male characters are indicated below as an aid to the identification of the species:—

T. armatus. Metasternum with a spine in front of each hind coxa; posterior tibia slightly flexuous, with a spiniform process near the inner extremity.

T. spinipes. Femora infuscate, in both sexes. Metasternum with a spiniform process behind each of the middle coxæ; posterior tibia straight, with a spine on the inside about one third of the length from the apex. Antennæ more widely separated; their tubercles flatter; the forehead broader.

T. mutandus. Male not known with certainty as yet.

Startes foveata, sp. n.

Body a little shining, dark red; sparsely clothed with short yellowish hairs, those along the sides of the elytra much finer and more numerous; tarsi and palpi yellowish red.

Head longer than broad, not as wide as the thorax, rounded behind the eyes; vertex convex, interocular foveæ large, becoming confluent in front, so as to form a continuous depression there. *Thorax* widest just before the middle, more gradually narrowed behind than in front; the surface indistinctly punctured, there is a large central fovea near the base, and another at each side near the hind angle. *Elytra* broader than long, somewhat narrowed towards the base, shoulders not at all prominent; their surface with ill-defined sculpture, sutural striæ well marked; along the middle of each elytron there is another broad stria which, however, becomes obsolete near the extremity, the interval is almost carinate. *Hind body* much deflexed, its large basal segment only being horizontal. *Legs* of moderate length, simple.

Underside chestnut-red, pubescent. *Head* longitudinally ridged in the middle. *Mesosternum* plane in the middle, this part with fine carinate borders. *Metasternum* flat or impressed in the middle; just in front of each hind coxa there seems to be a small tubercle, there is another behind, both are rather indistinct.

Antennæ about as long as the head and thorax; second joint quite as large as the exposed part of the first; fourth just longer than broad, slightly shorter than the third or fifth; sixth and seventh hardly longer than broad; eighth a little shorter than the preceding one; joints 3 to 8 are of nearly equal thickness throughout; ninth distinctly broader than eighth, but only a little more than half the bulk of the tenth; eleventh largest, conical, somewhat acuminate.

Maxillary palpi stout, two thirds the length of antennæ, first joint short, second gradually thickened, third short and thick, fourth almost as long as second, broadest near the base, gradually narrowed, with a short apical seta. *Front coxæ* cylindric, contiguous; the middle pair almost contiguous; the posterior not very widely separated. The *abdomen* apparently consists of six segments, but the suture between the fifth and sixth is very fine; the basal segment is nearly the length of the other five, it is densely fringed at the base; the hind thighs conceal the pubescence, but when these are displaced an indistinct suture can be seen between what I term the basal segment and the metasternum.

The male has a broader head and more prominent eyes than the female, so far as I can judge at present.

Length $\frac{3}{4}$, breadth quite $\frac{1}{4}$ line.

Hunua Range. Five examples.

Bryaxis sternalis, sp. n.

Sanguineous, legs and antennæ paler red, tarsi and palpi yellowish; shining, with very few short, fine, pale hairs.

Head broad, nearly flat between the antennæ, broadly impressed near the front, with two small interocular foveæ. *Thorax* widest just before the middle, where it is rounded; near the base there is a transverse depression which does not reach the middle. *Elytra* rather longer than broad, narrowed towards the base; their sutural striæ well-marked, the intrahumeral impressions more or less distinct. *Hind body* short, much deflexed, more evidently pubescent than the elytra. *Legs* moderately stout; front and middle tibiæ somewhat dilated along the inside, the former with distinct yellow ciliæ on the inner face.

Male.—Antennæ elongate, second joint obviously longer than the exposed part of the first; third a little longer than the following one; fifth rather longer than fourth; seventh slightly longer than eighth, which about equals the ninth; tenth transverse, yet not much broader than the preceding one; eleventh large, acuminate.

Underside chestnut-red, its pubescence short. *Head* obtusely elevated along the centre, depressed near each side. *Mesosternum* with a small tubercle in front of each middle coxa. *Metasternum* broadly depressed, more deeply behind, the sides of the depression appear elevated behind. *Abdomen*, along the middle, appears as if it were broadly depressed throughout when viewed sideways; when examined from behind the apical depression of the basal segment is seen to be limited in front by an angulate elevation, this elevation, at its outer angles, seems to be tubercular; fifth segment deeply depressed in the middle, each side of this cavity has an obtuse tubercle; there is a short, broad, apical segment.

Female.—Mesosternum with two tubercular elevations. *Metasternum* and abdomen simple, the basal segment of the latter large, 2 to 4 very short in the middle; fifth longer than the intermediate ones, its apex is limited by a very fine incurved suture, so that there seems to be a sixth segment. *Antennæ* shorter than those of the other sex, eleventh joint large, less acuminate, joints 3 to 5 rather longer than those next to them.

At first sight I supposed this to be *B. grata*, Sharp. It is a small insect, but, notwithstanding, it can be easily identified if the underside be carefully examined. The mesosternal elevations are more distinct in the female than they are in the male, a circumstance that will materially aid in the recognition of that sex.

Length $\frac{5}{8}$, breadth nearly $\frac{3}{8}$ line.

Ligar's Bush, Papakura; eight examples. Mount Pirongia, Waikato; two males.

Variety, Hunua Range, Drury. Interocular foveæ absent.

Bryaxis allocera, sp. n.

Red, head and thorax darker, tarsi and palpi fulvous; body nearly glabrous, shining, not at all short.

Head broad, nearly as large as the thorax, rounded behind, vertical in front, not prolonged; it bears two rather small and shallow foveæ between the eyes, the frontal impression is broad and very shallow. *Thorax* widest before the middle, with two indistinct basal foveæ. *Elytra* large, convex;

sutural striæ rather fine, there are no distinct impressions near the shoulders. *Hind body* short above, much deflexed, the basal segment longer in the middle than at the sides, scantily pubescent. *Legs* rather long and slender, tibiæ straight.

Male.—Antennæ 10-articulate; first joint longer and stouter than the second; third nearly as long as the preceding one, narrowed towards its base; fourth short and bead-like; fifth subquadrate; sixth strongly transverse, nearly twice the breadth of the fifth, its point of articulation near the outside; seventh shorter than sixth, nearly as broad, articulated near the middle; eighth still shorter, nearly as broad as the seventh, articulated at the middle, rather closely applied to the following one; ninth very large, its apex oblique, so that the outer side is a good deal longer than the inner; tenth conical, not acuminate, narrower than the ninth, so that the inner side is not in line with that of the preceding.

Underside. Metasternum broadly impressed. *Front trochanters* (or coxæ) with slender spines. Basal segment of the *abdomen* broadly impressed, with an elevation near each hind coxa; last segment impressed.

A moderately elongate species, the elytra and hind body, conjointly, form an oval figure. Its nearest allies are *B. sylvicola* and *B. fraudulenta,* but the last six antennal joints differ in form.

♂. Length $\frac{3}{4}$, breadth nearly $\frac{3}{8}$ line.

Mount Pirongia. One male, found in December 1892.

Bryaxis setifer, sp. n.

Shining, red, legs and antennæ paler, tarsi fulvous, terminal joint of maxillary palpi fuscous; body nearly nude, having only a few, very long, erect, slender setæ.

Head large, rather broader than the thorax; uneven above, the forehead rather deeply and broadly impressed, the two large foveæ on the vertex placed near the eyes, when looked at sideways they appear to unite with the frontal depression. *Eyes* convex. *Thorax* small, with a fovea-like compression at each side near the base. *Elytra* large, suboblong, curvedly narrowed near the base, with fine sutural striæ. *Hind body* short and deflexed. *Legs* slender; tibiæ nearly straight, a little expanded towards the extremity.

Male.—Antennæ ten-jointed; second joint nearly the length of the first; third short, hardly longer than broad; fourth bead-like, of nearly the same size as the preceding one; fifth broader than long, a little larger than fourth, moniliform; sixth broader than fifth, but not as broad as the seventh;

eighth of the same breadth as the seventh and ninth, longer than the former, shorter than the latter, yet not quite quadrate; ninth large, slightly longer than it is broad, a little longer at one side than at the other, scooped out near one side underneath; tenth conical, about as large as the ninth; the last four or five joints thickly pubescent and slightly asperate.

Underside indistinctly punctate, pubescent, castaneo-rufous. *Front trochanters* spined. *Metasternum* slightly flattened, but not depressed, in the middle. Basal segment of *abdomen* with two small median tubercles; second nearly twice the length of the third or fourth in the middle; fifth broadly impressed.

This, without doubt, is very much like No. 1476, but the ninth antennal joint of *B. glabrata* is larger, the eighth is shorter, being strongly transverse, joints 3 to 5 also differ a little, and the antennal tubercles are rather more prominent.

♂. Length $\frac{1}{2}$, breadth $\frac{1}{4}$ line.

Mount Pirongia. Two males only, Dec. 1892.

Bryaxis diversa, sp. n.

Nitid, dark red, legs and elytra chestnut-red, tarsi and palpi fulvous; sparsely clothed with minute, indistinct, pale hairs, those on the hind body are, however, more easily seen.

Head short and broad, rounded behind, with two well-marked interocular foveæ, the forehead depressed and obsoletely foveate; antennal tubercles rather flat and widely separated. *Eyes* well developed. *Thorax* rather longer than broad, widest just before the middle, its sides well rounded there, narrowed behind; its surface free from sculpture. *Elytra* suboblong, large, moderately convex, with fine sutural striæ. *Hind body* short, convex, much deflexed, so that the large basal segment only is at all horizontal. *Legs* moderate; front tibiæ a little swollen inside near the middle, and distinctly pubescent towards the extremity, the posterior somewhat arched and thickened towards the apex, and evidently pilose there; *tarsi* with the basal joint small, the second quite the length of the third, the basal joints of the posterior with slender elongate setæ underneath.

Male.—Antennæ 10-articulate, moderately slender; first joint cylindric, rather longer and stouter than the second; third rather longer than broad; fourth short and bead-like; fifth only a little longer than broad, distinctly larger than the contiguous ones; sixth subquadrate; seventh transverse; eighth shorter, but not narrower, than the preceding one; ninth large, oblong, its base and apex nearly quite truncate, it is slightly narrowed towards the base; tenth conical, about as large as the ninth, its apex rounded.

Underside distinctly clothed with yellow pubescence, finely sculptured. *Anterior trochanters* with slender basal spines. *Metasternum* convex, broadly impressed along the centre. Basal segment of *abdomen* with a smooth shallow impression behind, at each side of this, close to the apex, there is a distinct tubercle; 2 to 4 very short; fifth transversely impressed.

Female.—Antennæ with the seventh and eighth joints transverse, ninth nearly twice the breadth of the eighth, tenth much larger, yet quite transverse, eleventh conical. *Metasternum* rather convex. Basal segment of the *abdomen* large and plane, this and the metasternum with fine sculpture which appears granular or punctiform according to the light.

Allied to *B. munda* (page 129), the antennæ more slender, their two terminal joints decidedly smaller; head broader; hind body shorter and more deflexed. In *B. munda* the abdominal tubercles are situated on the middle of the first segment, and I find, in a reversed specimen, that the front trochanters have fine spines, these were overlooked when the description was drawn up.

Length $\frac{5}{8}$, breadth $\frac{1}{4}$ line.

Hunua Range, Drury. Four males and seven females.

Sagola lineata, sp. n.

Elongate, subparallel, shining; head and thorax red, antennæ paler, the elytra, legs, and palpi fulvous.

Head gradually narrowed behind the eyes; antennal tubercles only a little elevated, transverse; there is a rather narrow, slight elevation extending from the base forwards, this, along its frontal half, is divided by a slender linear groove; the two well-marked basal foveæ appear, when looked at sideways, to be prolonged forwards; its pubescence is slender and disposed transversely. *Eyes* moderate, placed near the middle of the sides. *Antennæ* elongate, second joint nearly as stout as the first, one half its length; third narrow, slightly longer than broad; seventh and eighth narrower at the apex than they are at the base; ninth and tenth transverse; eleventh subquadrate, but the minute apical false joint alters the form somewhat. *Thorax* cordate, with a large central depression behind the middle, there are two small foveæ near the base, and another, also small, near each hind angle; it is clothed like the head, but on each side there are two very long hairs. *Elytra* oblong, the shoulders only slightly narrowed; the sutural and intrahumeral striæ are well marked, the surface is indistinctly punctate; pubescence slender and elongate, but there are also some longer and coarser hairs on the sides. *Hind body* longer than the elytra, thickly pubescent; the basal segment with a transverse space covered with minute brassy setæ or scales; third segment rather longer than the others. *Legs* simple.

Underside. Head simple; third ventral segment large; no distinct sexual characters.

A careful examination of the head will at once lead to its recognition.

♀. Length $1\frac{1}{8}$, breadth quite $\frac{1}{4}$ line.

Mount Pirongia. One example, Dec. 1892.

Sagola pertinax, sp. n.

Rufescent, pubescence slender and elongate on the elytra, coarser on the hind body, which, besides, bears many long, erect hairs.

Head almost as broad as the widest portion of the thorax, its hind angles obtuse; the frontal channel is broad, and extends nearly as far as the back part of the eyes, there two foveæ behind. *Thorax* in shape and sculpture similar to that of *S. major*. *Elytra* oblong, slightly and gradually narrowed towards the base, hind angles rounded; the sutural striæ and intrahumeral impressions well marked, these latter divided into two parts. *Hind body* longer than the elytra, its basal segment with numerous minute brassy scales.

Underside. Head, the space behind the mentum is broad and smooth, it is raised backwards, and its middle portion, though truncate behind, projects backwards; it is scantily ciliate; the side, behind the eye, is swollen, and has a large rounded depression. *Metasternum* convex. The pubescence on the fifth and sixth segments of the *abdomen* is much more conspicuous than it is elsewhere. The *legs* exhibit no sexual characters.

Like *S. major*, smaller, the legs and antennæ more slender, the tibiæ very slightly curved, the underside of the head quite different. The beautiful, strongly curved, golden cilia seen on the lower part of the head in *S. laminata* is here absent.

Length nearly $1\frac{1}{8}$, breadth quite $\frac{1}{4}$ line.

Ohaupo, Waikato, near Mr. Kusab's saw-mill. Three examples. A fourth, evidently a female, has the head more rounded behind, and the basal dorsal segment bears only the ordinary pubescence, but I doubt whether it can be referred to this species.

Obs. S. ruficeps, No. 1882, is most likely only a varietal form of *S. major*, Sharp. I named it some years ago, before I had seen that species. Much depends upon the interpretation of Dr. Sharp's expression, "a transverse band of glandular pubescence." If this mean the same thing that I term "minute brassy scales or depressed setæ," the two species must be united. In my specimens of *S. major* the underside of the head, near the hind angle, has a smooth depression with raised hind margins. I cannot state whether Dr. Sharp's specimen presents the same appearance. It seems certain that the form and sculpture of the lower surface of the head in this genus must be more carefully studied before the numerous species can be satisfactorily separated.

Sagola citima, sp. n.

Narrow, elongate, nearly horizontal throughout; head and thorax red, the rest of the body and the legs chestnut-red; pubescence fulvous, more erect than is usual.

Head rounded and a good deal narrowed behind the eyes; the median channel deep, moderately broad, extending nearly to the hind margin, where it becomes narrower, close to this, near the base, there are two small foveæ; antennal tubercles elevated but somewhat flattened above. *Eyes* placed before the middle. *Thorax* widest before the middle, a good deal rounded in front, the sides behind appear abruptly contracted and nearly straight, in its widest part it is not broader than the head in line with the eyes; disk smooth and convex, the central impression near the base only moderately large, the two foveæ near the base are small; the fovea near the hind angle forms a large depression, it is prolonged forwards, so that the side at the middle is marked off from the disk. *Elytra* oblong, obliquely narrowed towards the base, the sutural striæ and intrahumeral impressions well marked and entire, at the base near each stria there is a distinct puncture. *Hind body* much longer than the wing-cases, third segment slightly larger than the second, the first, near its base, densely covered with very minute pale setæ, the pubescence shorter and finer than that on the elytra; the supplementary basal segment is exposed, its lateral margins are distinct. *Antennæ* with the basal joint stout, cylindric; second globular, hardly longer than broad; third small; fourth slightly longer than broad; 5 to 8 become rather shorter and broader; ninth and tenth transverse; eleventh, including the false terminal articulation, conical.

No. 1878 is most like this species; the sides of the thorax, however, are not marked off from the disk by a linear impression. No. 1883 has a broader, less posteriorly narrowed head. There are no distinguishing characters underneath.

Length $1\frac{1}{4}$, breadth nearly $\frac{3}{8}$ line.

Wellington. Mr. G. V. Hudson sent me a mounted specimen numbered 224.

Group **Scydmænidæ**.

Scydmænus cilipes, sp. n.

Elongate, not very narrow, convex, shining, rufous, tarsi yellow, palpi fulvous; pubescence conspicuous.

Head of moderate breadth, rather flat and bald in front; with rather coarse, outstanding, but not very elongate, obscure yellowish hairs behind. *Thorax* scarcely longer than broad, slightly, regularly, and curvedly narrowed anteriorly, the base not much broader than the shoulders; there are two distinct median basal foveæ, and a smaller one near each hind angle, where the sides are compressed or flattened; the hairs on the sides are like those on the head, on the disk they are finer and more scanty. *Elytra* elongate-oval, with two broad basal depressions, the shoulders a little elevated; their pubescence elongate, slender, upright, and quite yellow. *Femora* moderately clavate beyond the middle; *tibiæ* slightly flexuous, the anterior with conspicuous yellow setæ along the inside, their basal portion bare, the intermediate bear coarser setæ near the inner extremity.

Antennæ elongate, stout, pubescence elongate; second joint distinctly longer than the first, nearly twice the length of the third; fourth subquadrate, rather shorter than the third or fifth; sixth and seventh about equal; eighth subovate, rather longer than broad; ninth and tenth about as long as broad; eleventh longer than either of the preceding two; the four terminal joints are enlarged, but not suddenly. *Maxillary palpi* moderately long; second joint slender and curved, third gradually dilated, fourth small, not half the width of the penultimate. *Eyes* prominent. *Pygidium* covered. *Tarsi* slender, the anterior hardly at all expanded.

This and the following species have been carefully compared with every one of the New-Zealand exponents of the group. The bright yellow, conspicuous fringe on the front tibiæ will be an aid to its identification.

Length $\frac{7}{8}$, breadth $\frac{3}{8}$ line.

Ligar's Bush, Papakura. One, no doubt a male.

Scydmænus cedius, sp. n.

Shining, red, tarsi and palpi fulvescent, pubescent.

Head rather large, about the width of the thorax, its clothing yellow, indistinct in front, elongate, moderately coarse, and directed backwards. *Thorax* longer than broad, relatively narrow, widest before the middle, much narrowed between the middle and the base; with two basal foveæ near the middle, and one near each hind angle; pubescence yellow, long and slender, but coarser and darker near the sides. *Elytra* quite oval, large, considerably broader at the middle than the thorax, but at their base not wider than it is at the base; with two broad basal depressions, the shoulders raised, the disk very slightly, not distinctly, impressed before the middle; their clothing pale yellow, slender, elongate, and upright. *Tibiæ* nearly straight, with moderate pubescence.

Palpi rather slender, the penultimate joint of the maxillary not much dilated, fourth short, not aciculate. *Eyes* moderate.

Antennæ stout, second joint rather longer than the visible part of the first, about a fourth longer than the third, but rather thicker; 3 to 5 nearly equal, longer than broad, fourth not abbreviated; sixth and seventh nearly equal, not elongate; 8 to 10 transverse, loosely articulated, broader than the preceding one; eleventh broadly ovate, not very large.

Nos. 1901, 1905, and 2348 are most like this species. The first is considerably smaller; in the second the eyes are very small and indistinct; in the third the third and fourth joints of the antennæ are a good deal longer, and the first is evidently longer.

Length 1, breadth quite $\frac{3}{8}$ line.

Hunua Range, Maketu. One example.

Scydmænus allocerus, sp. n.

Elongate, not narrow, moderately convex, shining, red, tarsi yellow, pubescence yellowish.

Head nearly as broad as the thorax, its hairs moderately coarse and extending backwards, they are indistinct in front. *Thorax* longer than broad, widest near the front, much contracted near the base; with two basal foveæ near the middle, and a large impression at each side near the hind angle. *Elytra* oval, broad, widest before the middle; with two large basal impressions, the shoulders raised, broadly impressed before the middle; clothed with pale yellow, slender, outstanding hairs. *Tibiæ* nearly straight, finely pubescent.

Antennæ rather short, gradually incrassate; first joint but little more than half the length of the second and of a darker colour; third evidently longer than broad, thinner than the fourth or fifth, these are nearly equal to one another and are but little, if at all, longer than broad; sixth and seventh rather shorter and broader than the preceding one; joints 8 to 10 obviously transverse; eleventh short, as broad as the tenth at the base, but very much narrowed (not acuminate) towards the extremity.

Maxillary palpi moderately slender, the third joint but little dilated, fourth small. *Eyes* moderately prominent.

The antennal structure is the best guide to the recognition of this species; the terminal joint should be looked at first of all.

Length quite $\frac{3}{4}$, breadth nearly $\frac{3}{8}$ line.

Hunua Range, Maketu. A single specimen.

Scydmænus brachycerus, sp. n.

Elongate-ovate, slightly convex, red, palpi and tarsi yellowish, the clothing yellowish.

Head rather small, rounded, its coarse pubescence directed backwards. *Thorax* longer than broad, but little wider near the middle than it is elsewhere, a good deal narrowed in front, finely and indistinctly carinate along the middle; the centrobasal foveæ separated by a cariniform interval, there is a small fovea near each posterior angle; its clothing is similar to that of the head, but differently disposed. *Elytra* oval, widest near the middle, with two broad basal impressions; the sutural region flattened in front of the middle; they are clothed with slender, erect, yellow hairs. *Femora* clavate towards the extremity, the anterior distinctly thicker than the others; *tibiæ* nearly straight, finely pubescent.

Antennæ short, very gradually thickened; second joint quite double the length of the exposed part of the first; third longer than broad, smaller than second; 4 to 6 nearly equal, bead-like; seventh and eighth a little broader than the preceding one, not longer than broad; ninth and tenth transverse, broader than the eighth; eleventh conical, not quite as long as the ninth and tenth taken together.

Maxillary palpi with the second joint slender, third of nearly equal thickness throughout, its apex truncate, fourth invisible. *Eyes* moderately prominent.

The front thighs, the narrow penultimate joint of the palpi, and the short antennæ are the best distinguishing characters.

Length nearly $\frac{3}{4}$, breadth $\frac{1}{4}$ line.

Hunua Range. Unique.

Scydmænus xanthopus, sp. n.

Convex, elongate, shining, red, antennæ rather pale, legs sordid yellow.

Head of moderate breadth, with moderately coarse outstanding pubescence. *Thorax* much longer than broad, widest near the middle; with two rather small, distinctly separated, median foveæ near the base, there are no distinct foveæ near the basal angles, but there is a large impression at each side; its clothing resembles that of the head. *Elytra* ovate, widest before the middle, not very broad; apices subtruncate or broadly rounded, so that the broad pygidium is uncovered; there are two basal depressions, the shoulders appear elevated, the sutural region is unimpressed. *Legs* elongate, but not slender; *femora* clavate near the apex, the front pair thickest; *tibiæ* nearly straight, finely pilose.

Antennæ elongate, the last four joints dilated; second joint rather longer than the first; 3 to 6 nearly alike, seventh rather broader than the sixth; 8 to 10 transverse; eleventh nearly as long as the preceding two conjointly, obtuse at the extremity.

Second joint of the *maxillary palpi* curved and slender; third nearly oviform, not at all broad; fourth short, nearly as thick at its base as the apex of the penultimate. *Eyes* very small, not at all prominent.

This rather slender species may be known by the yellow legs, the exposed pygidium, and the structure of the palpi. I would place it in *Eumicrus*, along with Dr. Sharp's *S. Edwardsi*, if it were not for the fact that some New-Zealand species are just intermediate in structure between the two genera, so that *Eumicrus* will probably be abandoned as a genus.

Length $\frac{5}{8}$, breadth nearly $\frac{1}{4}$ line.

Hunua Range. One individual only.

Scydmænus heterarthus, sp. n.

Elongate, moderately convex, nitid, chestnut-red, the pubescence and the tarsi yellow, legs and antennæ fulvescent.

Head rather small, flattened anteriorly, with long hairs directed backwards. *Thorax* longer than broad, widest before the middle, a good deal narrowed towards the base, which appears depressed, but the usual foveæ seem to be absent, there is, however, an elongate impression at each side; the pubescence near the sides is rather coarse and conspicuous. *Elytra* oviform, not much rounded laterally, widest near the middle, covering the pygidium; they are clothed with slender, subdepressed, not elongate, yellowish hairs; basal depressions normal, shoulders raised, sutural region slightly impressed. *Legs* rather slender; *anterior femora* nearly twice as thick as the posterior; *tibiæ* nearly straight, finely pubescent.

Antennæ moderately elongate, the four terminal joints dilated; second joint longer than the first; 3 to 7 small, each slightly shorter than the one preceding it, third not perceptibly longer than broad; eighth distinctly broader than the seventh, but evidently narrower than the following one; ninth and tenth large, broader than long, not at all laxly articulated; eleventh rather small, slightly longer than broad, not as broad as the tenth.

Maxillary palpi small; third joint not much dilated, fourth small but rather thick. *Eyes* small, not prominent.

The narrow terminal joint of the antennæ and the slender build will lead to the identification of this species.

Length $\frac{1}{2}$, breadth quite $\frac{1}{8}$ line.

Ligar's Bush, Papakura.

Scydmænus relatus, sp. n.

Shining, red, tarsi yellow.

Head with conspicuous, rather coarse, fulvous hairs extending backwards. *Thorax* longer than broad, widest before the middle, much narrowed near the base; there are four basal foveæ, the external smaller than the central pair, the base appears to be transversely depressed. *Elytra* oval, widest near the middle; the basal depressions are large, the shoulders are raised, and the sutural region is indistinctly flattened.

Antennæ elongate, gradually thickened; second joint much longer than the visible part of the first; third very slightly longer than the fourth; 5 to 7 nearly alike, hardly longer than broad; eighth slightly larger than the preceding one; ninth and tenth transversely quadrate; eleventh large but not as long as the ninth and tenth taken together.

This most nearly resembles *S. brachycerus*; the antennæ, however, are not short, but, although this may prove to be a sexual character only, I, at present, think the two are distinct species.

Length $\frac{3}{4}$, breadth quite $\frac{1}{4}$ line.

Hunua Range, Maketu. Three examples.

Scydmænus insignis, sp. n.

Subovate, convex, rufous, head darker, the legs and antennæ reddish yellow, tarsi yellow; very sparingly clothed with slender, inconspicuous, pallid hairs.

Head, including the eyes, obviously wider than the front of the thorax, the middle flat and polished, and apparently without pubescence. *Thorax* a good deal longer than broad, rather wider at the base than it is in the middle; at each side there is a large impression which appears to be united to its fellow by a transverse groove, the basal region therefore seems to be constricted, there are no well-marked foveæ. *Elytra* oviform, widest near the middle, the shoulders so raised that the whole intervening space appears depressed; they are not distinctly punctured. *Legs* slender; *tibiæ* straight, the front pair with more distinct pubescence than the others.

Antennæ elongate, pubescent, the last four joints dilated; first joint scarcely at all shorter than the second; third rather more slender and shorter than the second, nearly twice as long as it is broad; fourth and fifth about equal, slightly longer than broad; sixth and seventh bead-like; eighth slightly longer than broad, about twice the size of the seventh, but not so broad as the ninth, which, though transverse, is not as short as the tenth, these joints rather loosely articulated; eleventh conical, longer but not broader than the tenth.

Maxillary palpi with the third joint large, straight outside, curvate inside; the fourth distinct, nearly as wide at the base as the apex of the third, acuminate.

This is an easily recognized species. The eyes are very large; the surface, owing to the very slender scanty pubescence, appears more polished or glossy than usual; and the basal antennal joint is longer than in its allies, though not elongated as in *Clidicus* and *Mastigus*. I have little doubt it will become the type of a new genus.

Length $\frac{5}{8}$, breadth quite $\frac{1}{4}$ line.

Hunua Range, near Drury. A single specimen.

Group **Colydiidæ**.

PROTARPHIUS, gen. nov.

Body oblong, not elongate, transversely convex. *Eyes* rather small but prominent. *Antennæ* 11-articulate, their basal joint much hidden above; club large, abruptly 2-jointed, Terminal joint of *maxillary palpi* broad at the base, narrowed apically. *Tarsi* rather short and stout, setose below; second and third joints equally short, the first longer than the second, fourth rather longer than the preceding three. *Epipleuræ* broad, gradually narrowed posteriorly, linear at the extreme apex only. *Prosternum* widely and deeply incurved in front, broadly, but not deeply, impressed near each side. *Antennal cavities* large at the point of insertion, the groove along the inner side of the eye rather narrow.

This genus may be placed near *Heterargus* and *Tarphius*. The eyes are larger than those of the former, the mentum is much smaller, all the coxæ are less widely separated, and the prosternum and epipleuræ differ.

Protarphius ruficornis, sp. n.

Oblong, convex, covered with greyish-yellow sappy matter, rufo-fuscous; antennæ, tarsi, and palpi yellowish red; legs infuscate.

Head small, immersed nearly to the eyes, about half the width of the thorax, with a few small granules and fine yellow setæ, the prominences over the antennal insertion not extending laterally beyond the eyes. *Antennæ* short; first joint thick, only its extremity visible from above; second stout, hardly longer than broad; 3 to 9 slender, third distinctly longer than fourth, 5 to 9 bead-like, the ninth scarcely larger than the eighth; club pubescent, large and compact, its basal joint large and transverse, thrice the breadth of the ninth, the terminal slightly longer than the basal one, but hardly as broad as that is. *Thorax* transverse, its sides somewhat explanate, but little curved, not serrate, abruptly contracted or notched close to the base; apex medially rounded, with a sinuosity inside each of the obtuse angles; the surface uneven, with five impressions and intervening elevations, its sculpture granular. *Elytra* oblong, of the same width as the thorax, the apical portion narrowed and nearly vertical; on each elytron there is a moderately elongate basal elevation, in line with this there are two nodosities, the larger one is on the top of the apical declivity, there is another series near the side; between the suture and the side there are four series of closely-placed punctures, the interstices are more or less transversely rugose. *Legs* rather short; *tibiæ* but little curved, with fine yellow setæ, like those on the body.

Underside rather plane, rufo-fuscous, with granular sculpture and fine setæ. *Abdomen* with deep broad sutures. The side of the *prosternum* bears five or six denticles which are not visible above.

Length $\frac{7}{8}$, breadth nearly $\frac{1}{2}$ line.

Mount Pirongia. Two examples, Dec. 1892.

Obs. No. 1167 may be placed in this genus; the tarsi, however, are more elongate and slender, and the eyes are larger and more prominent.

Protarphius indentatus, sp. n.

Oblong, convex, fuscous, covered with sappy matter; tarsi and antennæ red, club piceous.

Head with granular sculpture, somewhat piceous. *Antennæ* short, first joint but little exposed, ninth transverse and only slightly broader than the eighth; club large, its apical joint about as broad but rather longer than the basal one. *Thorax* transverse, abruptly contracted close to the base, each side with two small indentations near the middle; the middle of the disk is longitudinally depressed, at each side of this depression there are three elevations, the hindermost is the largest, the rest of the surface is somewhat uneven. *Elytra* with three nodiform elevations on the third interstices, one near the base and one on the summit of the posterior declivity; there are three others in a row, near the side, all placed behind the middle; the serial punctures are close but not very coarse.

This does not agree exactly with the typical species, but I see no other place for it. The eyes are large and prominent, the tarsi are elongate and slender, the sides of the thorax are feebly indented, the antennal cavities are less expanded in front of the eyes, and the epipleuræ are more attenuated posteriorly. It cannot be referred to *Tarphius* or any of its allies, but I do not think it necessary to make another genus for it at present.

Length $1\frac{3}{8}$, breadth $\frac{5}{8}$ line.

Taranaki. Two, found near Stratford several years ago.

CICONISSUS, gen. nov.

Body moderately narrow, transversely convex, finely and sparsely setose, without nodiform elevations. *Head* immersed up to the eyes; antennal prominences large, covering all but the extremity of the basal antennal joint. *Labrum* subquadrate. *Eyes* small.

Antennæ 11-articulate, of moderate length, and inserted just in front of the eyes, with the club abruptly two-jointed. *Thorax* evenly convex, sloping downwards in front; its base rounded towards the sides, so as to leave a gap between the hind angles and the shoulders; the apex obtusely rounded in the middle, with a slight notch behind each eye, the angles not projecting.

Scutellum small, usually hidden. *Elytra* longer than the thorax, not wider; shoulders rounded; they are narrowed but not abruptly declivous behind. *Legs* stout, rather short. *Tibiæ* unarmed, narrowed towards the extremity. *Tarsi* short and thick, setose below; basal joint short, not exceeding the second in length apparently; third short.

Prosternum rather flat, truncate in front, without antennal cavities. *Front coxæ* small, rather close to each other; the middle pair more distant; the posterior distinctly but not widely separated. *Metasternum* moderate. *Abdomen* plane; first segment about as long as the metasternum, second and third nearly equal, the sutures rather deep and straight. *Epipleuræ* broad near the base, becoming narrow, but not linear, behind.

Differs from *Coxelus* and its allies by the absence of the usual subocular antennal grooves, and from the series of which *Epistranus* is the type by the complete absence of prosternal cavities for the accommodation of the antennæ. The coxæ are more approximate than in *Coxelus*, there are no oral setæ, and the tarsi are different.

Ciconissus granifer, sp. n.

Subcylindrical, obscure red, tarsi rather paler; sparingly clothed with erect, hair-like, pale setæ.

Head depressed behind, with a transverse row of granules.

Antennæ reddish; second joint about as long as the first, as seen from below, narrowed towards its base; third rather shorter than second, only about half its breadth; 5 to 9 bead-like, ninth transverse, slightly broader than eighth; tenth very broad; eleventh somewhat rounded, nearly as large as the preceding one. *Thorax* rather broader than long, not at all short, its sides rounded, with eight or nine denticles on each; on the disk there are four longitudinal series of small tubercles or granules, beyond these the sculpture is less regular, and, near the sides, the granules are transformed into denticles. *Elytra* (conjointly) with about twelve rows of granules, the lateral margins denticulate. *Legs* with fine setæ similar to those on the tarsi.

Underside fusco-rufous, nearly plane, finely and sparingly setose, with small granules, the four basal segments of the abdomen nearly smooth.

In its natural state it is covered with greyish sappy matter; this, however, does not obliterate the rows of granules, but the true marginal sculpture is not seen until the insect has been cleaned; when this has been done, the sides exhibit outstanding denticles.

There is no indigenous species at all like this one.

Length $\frac{7}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia. Seven individuals, Dec. 1892.

Epistranus hirtalis, sp. n.

Body transversely convex, much narrowed medially, slightly shining, obscure chestnut-red; legs and antennæ red, tarsi paler.

Head with some small granules. *Antennæ* sparsely pubescent, club more distinctly; first joint but little visible from above, second thick, cylindric, nearly twice as long as broad, third nearly twice the length of the following one; joints 4 to 7 small, eighth and ninth transverse, tenth very broad, eleventh about as broad, rounded. *Thorax* about as long as broad, greatly narrowed near the base, widest near the middle; it is covered with tubercles, these are larger near the middle than elsewhere, at the sides they cause the margins to appear denticulate; along the middle of the disk there is a smooth linear space, between the middle and the apex there seems to be a transverse depression, owing to the tubercles being nearly absent there; each tubercle bears about six short fine yellow setæ, and from the centre of these there arises an erect elongate fulvous hair. *Elytra* rather longer, but not broader, than the thorax, the shoulders rounded, the sides a little curved and denticulate; they bear regular series of tubercles, about six in each row; between the tubercles there seem to be coarse punctures; on the posterior declivity there are about four series, and as these are much smaller than the tubercles on the dorsum, the interstices appear broad and smooth; their clothing is like that of the thorax. *Tibiæ* densely ciliate with yellow setæ; on the anterior above the middle the setæ are most conspicuous.

Underside rufescent, sparsely setose. *Prosternum* deeply and broadly concave at each side from the front angles to the femora; from each coxa there extends forwards a curved row of tubercles, five or six in each, along the middle in front there are some smaller ones, the intervening space appears depressed. Between the middle *coxæ* there is a large deep cavity, and just behind this there are two foveæ. The *metasternum* is deeply transversely depressed behind; the space between the posterior coxæ is broadly raised, a cavity behind this is limited by raised borders. The sides of the basal segment of the *abdomen* are depressed; the second has a curved elevation across it, but behind it is much depressed; the next two have very broad deep sutures; the fifth is rather flat and as long as the preceding two.

This cannot be *E. Lawsoni*, Sharp, which has short setæ above. It is near *E. valens*, but it has a considerably larger terminal joint to the antennæ. The clothing of the tubercles is remarkable. The specimen described above has been denuded with the point of a needle; it was covered with greyish sappy matter.

Length 1, breadth ½ line.

Mount Pirongia. Two specimens were obtained in December 1892.

ARCHÆOGLENES, gen. nov.

Body glabrous, moderately transversely convex, subcylindric. *Head* immersed nearly to the eyes, without lateral prominences; the margins, however, are a little thickened and form an obtuse curve across the forehead. *Labrum* subquadrate. *Mandibles* bifid at apex. *Maxillary palpi* short, with broadly oval terminal joints. *Eyes* free, convex, rather large, with coarse facets. *Antennæ* very short, 10-articulate, inserted below the edge of the forehead; *club* abruptly biarticulate. *Thorax* broader than long, with simple lateral margins; base and apex subtruncate, the anterior angles obtuse and but little projecting, the posterior rectangular. *Scutellum* short. *Elytra* slightly broader than the thorax at the base, closely applied thereto. *Legs* moderately elongate; front femora grooved underneath, the grooves with carinate edges; *tibiæ* laterally compressed, straight, minutely spinose at the extremity, their outer angles not rounded off. *Tarsi* narrow, their first joint only slightly longer than the second, fourth not longer than the preceding three; claws small but thick.

Underside along the middle on a rather higher plane than the sides. *Head* large, the portion in front of the antennal insertion very short; the subocular furrows broad, directed outwards behind. *Prosternum* rather short, almost truncate in front, the upper and outer portions (thoracic anterior angles) obtusely prolonged, smooth, and deeply excavate. In repose the *antenna* extends backwards along the inner side of the eye, it is then bent outwards, and the club fits into the cavity under the anterior angle of the thorax. *Front coxæ* moderately distant, the intervening process with obtusely raised side borders; the posterior are not more widely separated than the intermediate. *Mesosternum* not abbreviated. *Metasternum* simple, rather shorter than the abdomen. *Epipleuræ* broad, with sharply defined edges; they are not narrowed until they reach the apex, even there they are not linear. *Abdomen* composed of five nearly equal segments, considerably narrowed posteriorly, the last two sutures broad and deep; the suture between the two basal segments, owing to the coarse rugose sculpture, is ill-defined.

The bald surface, ten-jointed antennæ, grooved femora, and the remarkable antennal cavities render the recognition of this genus easy. It should be placed near *Chorasus*, from which, however, it is quite distinct.

Archæoglenes costipennis, sp. n.

Ochraceous, slightly nitid, the base and sides of the thorax darker; the anterior angles, however, are paler and semi-transparent.

Head with coarse shallow punctures, not quite as wide as the front of the thorax. *Antennæ* with short pubescence; second joint quadrate, stout, longer than the exposed part of the first; joints 3 to 8 of equal thickness, transverse, third slightly longer than the following one, ninth very short and broad, tenth obtusely rounded, as broad as the ninth but nearly twice its length. *Thorax* moderately convex, somewhat raised, smooth, and glossy in front of the base; the punctures before the smooth part are rather coarser and more distant from one another than those near the sides; the marginal channels are well-marked, the lateral margins are rather thick, entire, and not much rounded, so that the front and base are of about equal breadth; along the base there is a distinct transverse depression, with a fovea in the middle. *Elytra* oblong; the side margins near the shoulders are somewhat explanate, the apical margins are well-developed; they are striate-punctate, the suture is slightly raised, outside the third row of punctures on each elytron there is a distinct costa, the interstices beyond this are more or less elevated, the alternate ones most distinctly, so that there seem to be three costæ on each. *Tibiæ* with fine setæ only; their external apical angle appears to be as distinct as the inner one.

Underside pale brown, more or less coarsely punctured, the epipleuræ with two series of punctures.

Length $\frac{7}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia, one, December 1892; Hunua Range, one, 1890.

Near Whangarei Harbour I found a specimen about fifteen years ago; but as it was difficult to manipulate, I thought it better to defer its description until other examples could be obtained. It lives on the ground amongst decaying leaves.

Group **Lathridiidæ**.

Corticaria terricola, sp. n.

Ovate, broad, somewhat convex, slightly nitid; nearly black, the basal half of the elytra testaceous; tarsi and antennæ fuscous; sparingly clothed with short and elongate, mostly erect, pallid hairs.

Head broad, closely and rugosely sculptured. *Eyes* large and prominent. *Antennæ* with slender outstanding hairs, first joint stouter than second, 3 to 8 filiform; club laxly articulated. *Thorax* hardly as long as broad, rounded laterally, more narrowed in front than behind; rather closely punctured, with two small impressions on the disk, one behind the other, and one at each side; there is no distinct transverse basal depression. *Elytra* ample, their sides hardly at all rounded, broader at the base than the thorax; they are slightly impressed before the middle and are closely and moderately coarsely punctured. *Legs* slender; tarsi narrow, their terminal joint about the length of the preceding two, claws appendiculate at the base.

The large rotundate eyes, together with the sculpture and coloration, distinguish this species.

Length $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Ligar's Bush, Papakura. One example.

Group **Byrrhidæ**.

Pedilophorus lævipennis, sp. n.

Oviform, convex; shining, æneo-piceous, head and thorax slightly rufescent; tibiæ red, but with pitchy outer edges, tarsi testaceous, antennæ pale obscure red.

Head distinctly but not deeply and not coarsely punctured. *Thorax* narrowed anteriorly, its sides nearly straight, its surface with moderately fine and not closely placed punctures. *Scutellum* minute, longer than broad. *Elytra* nearly smooth, with very few minute indistinct punctures and some irregular but hardly perceptible longitudinal striæ. *Femora* rather slender and compressed. *Front tibiæ* slightly curved externally, with very shallow tarsal impressions.

Metasternum rather flat, very finely and distantly punctate; it is a little raised and truncate between the middle coxæ. *Abdomen* with minute sculpture and pubescence.

The scutellum differs from that of *Morychus coruscans*, Pascoe, and the sculpture and appearance differ.

Length $1\frac{3}{4}$, breadth 1 line.

Mount Pirongia. One, December 1892.

Pedilophorus tibialis, sp. n.

Glossy, cupreo-æneous, rufescent; legs red, antennæ obscure red, tarsi testaceous.

Head distinctly punctured, very closely so near the sides. *Thorax* very finely and not at all closely punctured. *Scutellum* small, triangular. *Elytra* finely sculptured, coriaceous. *Front tibiæ* widely dilated and curved externally, the tarsal impressions broad, shallow, and ill-defined, consisting only of a flattening along the front face. *Antennæ* rather short and stout, joints 3 to 5 only moderately slender, third longest, sixth obconical, broader and evidently shorter than the fifth; 7 to 10 rather compact and broad, eleventh large, nearly the length of the preceding two.

This, there can be no doubt, is a distinct species.

Length $1\frac{3}{4}$, breadth quite $\frac{7}{8}$ line.

Dyer's Pass, near Christchurch. One, damaged, found by Mr. H. Suter.

Pedilophorus puncticeps, sp. n.

Shining, head æneo-rufous, thorax and elytra æneous; legs red, tarsi, palpi, and antennæ paler.

Head coarsely and rather closely punctured. *Thorax* distinctly and rather closely, but not as coarsely or closely punctured as the head. *Scutellum* small, triangular. *Elytra* coriaceous. *Anterior tibiæ* broadly grooved and somewhat curved. *Antennæ* rather slender; sixth joint short, yet obviously longer than broad, the last five enlarged.

Mr. Pascoe describes the head of *Morychus coruscans* as being "leviter subconfertim punctato," the scutellum "transversim triangulari," and the thorax "subtilissime punctatus;" it is evident therefore that *P. puncticeps* is quite dissimilar.

Length $2\frac{1}{4}$, breadth $1\frac{1}{4}$ lines.

Hunua Range, Clevedon. My specimen was sent by Mr. George Campbell Munro.

Pedilophorus picipes, sp. n.

Æneo-piceous, legs and antennæ rufo-piceous; it bears some minute grey hairs.

Head closely and moderately coarsely punctured near the sides, quite distinctly on the middle. *Thorax* slightly but obtusely lobate medially at the base, with rather shallow but quite distinct though not close punctures. *Scutellum* small, triangular. *Elytra* minutely and irregularly punctured, coriaceous. *Antennæ* with the last six joints gradually dilated. *Front tibiæ* nearly straight, their grooves deep, with sharp edges.

This does not agree very well with the description of *Morychus coruscans.* The tibiæ are unlike those of the preceding species.

Length $2\frac{1}{4}$, breadth $1\frac{3}{8}$ lines.

Midhirst, Taranaki. One, found several years ago by myself.

Pedilophorus creperus, sp. n.

Shining, pitchy black; legs dark red, antennæ and tarsi obscure yellowish red.

Head rather closely and moderately coarsely punctured all over. *Thorax* distinctly, almost as closely but not as coarsely sculptured as the head. *Scutellum* triangular. *Elytra* finely and distantly punctured, subcoriaceous, and studded with minute greyish hairs. *Front tibiæ* straight, not at all deeply grooved.

The appearance of this form is very different from any of the New-Zealand species.

Length $1\frac{7}{8}$, breadth nearly $1\frac{1}{8}$ line.

Dyer's Pass. One individual, found by Mr. H. Suter.

Pedilophorus probus, sp. n.

Glossy, bluish green, slightly rufescent; legs rufo-piceous, the tarsi, palpi, and antennæ obscure reddish; sparingly clothed with minute greyish hairs.

Head distinctly and closely punctured near the sides and base, more distantly and coarsely in front, with two smooth spots on the middle. *Thorax* moderately closely, rather finely, but quite distinctly punctured. *Scutellum* triangular, not at all transverse. *Elytra* more finely sculptured than the thorax, slightly coriaceous. *Front tibiæ* a little dilated and curved outwardly below the middle, with rather broad tarsal furrows. *Antennæ* of moderate length; first joint pitchy, joints 7 to 11 gradually dilated, ninth and tenth strongly transverse.

The sculpture of the head is unlike that of the preceding species.

Length $2\frac{1}{8}$, breadth $1\frac{3}{8}$ lines.

Taierei, Otago.

I am indebted to Mr. S. W. Fulton for my specimen, which I had set aside as a varietal form of *Morychus coruscans.* It was found about ten years ago.

Obs. I have not had an opportunity of comparing many examples of the European species, so that it is difficult to estimate the exact value that may be attached to the differences in sculpture and coloration presented by the New-Zealand species or varieties; at any rate they seem distinct from one another so far as superficial appearance goes, and I feel sure that considerable disparities will be apparent on the lower surface when more material is available for careful comparison. They are of very similar outline, and the third joint of the tarsi is prolonged below the fifth in the shape of a large membrane. The following are congeneric :—

P. coruscans, Pascoe.
P. gemmeus, Broun.
P. lætus, Broun.

Morychus granulatus, sp. n.

Convex, very broadly oval, slightly shining; piceous, legs red, tarsi and antennæ yellowish; the clothing consists of erect infuscate setæ.

Head finely and moderately closely punctured. *Thorax* strongly transverse, about twice as broad as it is long, very much narrowed anteriorly, base truncate; its surface with fine and rather close granular sculpture; a considerable space near each front angle is much depressed. *Scutellum* obsolete. *Elytra* broadest at the base, attenuated posteriorly, slightly uneven, the suture a little raised behind; their sculpture resembles that of the thorax. *Tibiæ* fringed with short moderately coarse setæ; the anterior nearly straight, abruptly obliquely narrowed towards the apex, with tarsal furrows; the intermediate slightly curved. *Tarsi* finely setose, their third joint prolonged below the small fourth, with apparently a very short membranous appendage. *Antennæ* with red, stout, cylindric basal joint, second conical, 3 to 5 slender, decreasing in length, sixth slightly broader and shorter than fifth, seventh and eighth broader, ninth and tenth subquadrate, eleventh conical, about as long as the preceding two.

Underside piceous, rather densely covered with decumbent tawny hairs: prosternum thickly ciliate in front, its sides hollowed out for about two thirds of their whole area; its central piece does not extend laterally beyond the coxæ, its process is flat and curved behind. *Mesosternum* with a deep semicircular cavity in front. *Middle coxæ* widely separated, the intervening suture straight. *Epipleuræ* broad and pubescent in line with the metasternum, but abruptly narrowed behind it, smooth and depressed in front. *Metasternum* with a transverse lateral groove at each side; this groove has raised borders. *Abdomen* with a smooth depressed space at the base for the hind legs. *Femora* grooved below. *Tibiæ* smooth inside. *Palpi* with subacuminate terminal joints.

The short thorax, which is much depressed towards the acute front angles, the differently formed tibiæ, the peculiar sculpture, and densely clothed under surface distinguish this from *M. setarius.*

Length $1\frac{1}{2}$, breadth 1 line.

Ligar's Bush, Papakura. One example.

Obs. Nos. 431, 434, 1171, and 1608 are allied species. They may remain in the genus *Morychus* at present.

Liochoria sternalis, sp. n.

Convex, very broadly oval, shining, glabrous, black or piceous; the legs and basal joint of the antennæ red, remaining joints of these latter, the tarsi, and the palpi yellowish.

Head moderately closely and coarsely punctured near the eyes, distantly on the middle, the forehead rounded. *Thorax* transverse, narrowed anteriorly, its sides straight and finely margined; its punctuation rather fine and irregular, not at all close, the sides almost smooth. *Scutellum* invisible. *Elytra* less distinctly punctured than the thorax, the sides and apex almost smooth. *Legs* with fine short brassy setæ; *front tibiæ* very slightly curved, feebly grooved along the outer (not the front) face; the intermediate strongly arcuate externally. *Tarsi* with an elongate membranous appendage extending below the fifth joint.

Underside piceous, with some depressed yellow hairs; the metasternum with shallow distant punctures; the abdomen finely and closely punctured.

Prosternum very short, so that there is only a small space in front of the anterior coxæ; its flanks curved towards the sides in front, so that the anterior angles appear obtuse.

In No. 2363 the flanks of the prosternum are less curved in front, so that the front angles are acute or very nearly so, and the space before the coxæ is smooth and a good deal longer.

Length $1\frac{7}{8}$, breadth $1\frac{1}{4}$ line.

Ligar's Bush. Two specimens.

Obs. Nos. 435, 1170, 1364, 1609, 2363, and this species should be associated with No. 436 under the name *Liochoria*;

but as I have not seen *Liochoria Huttoni*, I cannot state whether the sternal structure differs from that of the species I now locate in the same genus. These five species evidently form one natural group.

Cytilissus, gen. nov.

Facies resembling the setose species of *Morychus*. *Antennæ* short, first joint large, cylindric, second quite half the length of the first, narrowed apically, third elongate and slender, fourth slender, shorter than third, fifth broader, subquadrate; *club* elongate, oblong, about as long as joints 3 to 5 taken together, compact, very indistinctly articulated, but, so far as I can see, composed of two nearly equal joints.

The antennæ, therefore, seem to have but seven joints, a character which of itself is sufficient in this group for generic separation.

Cytilissus claviger, sp. n.

Convex, broadly oval or subrotundate; with numerous erect, elongate, slender, cinereous setæ or hairs; piceous, slightly shining, the tibiæ and first joint of the antennæ red, tarsi and palpi yellow.

Head finely and distantly punctured. *Eyes* distinctly faceted. *Thorax* strongly transverse, narrowed anteriorly, sides straight, base and apex truncate, its angles acute; its surface very finely but not closely punctured. *Scutellum* invisible. *Elytra* distantly and very finely punctured. *Legs* with fine setæ; anterior tibiæ grooved along the outside, the middle pair only a little curved externally. *Tarsi* moderate, the third joint with a thin well-developed membranous appendage. *Palpi* thick, obtuse at the extremity.

Underside pitchy, punctate, with pale longish hairs.

Length $1\frac{1}{8}$, breadth $\frac{3}{4}$ line.

Mount Pirongia. I regret having been unable to find more than one of this interesting species.

[To be continued.]

XXIX.—*On an Abnormal Specimen of* Antedon rosacea. By Herbert C. Chadwick (from the Zoological Laboratory of the Owens College).

[Plate VIII.]

Three months ago, while selecting specimens of *Antedon rosacea* for serial section-cutting from a number which had been forwarded to the Zoological Laboratory of the Owens College by the authorities of the Zoological Station at Naples, my attention was arrested by one to the disk of which a small rounded body was attached. A cursory examination at once showed the specimen to be one of very exceptional interest, and my thanks are due to Prof. Milnes Marshall for permission to examine and describe it.

The disk (Pl. VIII. figs. 1 and 2), which measured 7·5 millim. in diameter, bore the usual number of well-developed arms, and with the exception of the displacement of one of the ambulacral grooves, to be more fully described later on, was in all respects quite normal. On its oro-lateral border, however, it bore the body to which allusion has already been made, and which proved to be a supernumerary disk (figs. 1, 2, and 3, *s.d.*). Roughly spherical in shape and about 3 millim. in diameter, it was attached to the normal disk by a sort of stalk, which gradually narrowed from the oral to the aboral surface. Near the centre of its oral surface was a well-developed mouth, fringed with tentacles, from which five ambulacral grooves radiated, just as do those of the disk of a normal *Antedon*. Of these, four could with little difficulty be traced outwards to the aboral aspect.

The remaining one (figs. 1 and 3, x) ran along the stalk of attachment to the normal disk and joined the ambulacral grooves of the pair of arms nearest to it, immediately after crossing the line of junction of the two disks. On the aboral surface the anus appeared as a minute crescent-shaped aperture (figs. 2 and 4, a). Close to it was a minute scarcely distinguishable pore, another rather larger aperture appearing on the summit of the funnel-shaped projection, *f.p.* (figs. 2 and 5). The nature and connexion of these will appear later on.

Minute Anatomy.—Having carefully noted and drawn the external characters of the specimen, I decalcified it by immersion for twenty-four hours in a 10 per cent. solution of nitric acid, and, after staining in borax carmine, I was fortunate enough to obtain an unbroken series of sections by means of the rocking microtome. From a very careful study of these I find that the body-cavities of the two disks communicate freely with each other through the stalk or isthmus of tissue which unites them, their alimentary canals, on the other hand, being quite distinct. The alimentary canal of the supernumerary disk (figs. 3 and 4, g') is well developed and contains food. The ambulacral system is also well marked and presents a feature of special interest. The minute pore close to the anus, to which I have already alluded, opens into a canal-like space (fig. 4, c), which traverses the body-wall for a distance equal to the thickness of seventeen sections, and again communicates with the exterior through the funnel-shaped projection already described (figs. 2 and 5, *f.p.*). That this canal was a modified ambulacral groove is shown by the epithelial cells which line it. They are precisely similar to those which line the ordinary ambulacral grooves; and further evidence in the same direction is afforded by the presence in its walls of numbers of the deeply staining problematical bodies which are invariably seen in sections of the ambulacral grooves of this species. Beneath the epithelium of the ambulacral grooves the nerve-band can be recognized without difficulty in most sections. The circular water-vessel (fig. 5, *c.w.v.*) and radial water-vessels are also present, and from the former a considerable number of water-tubes (fig. 5, *w.t.*) depend into the body-cavity. Water-pores traverse the body-wall in all the sections and are abundant on the interambulacral area, marked with an asterisk in fig. 1 (see also fig. 3, *w.p.*). The skeletal and axial nervous systems present in the normal disk are entirely absent in the supernumerary one; so also is the central plexus.

The interesting question now arises—What was the mode of origin of the supernumerary disk? In answer to it two hypotheses may, I think, be advanced:—

1. That the supernumerary disk originated as a bud from the normal disk.

2. That it is the result of incomplete evisceration.

In favour of the former hypothesis is the intercommunication of the body-cavities of the two disks—a condition of things one would expect to find in a budding organism. Against it is the entire absence of arms, skeleton, and axial nervous system in the supernumerary disk. The comparatively large size attained by the supernumerary disk and the fact that the remaining systems of organs had attained their adult condition add importance to this objection. A still weightier objection lies in the fact that, so far as I know, the formation of a bud has never been observed in any Echinoderm.

I am indebted to Prof. Marshall for the second hypothesis, and it appears to me to explain the facts most conclusively.

Though *Antedon rosacea* has never been proved to eviscerate spontaneously, eviscerated specimens frequently occur in dredgings; and the experiments of Prof. Marshall * and Mr. Dendy † have shown that evisceration may be and often is followed by complete regeneration of the visceral mass.

* "On the Nervous System of *Antedon rosacea*," Quart. Journ. Micr. Sci. xxiv. (1884) pp. 507–548.

† "On the Regeneration of the Visceral Mass of *Antedon rosacea*,"

These facts seem to me to make more than probable the supposition that at an earlier period the specimen had suffered evisceration without the visceral mass being completely detached. By the continuity of the ambulacral grooves of two of the arms of the normal disk with one of the grooves of the supernumerary disk a supply of food would be ensured to the latter without seriously curtailing that of the former during regeneration. In the paper just cited Mr. Dendy has shown in how short a time the visceral mass may be regenerated, twenty-one days being a sufficient length of time for regeneration to become so complete that "there is little to distinguish a regenerated specimen of this date from a normal *Antedon* except the small size of the visceral mass and the want of pigment upon it."

The abnormal character and displacement of the anus and the canal-like ambulacrum are not so easily accounted for; but they are minor points, and do not appear to me to impair the value of what has been advanced above.

EXPLANATION OF PLATE VIII.

List of reference letters.

a. Anus.
a.g. Ambulacral grooves.
c. Abnormal ambulacrum.
c.w.v. Circum-oral water-vessel.
f.p. Funnel-shaped projection of supernumerary disk.
g. Gut.
g'. Gut of supernumerary disk.
m. Mouth.
r.w.v. Radial water-vessel.
s.d. Supernumerary disk.
s.o. Skeletal ossicles.
w.t. Water-tubes.
x. Ambulacral groove.

Fig. 1. Oral surface of abnormal specimen of *Antedon rosacea*, × 5.
Fig. 2. Aboral surface of abnormal specimen of *Antedon rosacea*, × 5.
Fig. 3. Sagittal section through the normal and supernumerary disks, showing the point of union of the two, × 16.
Fig. 4. Sagittal section of the supernumerary disk, passing through the mouth and anus, × 16.
Fig. 5. Sagittal section of the supernumerary disk, showing the funnel-shaped projection traversed by the abnormal ambulacrum, × 16.

XXX.—*List of the Fishes collected by Mr. E. W. Oates in the Southern Shan States, and presented by him to the British Museum.* By G. A. Boulenger.

The collection made by Mr. Oates in a district previously unexplored, so far as Fishes are concerned, proves of great interest. It adds to our knowledge of the extension of species

Studies from the Biological Laboratories of the Owens College, i. (1886) pp. 299–312.

both from the Burmese and Siamese sides, and reveals the existence of seven previously undescribed species, all of which are represented by excellently preserved specimens. I may here add that the collection of Reptiles formed by Mr. Oates in the same district, although poor in number of specimens, yielded the type of a new genus and species of Snakes, which has been lately described in the first volume of the new Catalogue of Snakes as *Trirhinopholis nuchalis*, and an example of a Lizard previously unrepresented in the Museum, *Acanthosaura kakhienensis*, Anderson.

Ophiocephalidæ.

1. *Ophiocephalus gachua*, Ham. Buch.

Nampandet, 2000 feet; Fort Stedman, 3000 feet.

2. *Ophiocephalus siamensis*, Gthr.

Fort Stedman.

Mastacembelidæ.

3. *Mastacembelus Oatesii*, sp. n.

Depth of body $9\frac{1}{2}$ to $10\frac{1}{2}$ times in total length, length of head $6\frac{1}{2}$ to 7 times. Snout thrice as long as diameter of eye, ending in a trifid appendage; cleft of mouth extending hardly to below nostril; four or five strong spines at angle of præoperculum, increasing in size from the lower to the upper. Vertical fins distinct, united only at the base with the caudal. Dorsal XXIX–XXXIII * 48–55; originating above middle of pectoral. Anal III 46–55. Pectoral about $\frac{1}{3}$ length of head. 18–20 scales between origin of soft dorsal and lateral line. Pale yellowish brown, uniform or marbled with brown or with irregular dark brown blotches; dorsal line and top of head dark brown; pectoral usually brown with broad yellowish border.

Total length 290 millim.

Fort Stedman, 3000 feet. Eight specimens.

4. *Mastacembelus caudiocellatus*, sp. n.

Depth of body $8\frac{2}{3}$ to 10 times in total length, length of head 5 to $5\frac{1}{3}$ times. Snout thrice as long as diameter of eye, ending in a trifid appendage; cleft of mouth extending hardly to below nostril; no spines on præoperculum. Vertical fins distinct, united only at the base with the caudal.

* 29 spines in one specimen, 33 in two, 32 in the five others.

Dorsal XXXI–XXXIII 62–66; originating above extremity of pectoral, or a little behind. Anal III 60–65. Pectoral $\frac{1}{5}$ to $\frac{2}{9}$ length of head. 25–30 scales between origin of soft dorsal and lateral line. Brown above, yellow beneath; two or three blackish streaks along the sides, the upper proceeding from the eye; blackish marblings below the lateral streaks; a series of blackish ocelli with yellowish centres along the side of the tail; vertical fins yellowish, reticulated with black.

Total length 235 millim.

Fort Stedman, 3000 feet. Five specimens *.

Siluridæ.

5. *Clarias magur*, Ham. Buch.

Fort Stedman, 3000 feet.

6. *Silurus afghana*, Gthr.

Nampandet, 2000 feet.

7. *Amblyceps mangois*, Ham. Buch.

Nampandet.

8. *Macrones Dayi*, Vincig.

Nampandet.

Cyprinidæ.

9. *Cyprinus carpio*, L.

Fort Stedman, 3000 feet.
26 to 30 scales in the lateral line.

10. *Labeo angra*, Ham. Buch.

Nampandet, 2000 feet.

* The fine collection of Fish made by Mr. Oates in the Sittang River and adjacent streams from Toungoo to about 150 miles south, and presented by him to the British Museum in 1891, contains examples of another new *Mastacembelus*, which I propose to name

Mastacembelus alboguttatus, sp. n.

Depth of body 10 times in total length, length of head 7 times. Snout 4 to $4\frac{1}{2}$ times as long as diameter of eye, ending in a trifid appendage; cleft of mouth not extending to below nostril; three strong spines at angle of præoperculum, increasing in size from the lower to the upper. Vertical fins united at the base with the caudal. Dorsal XXXV–XXXVI 75–85; originating above middle of pectoral. Anal III 70–80. Pectoral nearly half as long as head. 25–30 scales between origin of soft dorsal and lateral line. Body and fins (pectorals included) dark brown, all over with round white spots; large blackish spots may be present on the body.

Total length 490 millim.

11. *Cirrhina latia*, Ham. Buch.

Nampandet.

12. *Barbus Oatesii*, sp. n.

Section *Barbodes*, Blkr. Depth of body $2\frac{3}{4}$ to 3 times in total length; length of head 4 to $4\frac{1}{3}$ times. Snout rounded, slightly prominent, as long as diameter of eye, which is $3\frac{1}{3}$ to $3\frac{1}{2}$ times in length of head; interorbital width 3 times in length of head; maxillary barbel as long as diameter of eye, rostral barbel a little shorter. Dorsal IV 8; spine strong, very strongly serrated, with 12 to 19 serræ, a little shorter than the head, opposite to first ventral ray, and equally distant from end of snout and caudal fin. Anal III 5, longest ray $\frac{3}{4}$ length of head. Scales 29–33 $\frac{5}{4\frac{1}{2}}$; 3 scales between lateral line and base of ventral. Silvery, each scale edged with black; opercular cleft black-edged; dorsal and caudal fins greyish, pectoral, ventral, and anal yellowish.

Total length 130 millim.

Numerous specimens from Nampandet, 2000 feet.

13. *Barbus schanicus*, sp. n.

Section *Barbodes*, Blkr. Depth of body $2\frac{3}{4}$ to 3 times in total length; length of head $3\frac{3}{4}$ to 4 times. Snout rounded, slightly prominent, as long as diameter of eye, which is $3\frac{1}{2}$ to $3\frac{2}{3}$ in length of head; interorbital width $2\frac{1}{2}$ times in length of head; rostral barbel as long as diameter of eye, maxillary barbel a little longer. Dorsal IV 8; spine strong, its stiff portion $\frac{3}{5}$ to $\frac{2}{3}$ length of head, serræ moderate, 22 to 25; the spine opposite to inner ventral ray, and equally distant from end of snout and caudal fin. Anal III 5, longest ray $\frac{1}{2}$ length of head. Scales 29–31 $\frac{6}{5\frac{1}{2}}$; 4 scales between lateral line and base of ventral. Olive-brown; belly silvery; fins greyish.

Total length 135 millim.

Toungyi, 4600 feet; four specimens. Fort Stedman, 3000 feet; two specimens.

14. *Barbus Dukai*, Day.

Two specimens from Nampandet, 2000 feet.

Lateral line 26–28.

15. *Barbus tor*, Ham. Buch.

Nampandet, 2000 feet.

16. *Barbus nigrovittatus*, sp. n.

Section *Labeobarbus*, Blkr. Depth of body equal to length of head, $3\frac{1}{2}$ to $3\frac{3}{4}$ times in total length. Snout obtusely pointed, slightly prominent, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is $4\frac{1}{2}$ times in length of head; interorbital width 3 times in length of head; rostral barbel $1\frac{1}{3}$ diameter of eye, maxillary barbel $1\frac{2}{3}$. Dorsal III 9; spine moderately strong, not serrated, its stiff portion half length of head, slightly in advance of vertical of first ventral ray, equally distant from end of snout and caudal fin. Anal II 5, longest ray $\frac{3}{5}$ to $\frac{2}{3}$ length of head. Scales 28 $\frac{3\frac{1}{2}}{3\frac{1}{2}}$; 2 scales between lateral line and base of ventral. Olive-brown above, white beneath, the two colours separated by a blackish stripe above the lateral line, as in *B. pleurotænia*; dorsal and caudal fins greyish, pectoral, ventral, and anal white (in spirit).

Total length 130 millim.

Fort Stedman, 3000 feet. Two specimens.

17. *Barbus compressus*, sp. n.

Section *Hampala*, Blkr. Body strongly compressed, its depth $3\frac{1}{3}$ to $3\frac{2}{3}$ times in total length; length of head $3\frac{1}{3}$ to $3\frac{3}{4}$ times. Snout obtusely pointed, a little longer than diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head, and equals interorbital width; jaws equal, or lower slightly projecting; mouth wide, extending backwards to below anterior border of eye or slightly beyond; rostral barbel minute or absent, maxillary barbel small, about $\frac{1}{3}$ diameter of eye. Dorsal IV 8; spine very strong, with 17 to 22 strong serræ, $\frac{1}{2}$ to $\frac{2}{3}$ length of head (as long as head in the young) just behind vertical of inner ventral ray, nearer end of snout than caudal fin. Anal III 5, longest ray $\frac{2}{5}$ to $\frac{1}{2}$ length of head. Scales 35–37 $\frac{7}{5\frac{1}{2}}$; 3 scales between lateral line and base of ventral. Uniform silvery, brownish on the back; pectorals and ventrals with or without a greyish blotch.

Total length 240 millim.

Fort Stedman, 3000 feet. Numerous specimens.

18. *Barbus Stoliczkanus*, Day.

Fort Stedman, 3000 feet.

In these specimens the anterior black spot is absent or very indistinctly indicated.

19. *Barilius ornatus*, Sauvage.

B. barnoides, Vinciguerra.

Fort Stedman and Nampandet. Numerous specimens.

20. *Barilius guttatus*, Day.

Nampandet.

21. *Danio malabaricus*, Jerd.

Nampandet.

22. *Danio æquipinnatus*, McCl.

Toungyi, 4600 feet.

23. *Nemachilus brevis*, sp. n.

Depth of body equal to length of head, $3\frac{2}{3}$ times in total length. Eye $\frac{3}{4}$ length of snout, slightly less than interorbital width, $\frac{1}{4}$ length of head; head naked; maxillary barbel extending to præopercular border, outer rostral barbel to centre of eye; lower lip fringed. Depth of caudal peduncle half depth of body, equal to the distance between the anal and the caudal fins. Dorsal II 8, originating slightly in advance of base of ventrals, and a little nearer to base of caudal than to end of snout. Pectoral $\frac{2}{3}$ length of head, a little longer than ventrals, which do not quite reach anus. Anal II 5, halfway between dorsal and caudal. Caudal notched. Body entirely covered with imbricate scales, of which there are about 30 between dorsal and ventral fins. Pale reddish brown, dotted with black; a small black blotch at base of caudal.

Total length 58 millim.

Fort Stedman, 3000 feet. Three specimens.

24. *Nemachilus botia*, Ham. Buch.

Nampandet.

25. *Lepidocephalichthys Berdmorii*, Blyth.

Nampandet and Toungyi.

26. *Acanthophthalmus pangia*, Ham. Buch.

Nampandet.

Notopteridæ.

27. *Notopterus kapirat*, Lacép.

Fort Stedman.

XXXI.—*Note on* Tarentola americana, *Gray*. By G. A. Boulenger.

On one of my last visits to the Paris Museum I was enabled, by the courtesy of Prof. Vaillant, to examine the type specimen of the Gecko named *Tarentola americana* by Gray and *Platydactylus Milbertii* by Duméril and Bibron. This specimen, sent by Milbert from New York to the Paris Museum, probably came from some West-Indian Island,—which we cannot say, as the lizard does not appear to have been rediscovered since. It bears most affinity to the Cuban *T. cubana*, Gundl. & Peters, the type of which I examined in the Berlin Museum (*cf.* Cat. Liz. iii. p. 490), and the West-African *T. Delalandii*, D. & B., but represents unquestionably a valid species. As in these species, the supraorbital bone is absent. The tubercles are larger than in *T. Delalandii*, scarcely keeled, in 12 series on the back; the enlarged caudal tubercles are smooth and nearly flat. The ear-opening is entirely surrounded by a fringe of converging conical tubercles. The symphysial (mental) shield is about once and a half as long as it is broad in the middle.

The number of well-defined species of *Tarentola* has now risen to nine, which may be distinguished by means of the following key:—

I. Supraocular region bony; 13 to 20 scales across the head, from eye to eye.

A. Tail rounded on the sides, elliptical in section.

Dorsal tubercles strongly keeled ...... 1. *T. mauritanica*, L.
Dorsal tubercles smooth or feebly keeled 2. *T. ephippiata*, O'Sh.

B. Tail flat inferiorly, with sharpish lateral edge.

Anterior border of ear denticulate .... 3. *T. annularis*, Geoffr.
Anterior border of ear not denticulate .. 4. *T. senegalensis*, Blgr.

II. Supraorbital bone present, but small; 10 to 12 scales from eye to eye......................... 5. *T. neglecta*, Strauch.

III. No supraorbital bone; 15 to 23 scales from eye to eye.

A. Anterior border of ear not denticulate; dorsal tubercles smooth or feebly keeled; symphysial shield at least twice as long as broad in the middle.

Symphysial shield not thrice as long as broad in the middle............ 6. *T. Delalandii*, D. & B.
Symphysial shield thrice as long as broad in the middle .... 7. *T. gigas*, Bocage.

B. Anterior border of ear denticulate.

Symphysial shield about once and a half as long as broad in the middle; dorsal tubercles very feebly keeled. 8. *T. americana*, Gray.
Symphysial shield about twice as long as broad in the middle; dorsal tubercles strongly keeled ...... 9. *T. cubana*, Gundl. & Peters.

XXXII.—*Description of a Second Species of the Carnivorous Genus* Nandinia, *from Southern Nyassaland.* By OLDFIELD THOMAS.

IN connexion with the working out of the fine series of Nyassa Mammals now being sent to the National Museum by Mr. H. H. Johnston, occasion has arisen for the examination of a couple of specimens of *Nandinia* from the same region, collected on the river Shiré by Sir John Kirk when with the Livingstone Expedition of 1863. The two specimens are flat skins of adult and young, and a comparison of them with the West-African *N. binotata* shows that they are, as might be expected from their locality, quite different specifically from that animal.

The species may be briefly diagnosed as follows:—

Nandinia Gerrardi, sp. n.

Similar to *N. binotata* in size and general colour, but the three prominent black lines on the dorsal aspect of the neck in that animal are entirely absent, the body is more sparsely and finely spotted, and the transverse black markings on the tail are narrower, closer together, and more sharply defined. The tail, also, of the type is considerably shorter than in *N. binotata*, but may be imperfect, so that no stress can be laid on this character. Back of ears concolorous with rest of head. Yellowish spots on withers present, but indistinct.

Hab. Lower Shiré River, Nyassaland. *Type* B. M. 64. 1. 9. 1.

Sir John (or, as he then was, Dr.) Kirk has labelled the type specimen as follows:—

"Skin of 'Nthoro'—an animal eating mice, poultry, &c., and living in the Lower Shiré Valley. June 1861."

It is with great pleasure that I have applied to this very distinct animal the name of my old friend Mr. Edward Gerrard, long the right-hand man of Dr. Gray, whose services in the Museum now extend over more than 50 years, and to whose kindness and intimate knowledge of the Museum Collection of Mammals every worker in that collection, and most of all I myself, have been so largely and constantly indebted.

The discovery of second species to previously monotypic genera is always a matter of interest, while the extreme rarity of new species of Carnivora lends additional importance to the recognition of so striking a species as *Nandinia Gerrardi*.

XXXIII.—*Description of a new Deer from Mount Dulit, Eastern Sarawak.* By Charles Hose, Resident of Baram, Sarawak.

During my exploration of Mount Dulit in 1892 * a species of Deer was met with clearly different from the common Bornean Deer (*Cervus equinus*), but unfortunately the only specimen of it that we could obtain was young, so that I am not at present able to describe the adult animal. The young specimen, however, which is now in the Natural History Museum at South Kensington, is so different from equally young individuals of *C. equinus*, that I feel no doubt that it is really distinct from that species, the only Bornean Deer to which it could be related. I would propose for it, in honour of H.H. the Rajah of Sarawak, the name of

Cervus Brookei, sp. n.

General colour of the fawn rufous, browner on head, neck, and shoulders, richer on the posterior back, fore limbs from elbows downwards, thighs, and outer sides of hind limbs. Muzzle and sides of face brown; forehead and crown rufous. Ears externally dark blackish brown, edged with pale rufous, internally whitish. Back with an indistinct mesial blackish line. Shoulders and rump spotted, the spots small, yellowish, few in number on the shoulders, more numerous on the upper side of the rump. Inner sides of limbs, both fore and hind, and belly whitish, with a strong suffusion of rufous, especially towards the feet. Chest between the fore limbs deep shining black, this colour extending backwards along the lower part of the sides, where it is divided in the centre by the whitish or yellowish belly-colour. Middle of metatarsals with an elongated tuft of rich rufous hairs, tipped with black. Feet rufous, without black markings. Tail bushy, deep shining black. In size this species probably attains a stature nearly or quite equal to that of *C. equinus*.

Hab. Mount Dulit, E. Sarawak.

The young specimens of *C. equinus* that I have seen in Sarawak differ from the type of this species by being almost or quite unspotted, and by having none of the striking contrast between the deep black of the chest and tail and the brilliant rufous of the sides and rump characteristic of *C. Brookei*.

* See 'Geographical Journal,' vol. i. p. 193, Mar. 1893.

XXXIV.—*On a small Collection of Lepidoptera from Darwin Harbour, Falkland Islands.* By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

THE little series of Lepidoptera of which the following is an account was obtained by Dr. W. F. Dale, and sent to Mr. J. Hartley Durrant, who forwarded it to me with the request that I would name it.

The collection contains ten species represented by about forty specimens, and is interesting as a contribution to a little-known fauna. So far as I can judge, it seems to show greater affinity to that of Chili than to any other.

1. *Argynnis siga.*

Argynnis siga, Hübner, Samml. exot. Schmett. Zutr. figs. 677, 678 (1832).

One example.

This is the only butterfly in the collection. No Sphinges or Bombyces were obtained; indeed, the most largely represented tribe was the Noctuites.

2. *Agrotis hispidula.*

Agrotis hispidula, Guenée, Noct. i. p. 293. n. 476 (1852).

Five examples of this somewhat variable species; it was originally described from Chili.

3. *Agrotis Dalei*, sp. n.

This insect has somewhat the aspect of a *Nonagria*; it has, however, very coarsely spined tibiæ and the antennæ are strongly pectinated, each pecten being finely ciliated on each side. Primaries above pale sericeous buff (almost dead gold in tint); costal half sparsely, irregularly, but distinctly speckled with black; a curved discal series of similar black flecks from near costa almost to inner margin beyond the cell; a few fine scattered black dots near outer margin and a well-defined marginal series; fringe of inner and outer margins pale cupreous or rufous-brown, traversed by two grey lines: secondaries grey, slightly darker on external border; fringe buff, shading into reddish ochreous towards apex: head and collar testaceous, the face slightly yellower; antennæ ferruginous; thorax sordid pale buff; abdomen grey, with pale ferruginous lateral and anal tufts. Primaries below smoky grey, slightly blackish at base of costa; base of median and submedian veins pearly opaline; costa washed with buff; an ill-defined transverse dusky discal stripe; external area pale rosy cupreous: secondaries sericeous whitish, the costal area, veins, and fringe buff, slightly rufous; a discocellular spot and five or six longitudinal dashes on the veins across the disk black: pectus whity-brown; legs rufous-brown, with ferruginous spines and whitish-tipped spurs; venter rosy, with the anal tufts slightly yellower.

Expanse of wings 43 millim.

One male of this very distinct species.

4. *Peridroma hostilis.*

Agrotis hostilis, Walker, Lep. Het. xi. p. 737 (1857).

Four examples.

I believe that this is no more than an extreme form of *P. saucia*. *P. stictica*, Blanch., from Chili, is quite intermediate in character between the two.

5. *Peridroma clerica.*

Agrotis clerica, Butler, Trans. Ent. Soc. 1882, p. 129. n. 27.

Three examples of this Chilian species.

6. *Leucania falklandica*, sp. n.

In marking somewhat intermediate between *L. sinuosa* of India and *L. propria* of New Zealand. Primaries above sericeous whity brown, the course of the median vein and the external borders suffused with grey; a black dot followed by a blackish spot at base of costal area; a diffused black streak, trisinuate in front, immediately above the median vein, terminating beyond the cell in a small oblique 3-shaped character; a well-defined black streak from base below the median vein, terminated by the extrabasilar line, which is much interrupted, transverse, and lunulated; a blackish dash on the inner margin also followed immediately by the same line; discal or postmedian line fine, arched inwards to costa, dentate-sinuate; a slightly irregular submarginal series of blackish sagittate spots; fringe white, traversed by two grey lines: secondaries white, slightly opalescent, the costal area silvery; veins and a rather narrow diffused external border smoky grey; fringe white, traversed internally by a smoky grey line: head and thorax whity-brown; collar greyish white, crossed at the back by an interrupted black line; tegulæ whitish at their apices; base of abdomen whitish buff, the remainder sericeous smoky greyish. Primaries below silvery greyish, becoming yellower on costa: secondaries white, with costa and veins buff; a diffused greyish external border; fringes as above: body below sandy buff, greyish here and there; tibial fringes slightly rufous, whitish at tips; venter sericeous.

Expanse of wings 37 millim.

7. *Eupithecia anguligera*, sp. n.

Somewhat intermediate in character between *E. fasciata* from the Nilgiris and *E. sibylla* from Chili. Leaden grey, slightly tinted here and there with brown: primaries elongate-triangular, traversed by about ten wavy blackish lines, but extremely variable; the alternate lines, beginning with that nearest the base, blacker, and therefore better defined than the others, the fifth and seventh, representing the outlines of the central band, black, thicker than the others and acutely angulated towards costa; the tenth line composed of more or less confluent pale-bordered blackish submarginal lunules; a marginal series of externally whitish-edged black dashes: secondaries with hardly a trace of marking from the median vein upwards; a triangular black patch at base below the cell, followed by six blackish zigzag lines, of which the first, third, and fifth are best defined and quite black upon the veins; marginal black dashes as on the primaries: thorax pale leaden grey, with darker transverse bands; abdomen much darker, with almost confluent blackish bands in the type, but extremely variable in depth of colour in a series. Under surface sericeous leaden grey; all the wings with black or blackish discocellular stigma, followed by two parallel blackish lines; the secondaries with traces of a third (subbasal) line; black marginal dashes as above.

Expanse of wings 19 millim.

A series of twenty-one examples, most of them more or less worn.

In some specimens the markings are very indistinct, in others the two black lines of the central band alone remain, with a well-defined discocellular stigma (which, in the type above described, is only shown on the under surface); in others again the outer line of the central band is only marked with black on the veins. In all these specimens, however, such markings as exist are similar in outline and similarly placed, so that it is evident that they represent only one variable species.

8. *Scoparia?*, sp.

A single example in worn condition.

9. *Crambus*, sp.

Three examples of a species allied to *C. vitellus* of New Zealand. The latter is also described as *C. sublicellus*, Zell.

10. *Apurima*, sp.

Three examples, in poor condition, of a species apparently referable to this genus.

XXXV.—*New Species of Oriental Moths.*

By Col. C. Swinhoe, M.A., F.L.S., &c.

Family **Saturniidæ.**

Antheræa delegata, sp. n.

♂ ♀. Bright ochreous red; antennæ pale red, front of thorax and costal band of fore wings dark steel-grey, the band in the male not reaching the apex, the ocelli in the male narrow, in the female large and round, ringed with brown, interlined with pale yellow and bordered by a black line, which runs inwards on each side of the ring and meets on the costa in the male only; the inner portion of both wings is covered with yellow patches, which are bright ochreous in the female, a prominent triangular patch being in the cell towards the base; two outwardly angulated, discal, thin, brown bands across both wings, close together, the outer one edged outwardly with grey, the space from this band to the outer margin dark uniform ochreous red; a yellow subcostal streak on fore wings near apex, with a deep black streak; a steel-grey band on both wings close to the outer margin.

Expanse of wings, ♂ $6\frac{2}{10}$, ♀ $6\frac{9}{10}$ inches.

Singapore (*Davison*). One pair.

The markings above are somewhat as in *A. Frithi*, Moore, but in this species both sexes are similarly coloured and marked, and in the male the hyaline discal ocelli are narrow, and not round, as in that sex of *Frithi*; this species is also allied to *A. latissa*, Westw., from Java.

Family **Euterotidæ**.

Euterote coryna, sp. n.

♂. Of a uniform dark pink-brown; antennæ pale ochreous grey, palpi black. Fore wings with the veins somewhat distinct and paler than the ground-colour, otherwise the wings above and below are without any markings; the colour above is bright and glossy, the apical portion of the fore wings being dull-coloured, without gloss; the colour below is paler and without any gloss, and very uniform except towards the base, where it is slightly paler; the legs are dark brown and the abdomen below is ochreous.

Expanse of wings $3\frac{3}{10}$ inches.

Lawang, Java (*Halliburton*). One example.

Allied to nothing I know of.

Family **Limacodidæ**.

Thosea Cotesi, sp. n.

♂. Head, thorax, and abdomen brown, the scales with pale tips. Fore wings brown, irrorated with pale scales; a pale line from apex to inner margin beyond the middle. Hind wing nearly black, the cilia pale.

♀. Paler; the oblique line on fore wing dark.

Expanse of wings, ♂ $\frac{8}{10}$, ♀ 1 inch.

Darang, Assam (*Cotes*). One pair.

The MS. description of this species was published in Faun. Brit. Ind., Moths, i. p. 380 (1892).

Altha rufescens, sp. n.

♂ ♀. Pinkish white, thorax and abdomen with red hairs. Fore wings suffused with dark red, which is marked here and there with dark brown; a black dot at the end of the cell, the wing crossed by several straight whitish bands, marginal points brown. Hind wings suffused with pale red, without markings; cilia of both wings very long, pale pinkish white. Underside pale pinkish white, unmarked.

Expanse of wings, ♂ $\frac{9}{10}$, ♀ 1 inch.

Ceylon (*Mackwood*). One pair.

Has a superficial resemblance to *Narosa conspersa*, Walker, and was received with a number of examples of that insect.

Family **Lasiocampidæ.**

Metanastria dora, sp. n.

♂. Dark pink-brown; antennæ greyish ochreous, palpi and head black, thorax and fore wings uniform very dark glossy pink-brown; the wing crossed by two indistinct outwardly curved black lines, antemedial and postmedial, a discal line of black spots marked with pure white, with a pale red shade inside the line of spots, a pure white prominent spot at the end of the cell on the inner side of the first transverse line. Hind wings paler, not glossed, uniform in colour, and without markings; cilia of both wings concolorous with the wings, with a pale line at its base; abdomen chestnut-red; anal tuft brown. Underside: pectus black, legs with black hairs, abdomen blackish brown.

Expanse of wings $2\frac{7}{10}$ inches.

Lawang, Java (*Halliburton*). One example.

Like a very black *M. latipennis*, Walker, but the colour is altogether different, the bands absent, and the cell-spot large and prominent.

Metanastria gynandra, sp. n.

♂. Dark pink-brown; antennæ pinkish grey, palpi, body, and wings dark pink-brown, palpi, head, and collar being very dark, nearly black. Fore wings with a pale dot at end of cell, followed by a pale narrow band edged on both sides with black and sharply elbowed outwardly above the middle; two or three similarly coloured indistinct straight bands in the upper disk, and that portion of the wing crossed by two indistinct sinuous black lines, then a pale pinkish space, followed by another similar line marked with white spot-like speckles. Hind wings very slightly paler than the fore wings and without markings; cilia concolorous with the wings. Underside uniformly brown, wings crossed by two dark discal bands.

Expanse of wings $2\frac{7}{10}$ inches.

Lawang, Java (*Halliburton*). One example.

Wings very narrow. Allied to no species known to me.

Metanastria himerta, sp. n.

♂. Fawn-colour; palpi and plume of antennæ brownish, abdomen above blackish brown, anal tuft ochreous. Fore wings with a black spot at the end of the cell and with three transverse, straight, complete, blackish-brown thick lines—

first before the middle across the cell, second postmedial, third discal and somewhat near the margin; cilia of both wings pink-brown. Hind wings with the apical portion suffused with brown and with indications of an antemedial transverse brown band in continuation of the second line of the fore wings. Underside: fore wings paler, with the two outer lines indicated; hind wings suffused with a pinkish tinge, with a suffused whitish central band or shade, including an inner line and a discal dentated line, smeared in parts with whitish.

Expanse of wings $2\frac{2}{10}$ inches.

Lawang, Java (*Halliburton*). Three examples.

Family **Lymantriidæ**.

Leucoma egerina, sp. n.

♂. Pure white; antennæ with grey branches, space at base of antennæ pinkish brown. Fore wings with a pinkish-brown costal band, veins of same colour, interrupted by the silvery speckles, which cover the entire wing in regularly waved transverse bands; a pinkish-brown mark at the end of the cell. Hind wings pure white, unmarked; cilia of both wings white, tinged with pinkish brown in parts.

Expanse of wings $1\frac{3}{10}$ inch.

Singapore (*Davison*). Three examples.

Allied to *L. submarginata*, Walker; differs in the absence of the two brown spots on frons and in having the silvery speckles on fore wings in regularly waved transverse bands.

Leucoma hipparia, sp. n.

♂. Pure silky white, branches of antennæ greyish; wings thinly clothed, a small black dot at the end of the cell of fore wings, the entire surface of both wings flecked with minute silvery scales; costa of fore wings and cilia of both wings tinged with flesh-colour. Underside also pure white, with minute silvery scales on both wings as above.

Expanse of wings $1\frac{3}{10}$ inch.

Singapore (*Davison*). Three examples.

Probably one of the species confused with *L. divisa* in Faun. Brit. Ind., Moths, i. p. 488 (1892). How such very differently shaped, differently sized, and differently clothed species as *divisa*, *lactea*, and *nigricilia* can be mixed together it is difficult to understand; they are all white, but otherwise quite distinct.

Adlullia stirasta, sp. n.

♂ ♀. Pale ochreous yellow, shafts of antennæ grey, the male with the head, thorax, and base of fore wing bright ochreous. Fore wings with a black spot at end of cell, a brown round mark towards hinder margin near the base and a brown discal band from centre of hinder margin, where it is broad, to the costa near apex, towards which it becomes somewhat distorted and attenuated, the round basal mark and discal band being formed by minute blackish-brown irrorations. Hind wings paler yellow and quite unmarked. Underside uniformly pale yellow, without any markings.

Expanse of wings, ♂ $1\frac{5}{10}$, ♀ $1\frac{7}{10}$ inch.

Mone, Shan States (*Manders*). One pair.

Allied to *A.* (*Chærotricha*) *varia*, Walker, which has a similarly disposed discal band of a dark reddish-brown colour and has a subbasal red patch on the costa.

Family **Hypsidæ.**

Hypsa paliura, sp. n.

♂ ♀. Palpi, head, body, and base of fore wings ochreous; palpi with a black spot at base, a black tip to second joint, and last joint entirely black with some white marks towards its base; a black spot on each side of the collar, a black spot on each side of the thorax in front, two down the centre, and segmental black spots down the centre of the abdomen; antennæ black. Fore wings dark grey; six black spots at the base, a broad medial white stripe from the basal ochreous patch, expanding outwards, with dentations along veins 2, 3, and 4, the dentation in vein 2 nearly reaching the outer margin; sometimes a white spot at the lower margin of the areole, vein 1 white, and in the females all the upper veins white. Hind wings white, with three large black spots in a triangle, one at end of cell, the other two in the disk; marginal border black, divided by white veins and with a white gap at end of vein 2, the band not reaching the anal angle.

Expanse of wings, ♂ $2\frac{4}{10}$, ♀ $2\frac{6}{10}$–$2\frac{8}{10}$ inches.

Nanchuan, China. One male, two females.

Allied to *H. monacha*, Cram., and *clavata*, Butler; differs from both in the greater width of the central white band on fore wings and in its peculiarly toothed outer margin, also in the broken form of the black marginal band of the hind wings.

Hypsa lara, sp. n.

♀. Antennæ brown; palpi below, head, thorax, and basal patch on fore wings yellow, palpi above and last joint brown, thorax with two black spots on each shoulder, abdomen white. Fore wings brown, with a broad longitudinal white central stripe from the yellow basal patch, expanding outwardly on the median vein to the end of the cell, the lower portion produced a little beyond the cell and somewhat rounded at the end; basal patch with black spots. Hind wings white, with a broad apical black marginal band, attenuated hindwards, not reaching the anal angle, and with its inner margin even. Underside with body and legs white, knees black; wings white, with broad costal and outer marginal borders.

Expanse of wings $2\frac{1}{2}$ inches.

Java (*Davison*). One example.

Its white abdomen is very characteristic.

Family **Nyctemeridæ.**

Leptosoma harca, sp. n.

♂. Palpi white, last joint black; antennæ black, head white, a black spot on the frons and another behind the antennæ, a black stripe connecting the two between the antennæ; thorax black, with white stripes; abdomen white, with black dorsal spots, anal tuft ochreous. Fore wings blackish brown, a broad and even-bordered white stripe from the costa beyond the middle towards the hinder angle, terminating on vein 2; veins white on the inner portion of the wings, a white streak from the base in the centre of the interno-median interspace, and another white streak on the hinder margin. Hind wings white, with broad even blackish-brown border.

Expanse of wings $1\frac{1}{2}$ inch.

Selangor, Malay Peninsula (*Davison*). One example.

Nearest to *L. tripunctaria*, Linn.; differs in its even-margined and smaller discal white band on fore wings and in the broad white stripe in the interno-median interspace being reduced to a narrow streak. There is an unnamed example of it in the British Museum.

Family **Lithosiidæ.**

Deiopeia antennata, sp. n.

♂ ♀. Body and fore wings coloured, spotted, and marked much as in *D. pulchella*, Linn.; the central black spots are more in the form of macular bent lines and the vermilion spots near the margin are replaced by long vermilion streaks which extend from the outer line to the black-spotted outer margin. The hind wings are white, but the marginal black band is broad at the apex and gradually fines down to the hinder angle, which it does not reach, and the large black knob to the marginal band near the hinder angle, so constant in *pulchella*, is altogether absent. In the antennæ, however, is the greatest specific difference; in *pulchella* and its close allies the antennæ in both sexes are slightly fasciculate, whereas in this species they are strongly bidentate in the male, with minute hairs between the teeth, and slightly fasciculate in the female.

Expanse of wings $1\frac{4}{10}$ inch.

Nicobars, Camorta. Three males and one female.

Camptoloma flagrans, sp. n.

♂ ♀. Very bright ochreous. Hind wings darker and brighter than the fore wings; three black transverse lines in fore wing from the costa near base, from beyond the middle, and from near apex, all terminating on the outer margin near the hinder angle in a large red patch or smear, which is continued in a streak or streaks along the hinder margin; on the outside of this patch are two large black spots on the yellow cilia, marginal line and streak across end of cell also black. Hind wings without markings, as also is the underside, being of a uniform deep bright ochreous, with the three black lines and two cilia spots visible; anal tuft on abdomen pink.

Expanse of wings $1\frac{6}{10}$–$1\frac{8}{10}$ inch.

Cherra Punji, Khasia Hills. One male, six females.

Very closely allied to *C. interiorata*, Wk., from Japan, of which I have a long series; the red patch on fore wings is more diffuse and the cilia has only two large black spots, whereas in *interiorata* there are always three spots.

Petosia euchana, sp. n.

♂ ♀. Of a uniform sandy-yellow colour; palpi, head, and tip of abdomen bright ochreous, tip of palpi and antennæ black. Fore wings with a black spot on the disk outside the cell and another below it on the submedian vein; in the female these spots are very much larger than in the male. Hind wings of male paler than the fore wings, with ochreous margin; in the female the entire wing is uniform ochreous. Underside: wings pale ochreous, unmarked in the male, with the spots showing through in the fore wings, and with central brown suffusion in the females; body and legs dark bright ochreous; tibiæ and tarsi above black.

Expanse of wings, ♂ $1\frac{7}{10}$, ♀ 2 inches.

Koni, Shan States, September 1888 (*Manders*). One male, two females.

Miltochrista esmia, sp. n.

♂. Of a uniform pale pink colour; antennæ, palpi, head, and thorax dark pink. Fore wings with all the borders darker pink, veins blackish, and dark pink streaks in all the interspaces. Hind wings with the apical border brighter and darker coloured, otherwise without any markings. Underside paler, the fore wings, except on the borders, suffused with grey; veins blackish, as are also the upper veins of the hind wings.

Expanse of wings $1\frac{1}{10}$ inch.

Koni, Shan States, October 1888 (*Manders*). One example.

Setinochroa cylletona, sp. n.

♂. Bright ochreous; antennæ, palpi, stripe down the frons, and head black; some black spots on the thorax and all the abdomen above, except the base and tip, blackish brown. Fore wings with five black spots, one at base, small, the others larger and uniform in size, one on costa one third from base, with one below it in the interno-median interspace, one at end of cell, and another below it at hinder angle; costal line black, which thickens into a band before outer two thirds to apex; marginal line of both wings black, with black cilia.

Expanse of wings $\frac{7}{10}$–$\frac{9}{10}$ inch.

Koni, Shan States, October 1888 (*Manders*). Two examples.

Family **Acontiidæ.**

Acontia nygmia, sp. n.

♂ ♀. Head, thorax, and fore wings pinkish grey; abdomen and hind wings darker and more pinkish coloured; fore wings with greenish-black spots and patches, two small spots close to the base, one above the other; a large patch outlined with pale yellow in the middle of the wing, running obliquely inwards on to the costa, where it is narrow; a large spot on the costa beyond the middle above the upper shoulder of the middle patch, and a smaller spot on the costa close to the apex, which is the termination of a submarginal lunulate blackish line. Hind wings with two dark sinuous pink discal bands and a similar marginal band. Underside with the fore wings suffused with pink; a brown mark at the end of the cell and two yellow subapical spots; costal border mouse-coloured, hinder marginal space pale, hind wings suffused with mouse-colour; the female is paler, with the central patch much smaller.

Expanse of wings $1\frac{3}{10}$ inch.

Singapore (*Davison*). Two males, one female.

Family **Catephidæ**.

Stictoptera timesia, sp. n.

♂ ♀. Antennæ, palpi, head, and body fawn-colour, thorax brown on each side. Fore wings blackish brown, with a pale fawn-coloured apical costal patch and with the whole of the lower portion of the wing from the centre of the outer margin to the hinder margin one third from base hindwards of the same colour; this space is striated with brown, and into the outer portion of it a blackish-brown streak runs from the blackish-brown space. Hind wings blue-white, semi-hyaline, with brown veins and a broad black-brown border.

Expanse of wings $1\frac{1}{2}$ inch.

Singapore (*Davison*). A long series.

This insect is figured by Druce as a var. of *Stictoptera* (*Steira*) *variabilis*, Moore, in P. Z. S. 1888, p. 223, pl. xiii. fig. 4; his figure 3 represents *S. cucullioides*, Guen. The different species of the genus *Stictoptera*, with the exception of *grisea*, Moore, do not appear to be variable. Considerable confusion appears to exist with reference to this genus; each species has its own characteristic line-markings whatever shade the colour of the insect may be. *S. grisea*, Moore, = *ferrifera*, Walker, = var. *plagifera*, Walker. *S. variabilis*, Moore, *S. cucullioides*, Guen., *S. subobliqua*, Walker, *S. trajiciens*, Walker, *S. signifera*, Walker, and *S. timesia*, mihi, are all good and constant species, the shades of colour which are not characteristic varying much in the sexes. I have examined long series of these different species in my museum and in the Oxford University Museum collected by Wallace.

Family **Geometridæ**.

Episothalma ocellata, sp. n.

♂. Of a uniform green colour, as in *sisunaga*; costa of fore wings and outer margin of both wings black; cilia of both wings black, with pale flesh-coloured base; a black ringlet with pale flesh-coloured centre at end of each cell; a transverse band of small black spear-shaped spots on the veins across the disk of both wings; these spots are marked outwardly with pale flesh-colour, and are connected together by an indistinct band, these spots looking like the tips of the dentations of the band, but the band is indistinct and the spots very prominent. Underside greyish ochreous, sparsely streaked with brown; a ringlet at end of each cell and a brown discal, complete, thin, nearly straight band across both wings.

Expanse of wings $1\frac{9}{10}$ inch.

Khasia Hills (*Hamilton*). Two examples.

Allied to *E. sisunaga*, but larger; the apex of fore wings much more falcate; differs much in the ocellated spots and in the black spots on the discal band; the underside is quite different, *sisunaga* being of a pale uniform greenish grey and unmarked.

Agathia prasina, sp. n.

♂. Bright grass-green; antennæ, head, and body chocolate-brown, thorax green in front. Wings bright green, with chocolate-brown markings; fore wings with a dark basal patch, costal band and transverse medial band pale, the latter curves inwards from the centre of costa to the inner end of the broad discal band near the inner angle; the curve is slightly irregular on its outer margin and more so on the inner margin; the discal band is dark, has a pale central line, and is joined to a pale marginal band, leaving a large green subapical space on the outer margin. Hind wings green, with a broad dark discal band, which spreads to the margin in its lower half, leaving a large green space on the margin below the apex; this band is intersected near its inner margin by a dentated paler band and by some black thin lines.

Expanse of wings $1\frac{7}{10}$ inch.

Khasia Hills (*Hamilton*). Three examples.

Closely allied to *A. carissima*, Butler, from Japan; but I have compared it with the type, and it is quite distinct and can easily be distinguished by the difference in the shape of the central band of the fore wings.

Pachyodes erionoma, sp. n.

♂. Of a pale pinkish-grey colour or pale flesh-colour; antennæ black, last joint of palpi brown, tip pale flesh-colour, as is the top of the head; thorax and abdomen greenish brown.

Wings densely covered with greenish-brown striations, both wings crossed by a discal brown outwardly dentate line, which is deeply bent outwardly above the middle in the fore wings. Fore wings with an inner nearly straight brown line; some greenish-brown marks on costa; a greenish-grey shade outside the discal line, a subapical white patch on outer margin, some white submarginal marks below, some similar marks on hind wings, marginal line black, lunulate; fringe on fore wings patched with white. Underside pure white, with broad discal black bands on all the wings, broadest on fore wings, where it runs into the outer margin in places, broadens upwards, leaving a white apical patch on the outer margin. Body and legs white; fore tarsi with black bands.

Expanse of wings $1\frac{8}{10}$ inch.

Khasia Hills (*Hamilton*). Many specimens.

Allied to *P. apicalis*, Moore, but is pure white below instead of bright ochreous, is greyer and duller coloured above, and the outer transverse line is altogether more deeply dentated and elbowed outwardly in fore wings.

Family **Boarmiidæ.**

Subfamily *Ennomiinæ.*

Fascellina curtaca, sp. n.

♂. Dull olive-green, tinged with ochreous; wings sparsely striated with black. Fore wings with a blackish central, transverse, upright fascia, above which is a black streak running inwards on to the costa; a discal black line from the costa one third from apex, angled to near the margin below the apex, then becomes double and runs nearly straight to the hinder margin near the angle; a small black patch on the outer margin at the middle, the inner end crossing the line; the hinder marginal space inside the line pale yellowish. Hind wings with a straight black, central, transverse, double line in continuation of the double line of the fore wings, and a thin black submarginal line evenly curved like the margin; the wing pale yellowish inside the double line and on the lower part of the outer portions. Underside yellow, striated with brown; fore wings with a white discal line edged with black on both sides, angled outwardly above, with a black shade on the inner side below the costa, followed by a blackish band and a whitish space containing a brown-angled subcostal line; a whitish subapical space, followed by a blackish marginal space which contains a small yellow patch at the angle; lower portion of the wing yellow. Hind wings yellow; a black central straight band and a submarginal thin black line curved like the outer margin; cilia of both wings black.

Expanse of wings $1\frac{4}{10}$ inch.

Khasia Hills (*Hamilton*). One example.

The hinder angle of fore wings is excavated as in *F. dacoda*, but the colour and markings above and below are quite different.

Fascellina dacoda, sp. n.

♂. Pale chestnut-brown, tinged with ochreous; palpi and head dark chestnut-brown. Fore wings with some ochreous suffusion in the upper centre and on the costa, a sinuous double black line, with an intervening white line, from the hinder angle to the second median vein near the margin; above this is a slaty-coloured marginal space; outside the double line the wing is paler and smeared with white. Hind wings with a postmedial straight and complete similar line in continuation of the double line on fore wings, the space outside the double line being paler and more ochreous. Underside: fore wing striated with chestnut; a patch of black at the base; a white distorted discal line which forms the outer margin of a large chestnut costal subapical patch and of a smaller similarly coloured central patch; a black band in the place of the double line, the band terminating in the disk in two short branches. Hind wing with a red double line, which is joined together hindwards, the wing pure ochreous outside and greyish ochreous inside the line; a white apical dot.

Expanse of wings $1\frac{4}{10}$ inch.

Shillong, Khasia Hills (*Hamilton*). One example.

The hinder angle of fore wings is less excavated than in any of the other Indian species of this genus.

Catopyrrha khasiana, sp. n.

♂. Upperside like the male of *C. phœnix*, Swinh. (Trans. Ent. Soc. Lond. 1891, p. 484), but of much brighter ochreous colour, the bands much more red; on the underside the colour is very different, being pure pale ochreous yellow, striated with red, with a bright dark ochreous-red discal band, with the inner margin brown and the outer margin irregular, reaching the outer margin of the wing in parts on the fore wing; a white patch at the apex.

♀. Yellow, more sparsely irrorated; bands paler, except towards upper part of outer band; underside as in the male, and very much resembles the female of *Hyperythra lutea*, but can be distinguished by the shortness of the cells of the wings.

Expanse of wings, ♂ $1\frac{8}{10}$, ♀ 2 inches.

Khasia Hills (*Hamilton*). A long series.

I have put this species, with its ally *C. phœnix*, into the American genus *Catopyrrha*, Hübner, because I can find no generic difference between its structure and that of typical *Catopyrrha*. It cannot stand in the genus *Hyperythra*; amongst other differences it lacks the secondary sexual character in the male which distinguishes the genus *Hyperythra*, *i. e.* the long tuft of hairs on the underside of the fore wings near the hinder margin. The species *khasiana* may be a seasonal form of *phœnix*, the markings being very similar, but the coloration is very different, and I have received over a hundred specimens showing no variation.

Subfamily *Macariinæ*.

Gonodela apataria, sp. n.

♂. Pinkish grey, striated with brown and smeared with purplish, the ground-colour shining on costa of hind wings and more or less on the basal and central portions of both wings; transverse lines brown, subbasal sinuous and indistinct, another medial sinuous, more distinct; one discal, dark, duplex, nearly straight, from abdominal margin of hind wings one fourth from the angle to the costa of fore wings one third from the apex; before reaching the costa it is deeply angled outwards and streaked at the angle with chestnut-red; the whole space from this band to the outer margin is purplish, with a subapical dark patch on the costa of fore wings and a white dot; a blackish suffusion outside the band, which follows the angle and crosses to the outer margin below the apex; on the hind wings there are also some black suffusions in the purplish space and a black spot; a small whitish spot at base of first median interspace; marginal line black and lunular; cilia purplish grey, whitish at its base. Underside bright ochreous, striated on fore wings with brown, with a large blackish patch on the lower half of the outer space, narrowing upwards to the white subapical dot, which is prominent, as is also the square white spot in the centre of the wing; a black mark at the end of all the cells. Hind wings with a transverse blackish straight band from outer angle to apex, beyond which are brown striations; cilia as above.

Expanse of wings $1\frac{5}{10}$ inch.

Khasia Hills (*Hamilton*). Many specimens.

Is marked above very similarly to and looks like *Gubaria metagonaria*, but can at once be identified by the difference in the shape of the outer margin of hind wings; below it is quite different.

Subfamily *Boarmiinæ*.

Alcis dasimaria, sp. n.

♂ ♀. Greyish white; antennæ brown, with black plumes in the male; head, body, and fore wings covered with brown irrorations; abdomen with brown bands. Fore wings with three equidistant sinuous transverse brown lines, the first two on a reddish suffused ground, the third with a suffused reddish outer band; a similar broad band on the outer margin, leaving a white sinuous band between, marginal lines blackish brown with black points. Hind wings nearly white, some reddish-brown irrorations on the abdominal and outer portions; a sinuous line across the disk and indications of another line near the angle. Underside greyish white, sparsely irrorated with brown atoms; a brown dot at the end of each cell and a brown, thin, partly macular discal band across both wings.

Expanse of wings, ♂ $1\frac{3}{10}$, ♀ $1\frac{5}{10}$ inch.

Darjiling (*Möwis*). Four examples.

Bylazora heledaria, sp. n.

♂. Pale olive-brown, irrorated with brown atoms; a brown spot at end of each cell; both wings crossed by olive-brown bands and lines. Fore wings with subbasal, antemedial, and discal bands, these bands crossing both wings; indications of another band on the costa of fore wings between the second and third bands, and also indications of a submarginal band across both wings; a sinuous line outside the second band on fore wings, which is continued on the hind wings and ends at the abdominal margin near the termination of another sinuous and partly dentated line which crosses both wings on the inner side of the discal band; marginal line brown; fringe pale. Underside pale olive-grey, with the outer borders broadly darker.

Expanse of wings $1\frac{5}{10}$–$1\frac{7}{10}$ inch.

Mahableshwur, May 1887. Taken by myself.

I have it also from the Nilgiri Hills, from Mr. Lindsay. Its pattern and coloration is quite different from any other species in this genus.

Family **Larentiidæ.**

Photoscotosia keraria, sp. n.

♂ ♀. Blackish brown. Fore wings with most of the veins whitish, transverse lines whitish, sinuous, first subbasal, second just before the middle, curved outwardly in its centre, third discal, more prominent than the others; a submarginal lunulate line. Hind wings greyish white, with a little brown suffusion on the abdominal and outer margins. Underside grey; fore wings of male suffused with brown on the costa and apical margins, and with the long tuft of hairs brown with reddish base; in the female there is no suffusion at all; hind wings with a brown dot at end of cell.

Expanse of wings, ♂ $1\frac{8}{10}$, ♀ 2 inches.

Darjiling (*Möwis*). One pair.

Eustroma monana, sp. n.

♂ ♀. Antennæ, head, body, and fore wings brown. Fore wings crossed by three transverse outwardly curved ochreous-grey lines, first one-fifth from base, second before the middle, bent outwardly at the centre, third discal, rounded in each interspace, with pale streaks running inwards on the veins; space beyond paler, with several lunulated brown bands; a submarginal pale line, bordering a brown, subapical, blackish-brown marginal space, and two or three lower marginal spots. Hind wings ochreous, whitish in the costal space, suffused with brown on the inner half, through which run two sinuous yellowish discal lines. Underside: fore wings ochreous grey, with a large brown central space limited by the median vein and its first branch; an apical and a central marginal brown patch. Hind wings darker and more ochreous, with a black spot at end of cell.

Expanse of wings $1\frac{8}{10}$ inch.

Shillong (*Hamilton*). Two pairs.

Allied to *E. obscurata*, Moore; distinguishable by its more ochreous hind wings and by the incompleteness of its outer pale line on fore wings; in *obscurata* the pale line runs inwards on the first three veins only, in this species it circles in on every vein.

Lobophora pulcherrima, sp. n.

♂. Greyish white, fore wings irrorated with brown atoms, crossed by brown duplex sinuous bands, subbasal, antemedial, postmedial, discal, and marginal, streaked and spotted with bright red; one or two spots near the base, some red suffusion in the centre, bright red streaks in front of the discal band, a row of bright red submarginal spots with grey centres and red marginal line, disconnected between the veins, with white points on the veins; cilia white, with brown dots. Hind wings greyish white, unmarked. Underside grey; fore wings with brown veins, a brown marginal line similar to the line above, and some of the markings showing through the wing.

Expanse of wings $1\frac{2}{10}$ inch.

Khasia Hills (*Hamilton*). One example.

Allied to *L. decorata*, Moore.

The types of all these species will be presented to the British Museum as usual.

XXXVI.—*On a remarkably sculptured Terrestrial Isopod from New Zealand.* By George M. Thomson, F.L.S.

[Plate IV.]

Some years ago I received from Mr. A. Hamilton a single specimen of a very curious and interesting Isopod, which he picked up among dead leaves &c. in the neighbourhood of Petane, near Napier, New Zealand. The specimen, which was dry, was in rather a mutilated condition, having lost its outer antennæ and having the opercular plates on the underside of the abdomen somewhat damaged, so that I could not tell whether they were tracheate or otherwise. From these causes I have been quite unable to locate the animal in its proper genus. It belongs evidently to Budde-Lund's section Armadilloidea, and it may be necessary to constitute a new genus for its reception.

I have long hoped to discover or receive more specimens of so striking a form; but as no others have been obtained, I think it desirable to have it figured and provisionally described.

The specimen, inclusive of the flange-like processes of the frontal plates, epimera, and abdominal segments, is 6 millim. long and 3·5 millim. broad, and is somewhat curved upwards in the middle. It does not appear capable of being rolled into a very perfect ball, like the species of *Armadillo*, but, to judge from the dried specimen, there is considerable flexibility in the body-segments.

The head is short and is somewhat sunk into the broad first thoracic segment. The latter is somewhat broader than the succeeding segments when the body is flattened out, but when naturally arched it appears nearly twice as broad, owing to its flanges standing out horizontally, while the others are placed more vertically to their respective segments. Down each side of the median line of the back is a row of erect conical or somewhat curved spines, two on each segment. The last pair on the posterior thoracic segment are large and obtuse, and are produced backwards. On each side of these spines are two rows of somewhat acute elongated curved plates or carinæ, one on each segment, while outside of them, but within the flange-like epimera, are two or three rows of tubercles. On the head are two median spines, outside of which two nearly square plates project forward; below the outer angles of these are placed the compound eyes. The abdomen also bears numerous conical processes, produced backwards, which, when viewed from above, appear like spines. The margins of the head, thoracic segments, and posterior abdominal segments are produced into flange-like processes; that of the first thoracic segment is very large and broad, while the succeeding ones increase in width from the second to the seventh.

The first pair of antennæ are very minute and are 2- (? 3-) jointed; the second pair are wanting. Owing to the defective condition of the specimen the mouth-parts could not be made out. The legs are very feebly developed and, so far as I could make out, appear to want the dactylos. The last segment of the abdomen terminates in a nearly square extremity, and the last pair of abdominal appendages barely reach to the end of this. These appendages have the outer branch somewhat broadened at one third of their distance from the base, and the outer side produced into a long process rounded at the end. The inner branch, which is much shorter, is articulated in the deep sinus of the outer joint; it is tipped by a minute jointed seta. The opercular plates on the underside of the abdomen are somewhat acutely triangular.

I know of no terrestrial Isopod so remarkably sculptured as this specimen, nor is it easy to assign any function to this singular ornamentation. For progression among dead leaves and other débris of a forest its projecting points and plates would appear to be ill-adapted.

EXPLANATION OF PLATE IV.

Fig. 1. Body of animal from above, somewhat flattened.
Fig. 2. Ditto from the side.
Fig. 3. Head viewed from the left front. *a.a.* = first antennæ.
Fig. 4. Last segment of abdomen from below.
Fig. 5. Abdomen from below, showing the opercular plates.
Fig. 6. One of the legs.

XXXVII.—*On a Reptilian Tooth with two Roots.* By H. G. SEELEY, F.R.S.

THE division of the root of a mammalian tooth into two or more portions has been regarded as a convenient means of predicating mammalian organization for the animal in which this condition is found, notwithstanding the circumstance that in diverse groups of mammals the root is not divided in any of the teeth, and that in mammals the division is absent from the incisors and almost all canines.

Professor Marsh, in 1890, figured, in the 'American Journal of Science,' teeth of the animal which he named *Triceratops*, in which two roots certainly occur, but placed transversely, as sometimes happens among the wider posterior molar teeth of mammals. It is not improbable that this division, as American palæontologists have suggested, is apparent rather than real, and has been produced by absorption of the tooth in wear, by the successional tooth rising beneath it, since the form of the excavation between the roots exactly corresponds to the form of the crown. In any case, the condition in this American fossil, by whatever name the genus may be eventually known, was unparalleled among Reptilia, though in a few mammals with two roots to a posterior molar tooth those roots are arranged transversely.

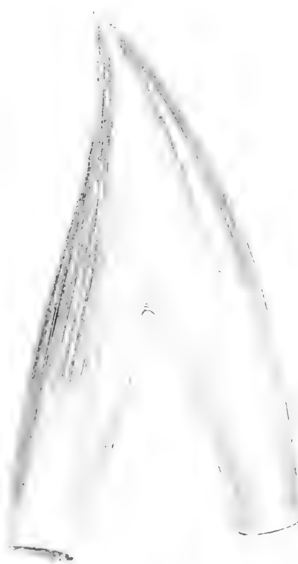
In 1854 (Quart. Journ. Geol. Soc. vol. x. p. 420) the late Sir Richard Owen figured a Purbeck fossil from bed K. 93 in Austen's guide, under the name *Nuthetes destructor.* It was then described as a pleurodont lizard allied to monitors of the genus *Varanus*; and figs. 2 *d* and *e* (*l. c.*) are representations of teeth in the jaw which have the aspect of possessing two roots arranged in the antero-posterior direction. This condition is further evidenced by the enlargement of the tooth *d* given in fig. 4, though no word occurs in the text referring to the structure; so that it is probably only a pit or groove at the base of the crown. With these fragments of jaw the author associated a tibia and fibula, indicating long and slender hind legs; but I am not aware of any evidence of association, and am disposed to refer the limb-bones to the crocodilian genus *Theriosuchus.* On at least three other occasions references were made to these teeth. In the Palæontographical Society's volume for 1861 they are said to be like teeth of *Megalosaurus*, finely serrated back and front, and attached by partial anchylosis to the inner side of an alveolar wall. Of this character I have not seen any evidence; but I have not had the opportunity of examining the original specimens. In 1854 *Nuthetes* was said to differ from *Megalosaurus* in showing no trace of alveolar divisions for the teeth. This may be quite true, and yet not bear the construction that the teeth were not in sockets, for the bones of the jaw are extremely thin and have a deneness and thinness which are only known in bones of Ornithosauria and Saurischian reptiles, and genera like *Aristosuchus.* Sir Richard Owen further states that the thickest part of the crown is not the middle, but is nearer the anterior border, as in *Varanus* and *Megalosaurus.*

In Sir R. Owen's 'Palæontology' the known facts are summarized and the fossil grouped under the Lacertilia (second ed., 1861, p. 307) and described as a carnivorous or insectivorous lizard.

Subsequently, in the Palæontographical Society's volume for 1879, further remains discovered by Mr. Beckles are figured (pl. ii.) and described. The genus is grouped with the Crocodilia, and the teeth (p. 16) are said to show an excavation or longitudinal depression on the side of the base. In the British Museum Catalogue of Foss. Rept. pt. i., 1888, Mr. Lydekker groups the genus as "ordinal position uncertain," placing it after the animals which are massed together as Dinosauria, and remarking that the teeth are more like those of dinosaurs than lizards.

The jaws indicate a very small animal, being (as stated by Sir R. Owen) in the fragments preserved only 6 lines deep, while the largest fragment of jaw is $1\frac{1}{2}$ inch long. I have no doubt, if ordinal affinities can be inferred from teeth, that these animals are Saurischian and nearly allied to *Streptospondylus, Megalosaurus,* and *Aristosuchus.* The teeth are essentially diminutive forms of a Megalosaur. This identification is based upon the shape of the crown, the condition of its surface-enamel, the serrations at the anterior and posterior margins of the crown, and the general form of the root, which, however, is shorter than in *Megalosaurus*; and the comparison would probably be closer with *Streptospondylus*, to which genus I should be disposed to refer the teeth from Cuckfield, for which Mr. Lydekker has suggested the name *Megalosaurus Oweni*. It is interesting that the dwarf carnivorous Saurischian *Nuthetes* should be associated with a dwarf Ornithischian, *Echinodon*, allied by its teeth to *Scelidosaurus*, and to that genus I should refer the dermal bones, termed granicones, which were associated by Sir R. Owen with *Nuthetes*.

There being obvious points of resemblance between the Saurischia and the Anomodontia, in the possession of similar skeletal elements which approximate to those of mammals, it has seemed worth recording that in the British Museum, among the twelve isolated teeth of *Nuthetes* and two fragments of jaw obtained with the Beckles collection, is a single tooth which distinctly shows two roots in anterior and posterior positions. This tooth is 7 millim. long, has lost its enamel, and therefore shows no trace of the characteristic marginal serrations. It exactly corresponds in form to the anterior teeth in Owen's original figure, and widens from the apex to the base of the roots, where it is 4 millim. wide. The height of the crown is 4 millim., its side is flattened; there is a medial area slightly depressed, with slightly elevated lateral ridges back and front, which exactly correspond with those upon the typical teeth of *Nuthetes*. Below the crown the tooth divides into two slightly divergent roots, which are 3 millim. long; and the posterior root may be slightly the larger. Each root is channelled on the side by a shallow depression similar to that which usually extends down the sides of the single-rooted teeth of *Nuthetes* and *Megalosaurus*. The roots are well-defined and marked with slight wavy concentric lines of growth, similar to those which frequently occur upon the roots of teeth placed in sockets, and not unlike the transverse enamel-waves on the crowns. The roots narrow slightly towards their extremities; the posterior root



Tooth of *Nuthetes*. Brit. Mus. No. 48208. × 10.

appears to be fractured near its termination, where it indicates a pulp-cavity, though the inner and outer walls are compressed close together. The roots are about 1 millim. wide. Notwithstanding a certain resemblance in form of the interspace between the roots to the form of the crown, I do not see any ground for affirming that it has been produced by absorption. It is, however, certain that the character is an abnormal one, since it is absent from the other isolated teeth, and its chief interest consists in showing that it is possible for a reptile to develop roots to a tooth of the mammalian molar type; so that if this abnormal condition, seen in *Nuthetes*, were normal and general in a fossil jaw, it would constitute an important deviation from the reptilian dentition.

The figure is ten times natural size.

XXXVIII.—*Descriptions of Two new North-Bornean Mammals.* By Oldfield Thomas.

[Plate VII.]

Semnopithecus sabanus, sp. n. (Pl. VII.)

Body, arms and legs, and tail grey; hands and feet black, as in the group to which *S. Hosei*, *S. Everetti*, and *S. Thomasi* belong.

Forehead with a high median black crest, commencing immediately behind the centre of the brow-ridges; the hairs of the crest stand up vertically and are about an inch and a half in length. Eyebrow-bristles long, black, projected forwards over the eyes; behind them, on each side of the central crest, the forehead-hairs lie back flat against the head and are whitish in colour over the whole crown. Outside these whitish patches, again, the sides of the face, from the orbits to the ears, are quite black, and the hairs of the occiput are also decidedly darker, especially terminally, than are those of the pale frontal patches. It results from this arrangement of the colours that on looking down vertically on the crown one sees a pale frontal area, bisected mesially by the blackish crest and surrounded on all sides by black, in front by the black eyebrows, laterally by the black temples, and posteriorly by the black tipped occipital hairs. These crown colours are, however, not pure, the black crest being largely mixed with white hairs, and the pale frontal patches with black ones. Occipital hairs directed backwards, not reversed forwards as in *S. Thomasi*. Chin, sides of neck, throat, and chest greyish, owing to a mixture of black with the white hairs; these parts are pure white in all the allied species and contrast with the dark colour of the nape and crown. Belly and inner sides of the upper arms and of the legs to the ankles white, becoming gradually greyer distally. Hands and feet shining black, but the forearms to the wrists and the legs to the ankles are clear grizzled grey, as is also the tail both above and below.

Skin of face white (presumably flesh-coloured in life) all across and between the orbits and round the cheeks, so that it is only black just over the maxillary and premaxillary bones and on the chin. In the other species the skin is nearly or quite black all over the face.

Skull, as usual in this genus, showing but few tangible characters. It appears, however, to have a decidedly broader and rounder brain-case than in the allied species; it is slightly less prognathous, and in the lateral view the concavity at the anterior nares is deeper and more abrupt, while above them the tips of the nasal bones stand out much more prominently, at least than in *S. Hosei* and *S. Everetti*. The ascending processes of the maxillary bones are broad and strong, and pass up beyond the nasals to articulate with the frontals, and entirely shut out the maxillary bones from the sides of the nasals; in this character conditions quite different seem to obtain in the allied species, although there is undoubtedly a good deal of individual variation in the relative extent of the facial bones. In the dentition the canines both above and below are considerably smaller and slenderer than in the other species. Fifth cusp to $\overline{\mathrm{m.\,3}}$ small or absent, *i. e.* small in the type and absent in the second specimen, the two thus showing how variable this character, often supposed to be of generic value, may be.

Dimensions of the type, an adult male skin (B.M. 93. 3. 4. 2):—

Head and body (c.) 600 millim., tail 760.

Skull: extreme length 95, basal length 65·5; greatest breadth 73·6; interorbital breadth 8; intertemporal constriction 46·7; brain-case, breadth 61, height (basilar suture to bregma) 46; palate, length 32·5; nasal opening, height 16·4, breadth 10·7; length of upper premolar and molar series 24·6.

Hab. Paitan, N. Borneo. Coll. A. Everett, July 1892.

Besides the type, a second specimen, in most respects precisely similar and also a male, was obtained by Mr. Everett at the same time and place.

This handsome monkey seems only to be nearly allied to the species above referred to. Of these it differs from *S. Hosei* and *S. Everetti* by its vertical frontal crest, its greyish crown surrounded by black instead of black surrounded by white, and its greyish nape and sides of neck, where there is none of the sharp contrast between black and white characteristic of those species; the legs also above the ankles are grey instead of black.

From *S. Thomasi*, which also has a crest, it is distinguished by its backwardly directed occipital hairs, its perfectly unicolor tail, its paler back, and by the lesser extension and purity of the white of the belly and inner surface of the limbs.

In addition, as already noted, *S. sabanus* is distinguished from all its allies by the whitish or flesh-coloured tint of the upper half of its face.

Mus Margarettæ pusillus, subsp. n.

Apparently similar in every way to the typical form, but very markedly smaller in all dimensions, as is shown by the following measurements of the type (an adult female in alcohol):—

Head and body 67 millim., tail 123; hind foot without claws 16·8; ear from notch 13·8.

Skull: basal length 19·1, upper length 22·6; zygomatic breadth 12·2, breadth of brain-case 11; nasals, length 7·3; interorbital breadth 3·9; interparietal, length 3·2, breadth 6·5; anterior zygoma-root 2·5; palate, length 11·5; diastema 6·1; anterior palatine foramina 3·0; length of upper molar series 3·0.

Hab. Mount Kina Balu, N. Borneo. Coll. A. Everett.

This beautiful little mouse is evidently a local representative of the very remarkable species I described as *Mus Margarettæ*, from the Penrisen Hills, Western Sarawak*, and as such deserves a subspecific name. The specimen is distinctly older than the original type of the species, and is of the same sex, so that the difference in size is clearly due neither to age nor sex.

A second specimen, identical in all respects with that now described, was sent home by Mr. Everett, but was not acquired for the Museum collection.

* Ann. & Mag. Nat. Hist. (6) xi. p. 346 (1893).

XXXIX.—*On Two new Members of the Genus* Heteromys *and Two of* Neotoma. By Oldfield Thomas.

In the April number of the 'Annals'* I had the pleasure of describing two new pocket-mice of the genus *Heteromys* from Mexico and Guatemala, one of them, *H. Salvini*, representing a new annectant group distinguished by the characters presented by the soles of the hind feet. To this species, *H. Salvini*, besides the type from Dueñas, Guatemala, a second specimen from Costa Rica was doubtfully referred.

The Museum has now received from Dr. A. C. Buller, the discoverer of the Mexican species previously described, another pocket-mouse from a different locality in Jalisco, and this proves also to belong to the group of which *H. Salvini* is typical, and agrees closely with it in size and cranial characters, but differs considerably in colour.

On comparing this new specimen with the other two from Guatemala and Costa Rica, it is evident that it represents a new species of this group, while at the same time a more detailed examination shows that the Costa-Rican animal ought itself to be separated, at least subspecifically, from the Guatemalan.

Heteromys pictus, sp. n.

Size about as in *H. Salvini.* Colour above coarsely grizzled rufous, the usual black-tipped spines being profusely mixed both on head and body with coarse orange-tipped hairs; sides brighter rufous, the junction between the dorsal and ventral colours being marked, especially anteriorly, with a bright orange-rufous line, far richer than in any other species. Ears black with white edges. Fore limbs wholly white, except that there is an inconspicuous patch of grey outside the elbow. Hind limbs white on their inner sides and on the top of the feet, dusky on their outer and hinder sides, this colour passing down on to the hairy part of the soles of the feet. Soles hairy for about one third the total length of the foot; the naked part with six pads as in *H. Salvini*, but the minute fifth one is situated rather further forwards, halfway between the fourth and sixth. Tail sharply bicolor, blackish above, white beneath.

* Ann. & Mag. Nat. Hist. (6) xi. p. 329 (1893).

Skull very similar to that of *H. Salvini* (*typicus*), but rather smaller and more delicately built; interparietal large, its length 54 per cent. of its breadth; upper incisors forming a segment of a very small circle, so that their tips are much bent inwards towards the mouth, and the diastema is proportionally short.

Dimensions of the type (a beautifully prepared ♀ skin):—

Head and body 104 millim., tail 113, hind foot 24·8, ear from notch (contracted) 12.

Skull: basal length 26·5, greatest length 31·6, greatest breadth 15·2; nasals, length 12·7, breadth 3·6; interorbital breadth 7·7; interparietal, length 4·6, breadth 8·5; diastema 7·7; length of upper molar series 4·3.

Hab. Mineral San Sebastian, Jalisco, Mexico, 4300 feet. Coll. Dr. A. C. Buller, May 9, 1893.

Heteromys Salvini nigrescens, subsp. n.

Colour very similar to that of *H. S. typicus*, but the yellowish grizzling on the back, inconspicuous in that animal, is entirely absent, at least along the mesial line, so that the dorsal colour is a deep uniform smoky brown. Towards the sides a few yellow-tipped hairs are present, but not in sufficient numbers to affect the general tone. No trace of a yellowish lateral line. Limbs as in *H. S. typicus*.

Skull decidedly smaller and more delicate than in the typical form, the muzzle more slender, the interorbital region narrower, and the interparietal conspicuously smaller (its length-breadth percentage 51).

Dimensions of the typical skin (B.M. 69. 7. 19. 6):—

Head and body 127; tail broken; hind foot without claws 25.

Skull: greatest length 32·7, greatest breadth 15·4; nasals, length 12·7, breadth 3·8; interorbital breadth 6·8; interparietal, length 4·1, breadth 8; diastema 9·4; length of upper molar series 4·7.

Hab. Costa Rica.

Neotoma macrotis, sp. n.

Intermediate in size between the western *N. floridana* and *N. mexicana*. Colour, so far as can be made out in a spirit-specimen, very much as in the latter species. Belly-hairs white-tipped. Feet white, faintly clouded proximally with grey. Tail sharply bicolor, black above, white below and on the sides; well covered with hairs, but the scales showing through. Ears very large, laid forward they reach in front of the anterior canthus of the eye; their minute hairs reddish brown.

Skull strongly built, its frontal profile convex; supra-orbital ridges strongly marked; anterior palatine foramina barely reaching backward to the level of the anterior root of $\frac{m.1}{}$. Teeth small; their structure as usual.

Dimensions of the type (an old male in spirit):—

Head and body 180 millim., tail 165; hind foot, without claws, 33·7; ear from notch 29.

Skull: basal length 41·6, greatest breadth 24·7; nasal length 18·4; interorbital breadth 6; interparietal, length 5, breadth 11; palate, length 23·1; length of palatine foramina 9·8, upper molar series 8·4.

Hab. San Diego, California. Coll. Prof. Eigenmann.

Neotoma lepida, sp. n.

Size very small, smaller than in any known species. Colour soft ashy grey, washed with pale fawn, the general tone not unlike that of specimens of *N. arizonæ*; hairs of chest and inguinal region pure white, those of belly grey basally. Ears large, their minute hairs whitish. Hands and feet pure white. Tail very thickly haired, so much so as to be intermediate between that of the round-tailed and the bushy-tailed species, the scales entirely hidden by the hairs; its colour mixed brownish fawn above, white below.

Skull small and delicate; frontal profile flattened; supra-orbital edges square, scarcely ridged; palatine foramina as in *N. macrotis*; molars small.

Dimensions of the type (a skin, fully adult):—

Head and body (probably stretched) 180 millim., tail (c.) 100, hind foot 27·2, ear 25.

Skull: lambda to nasal tip 34·5; greatest breadth 21·2; nasal length 14·6; interorbital breadth 5·4; palate, length 20; palatine foramen 8·2; upper molar series 7·5.

Hab. Utah.

This interesting wood-rat had been put down as *N. cinerea*, but its far smaller size and less bushy tail will readily distinguish it from that species.

MISCELLANEOUS.

The Bahama Amphioxus. By E. A. Andrews.

In addition to the *Amphioxus*, or lancelet, found on the coasts of many parts of Europe, some five others have been reported from various parts of the world. Günther recognizes these six as species of *Branchiostoma*, that name having been given prior to the term *Amphioxus*. The chief specific characters that can be made out in the preserved specimens are the relative positions of anus and atriopore as expressed by the number of muscle-segments anterior to, between, and posterior to these openings. In addition to these forms there is an undescribed lancelet in California, which, as far as the above criteria may be trusted, belongs to a distinct species of *Branchiostoma*, and a Japanese form that may prove to be one of the known species.

The great morphological interest attached to the lancelet as the simplest and, in many respects, the most primitive of known vertebrates makes the taxonomy and geographical distribution of this group of more than common importance, and justifies a short preliminary account of a new form found in the Bahamas.

While the Johns Hopkins Marine Laboratory was stationed at North Bimini, Bahamas, in the summer of 1892, many small lancelets were taken swimming at or near the surface as well as living in the calcareous sand on the flats exposed at low water.

These partly pelagic acraniates differ so much from the known forms that they may be regarded as *generically* distinct. Their chief anatomical peculiarities are as follows:—

(1) The gonads are developed only upon the right side of the body, both in the adult and in the young.

(2) The notochord, neural tube, and median fins are prolonged as a considerable caudal process posterior to the myotomes.

(3) The ventral fin is without any fin-rays or successive fin-ray chambers.

(4) The pre-oral hood is extensive; cirri smooth and united by the hood-membrane for the greater part of their length.

(5) The right metapleuron is continuous with the median ventral fin, which passes to the right of the anus.

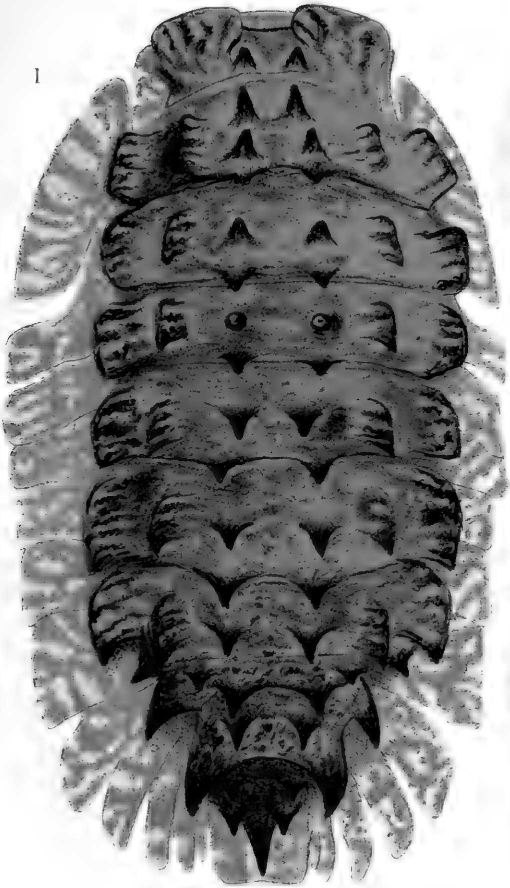
(6) The "olfactory pit" is apparently absent.

(7) Myotomes anterior to atriopore 44, between atriopore and anus 9, posterior to anus 13: total 66. Length 13–16 millim.

(8) Swims free in the evening both at Bimini and in Nassau Harbour. Lives also in the calcareous sand.

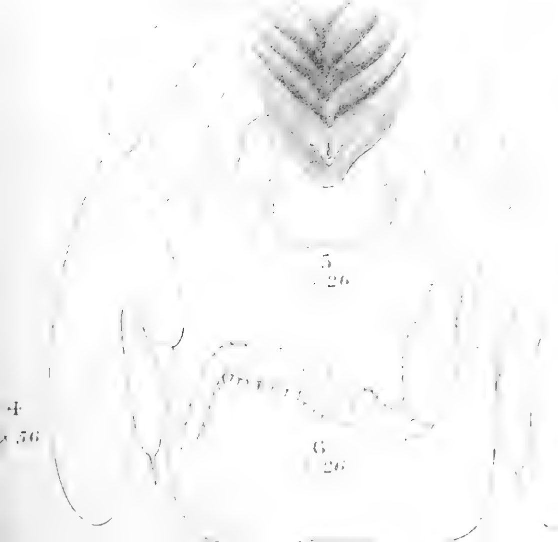
An illustrated description of these characters of this new genus of acraniates will appear in a forthcoming number of vol. v. of the 'Studies from the Biological Laboratory.'—*Johns Hopkins University Circulars*, vol. xii. no. 106, p. 104.

1



2

19

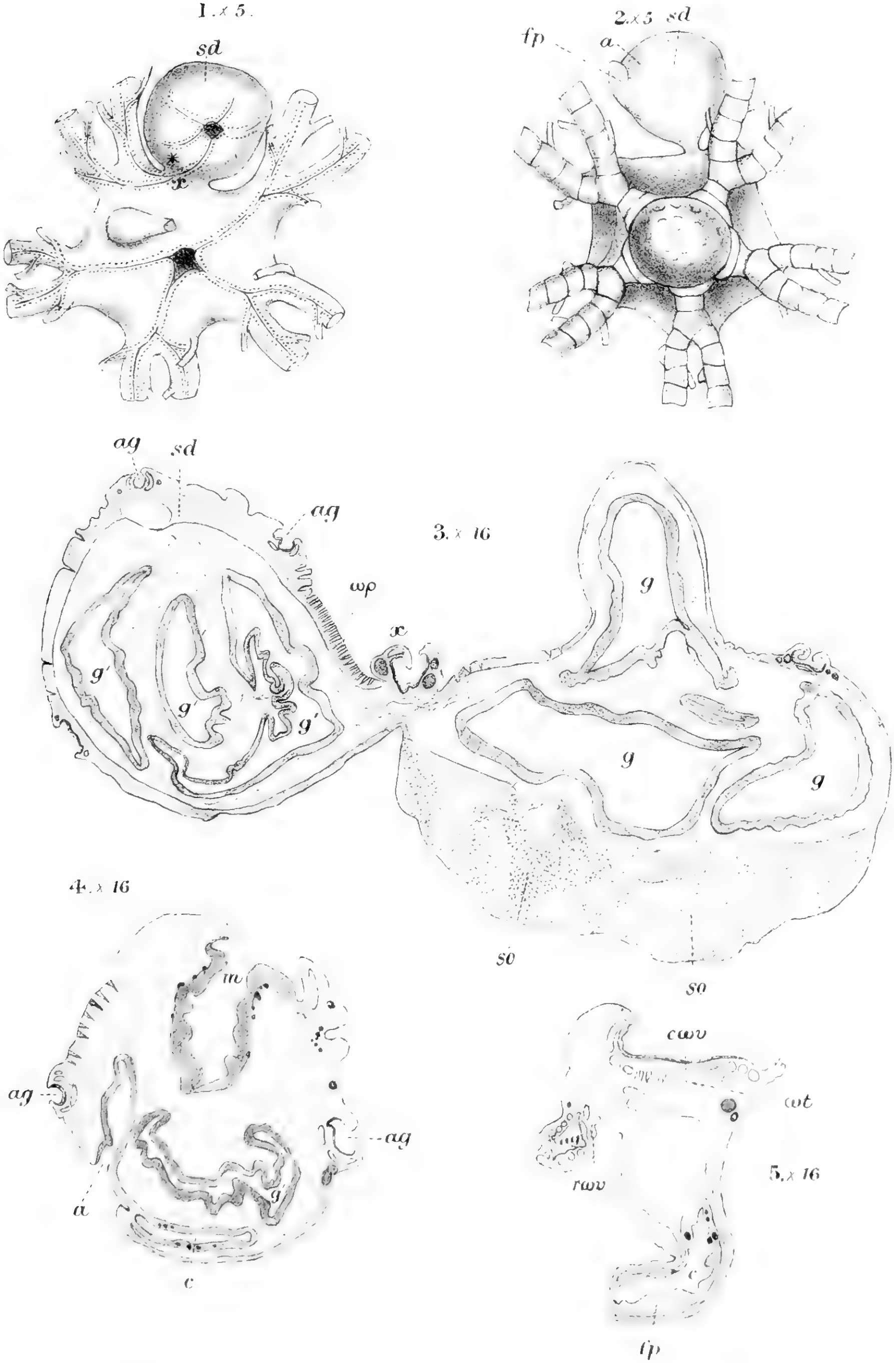


5
26

4
× 56

6
26

Smit del et lith



H. C. C. ad nat. del.

Mintern Bros. lith.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 70. OCTOBER 1893.

XL.—*On some new or rare Crustacea from Scotland.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT.

[Plates XI.–XIII.]

COPEPODA.

Diosaccus propinquus, sp. n. (Pl. XI. figs. 1–6.)

Female.—Length, exclusive of caudal setæ 1 millim. ($\frac{1}{25}$ of an inch). Body moderately robust. Anterior antennæ eight-jointed, the first four joints stout, subequal, the last four slender; the combined length of the last four is equal to nearly two thirds of the combined length of the first four; the proportional lengths of the joints are shown by the formula—

$$\frac{14 \,.\, 14 \,.\, 12 \,.\, 15 \,.\, 8 \,.\, 12 \,.\, 5 \,.\, 9}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8}.$$

Posterior antennæ comparatively short and stout, secondary branch two-jointed (fig. 3). Mandible-palp one-branched, two-jointed as in *Diosaccus tenuicornis* (Claus), but the end joint is much narrower than, and only about a third of the length of, the basal joint. The maxillæ and anterior foot-jaws are nearly as in *Diosaccus tenuicornis*. The posterior foot-jaws are stout and the terminal claw is as long as the joint from which it springs. The first three pairs of thoracic feet are nearly as in *Diosaccus tenuicornis*, except that a stout plumose seta springs from the basal joint of the first pair, and the outer branches of the same pair are fully half the length of the entire inner branches exclusive of the terminal claws (fig. 4). Inner branches of the fourth pair two-jointed, slender, and shorter than the outer branches. Basal joint of the fifth pair subquadrate and furnished with four subterminal plumose setæ; secondary joint broadly ovate, extending considerably beyond the basal joint and bearing six setæ—two small ones at the apex, one plumose seta of moderate length on each side of the apex, and two small ones on the outer margin (fig. 6). Caudal stylets as long as the last abdominal segment. Ovisacs two.

Hab. Moray Firth, a few miles northward of Kinnaird Head, 130 fathoms.

Three specimens only were obtained, all females.

Remarks. This species closely resembles *Diosaccus tenuicornis* (Claus), but the anterior and posterior antennæ are shorter and stouter, the outer branches of the first thoracic feet are proportionally longer, the inner branches of the fourth pair are only two-jointed, and the secondary joints of the fifth pair are ovate and extend considerably beyond the basal joints.

Laophonte littorale, sp. n. (Pl. XI. figs. 7–14.)

Length ·85 millim. ($\frac{1}{30}$ of an inch). Body elongate, subcylindrical, forehead slightly produced and bluntly rounded. Anterior antennæ sparingly setiferous—in the female seven-jointed, the third joint longer than any of the others, while the fifth is very short, as shown by the formula—

$$\text{Female anterior antennæ} \ldots \frac{9 \;.\; 10 \;.\; 12 \;.\; 5 \;.\; 3 \;.\; 6 \;.\; 8}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7}.$$

In the male anterior antennæ the fourth joint from the end is considerably dilated, the following joint is distinctly hinged to the fourth; the penultimate joint is very short, and the last forms a stout grasping claw. The secondary branch of the three-jointed posterior antennæ is rudimentary, and consists of one small joint bearing an apical seta. The mouth-organs are nearly as in *Laophonte curticauda*, Boeck. The outer branches of the first thoracic feet, which consist of three subequal joints, are equal to about half the length of the inner branches exclusive of the terminal claw. The inner branches of the first four thoracic feet are all two-jointed; the fourth pair in the female and male are dissimilar—those of the female do not differ much from the others except that they are rather shorter and stouter, but in those of the male the inner branches are almost obsolete, being reduced to two minute joints, while in striking contrast to these the outer branches are robust and are armed with several stout spines in place of setæ; the first joint of the outer branches is considerably longer than the next two together (fig. 12). The fifth pair in the female have both joints broadly foliaceous and subquadrate, and bear a number of strongly plumose terminal setæ; in the male the fifth pair are rudimentary and consist of a slightly produced basal portion carrying four setæ, in addition to a small spine-like seta on the inner margin (fig. 13). The caudal stylets are covered with cilia, and are about two and a half times longer than broad and equal to one and a half times the length of the last abdominal segment.

Hab. In pools of brackish water at the mouth of a small stream at Luffness, Firth of Forth, and in similar pools at the mouth of the river Alness, Cromarty Firth. Not very rare.

Remarks. Laophonte littorale resembles *Laophonte curticauda*, Boeck, in some respects, but differs very markedly in the structure of the fourth thoracic feet of the male (the outer branches are, however, somewhat similar to the outer branches of the third pair of the male of that species, but the proportional lengths of the joints are different). There are other, though less obvious, differences between the two species, as, for example, in the structure of the first thoracic feet and of the male fifth feet. The species appears to be confined to water that is more or less brackish.

PSEUDOCLETODES, subgen. nov.

Resembling *Cletodes*, Brady, in general appearance, but the inner branches of the first thoracic feet are obsolete or rudimentary; inner branches of the second, third, and fourth pairs two-jointed, the first joint very small.

Pseudocletodes vararensis *, sp. n.
(Pl. XII. figs. 4–14.)

Length 1·14 millim. ($\frac{1}{22}$ of an inch). Rostrum prominent, moderately broad, with a minute hair on each side of the

* Εἴσχυσις Οὐάραρ (Æstuary of Varar), the name used by Ptolemy for the Moray Firth.

triangular apex. Body narrow, tapering slightly and evenly to the caudal extremity (fig. 4). Anterior antennæ (female) six-jointed, stout, each of the third, fifth, and sixth joints armed with a strong setiferous spine on the upper aspect; the upper distal angle of the third joint is produced and forms the base of a stout olfactory appendage; the formula shows the proportional length of the joints—

$$\text{Female anterior antennæ} \ldots \frac{9\ .\ 10\ .\ 8\ .\ 3\ .\ 4\ .\ 10}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6}.$$

Posterior antennæ somewhat similar to those of *Cletodes linearis*, Claus, but rather shorter and stouter. Mouth-appendages also somewhat similar to those of that species. Inner branches of the first thoracic feet obsolete and replaced by a dagger-shaped setiferous spine; the second joint of the outer branches is furnished with a small plumose seta on the inner edge and a stout conical spine springs from the outer distal margin of the first and second joints, while the third joint is provided with five spiniform setæ round its extremity and outer edge (fig. 9). The inner branches of the next three pairs are nearly alike, except that those of the second and third pairs are rather longer than the first two joints of the outer branches, while those of the fourth pair scarcely reach to the end of the second joint; the inner branches of the third pair in the male are slightly shorter than in the female, and armed with a terminal conical spine, as shown in the figure (fig. 13). Caudal stylets broad, subovate, nearly straight on the outer edge and convex on the inner, and provided with a few small lateral and terminal setæ.

Hab. Among *Filograna implexa*, brought up in the trawl-net in the Moray Firth.

Remarks. In form and in many of its details this curious species is closely allied to *Cletodes*, but the remarkable structure of the first thoracic feet is so much at variance with the characters of that genus as to render its position in *Cletodes* untenable.

PSEUDANTHESSIUS, Claus.

This genus of the Lichomolgidæ is distinguished from its allies by the structure of the mouth-appendages, and especially of the fourth pair of thoracic feet, the inner branches of which are one-jointed (fig. 20). Two British species of *Pseudanthessius* have already been described, viz. *Pseudanthessius liber* (B. & R.) and *Pseudanthessius Thorellii* (B. & R.)*. We have now to record a third species, which

* Mon. Brit. Copep. vol. iii. pp. 44 and 47.

was obtained by carefully washing some masses of *Filograna* trawled in the Moray Firth.

Pseudanthessius gracilis, Claus. (Pl. XII. figs. 15–20.)

Pseudanthessius gracilis, Claus, Arbeit. zool. Inst. Wien, 1889, vol. viii. p. 344, Taf. iv. figs. 1–7.

Length 1·3 millim. ($\frac{1}{19}$ of an inch). First body-segment rather longer than broad, gently curving toward the rounded forehead; last thoracic segment scarcely broader than the slender abdomen. Anterior antennæ not reaching to the end of the first body-segment, seven-jointed, the third and last joints much shorter, as shown by the appended formula—

$$\frac{17 \,.\, 20 \,.\, 8 \,.\, 14 \,.\, 16 \,.\, 13 \,.\, 9}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7}.$$

Secondary antennæ four-jointed, third joint very small, the last provided with one plain and four elongate and geniculate spiniform setæ. Mandibles stout, produced to an acute apex, inner margin evenly convex, middle portion of the exterior margin ciliate. Maxillæ simple, bearing three apical setæ (fig. 17). Anterior foot-jaws slender, armed with a few strong teeth on the upper edge; a plumose seta springs from the inner edge near the base of the foot-jaw. Posterior foot-jaw three-jointed, second joint somewhat dilated and bearing a stout spiniform seta near the middle of the inner aspect; the last joint very small and terminated by a stout conical spine and a spiniform seta about three times longer than the joint from which it springs (fig. 19). Inner branches of the first three pairs of thoracic feet three-jointed; inner branches of the fourth pair one-jointed and scarcely reaching to the end of the second joint of the outer branches, and armed at the truncate apex with two dagger-shaped spines; the inner branches are without setæ, but there is a small hook-like process near the middle of the inner margin (fig. 20). Fifth pair small, subquadrate, attached to the produced angles of the last thoracic segment, and provided with an elongate dagger-like spine and a plain seta at the apex, and a small seta near the articulation of the joint with the thorax. The first abdominal segment is about equal to the combined length of the next three and is somewhat dilated towards the distal end. Caudal stylets equal to about twice the length of the last abdominal segment; a small seta springs from near the middle of the outer edge of each stylet in addition to the terminal setæ.

Hab. Also among *Filograna*, from the Moray Firth. Several specimens were obtained.

Remarks. This species somewhat resembles *Pseudanthessius Thorellii* (B. & R.), but differs particularly in the form of the anterior foot-jaws, in the proportional length of the inner branches of the fourth thoracic feet, and in the form of the abdomen.

Remigulus *, gen. nov. (provisional name).

Body cyclopoid. Anterior antennæ short, six-jointed. Posterior antennæ three-jointed, without a secondary appendage. Mouth-organs rudimentary—the mandibles, maxillæ, and foot-jaws consist for the most part of simple stylet-shaped appendages. The first four pairs of thoracic feet have all the outer branches three- and the inner two-jointed. Fifth pair unbranched, two-jointed.

The genus *Remigulus* is provisionally instituted to include a curious cyclopoid copepod from Loch Linnhe, west of Scotland. The following is a description of the species:—

Remigulus tridens, sp. n.
(Pl. XI. figs. 15–20; Pl. XII. figs. 1–3.)

Basal joints of the six-jointed anterior antennæ armed with three prominent teeth (Pl. XII. fig. 1); when the animal is viewed from above the basal joints with their armature are entirely hidden by the boldly rounded forehead. The formula shows the proportional length of the joints of the anterior antennæ—

$$\frac{7 \,.\, 10 \,.\, 12 \,.\, 4 \,.\, 5 \,.\, 6}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6}.$$

Posterior antennæ stout, the second and third joints subequal and shorter than the first; the second joint is more or less covered with cilia and armed with a stout hooked spine at the distal end; the last joint, which is narrower than the preceding one, bears four spiniform and geniculate terminal setæ. Mandibles and other mouth-organs as described in the generic definition (Pl. XI. figs. 17, 18, 19; Pl. XII. fig. 2). The first and second joints of the outer branches of the first pair of swimming-feet are furnished exteriorly with a marginal row of small teeth; the joints of the short and stout inner branches are subequal and are each provided with a plumose seta on the interior edge, while the second joint is strongly dentate on the outer margin and armed at the apex with two small hook-like spines. The inner branches of the next three pairs

* *Remex*, a waterman.

are comparatively slender and composed of two unequal joints, the first being only about half the length of the second. The first joint of the fifth pair is short, the second large and foliaceous, thickly covered with cilia, and furnished with four subterminal setæ. The abdomen and stylets together are only about one third the length of the cephalothorax. Caudal stylets nearly equal to the combined length of the last two abdominal segments. The base of the principal seta of each stylet is considerably enlarged and is articulated to the elongate slender distal portion.

Hab. Loch Linnhe (near the mouth of Loch Spelve), Argylshire, 1892.

Remarks. This curious species resembles some of the Lichomolgidæ in general appearance, but it differs from anything known to us in the rudimentary structure of the mouth-appendages and in having the inner branches of all the first four thoracic feet two-jointed. Though obtained among dredged material, its structure clearly indicates semiparasitic habits similar to the Lichomolgidæ and other closely allied forms; but its host is at present unknown to us.

The following interesting copepods have also recently been obtained:—

Cervinia Bradyi, Norman. *Pterinopsyllus insignis*, Brady. *Misophria pallida*, Boeck. *Laophonte monensis*, I. C. Thompson. *Thalestris peltata* (Boeck).	Moray Firth (the last three were washed from *Filograna implexa*). Not previously recorded for the east of Scotland.

Caligidium vagabundum, Claus.

Caligidium vagabundum, Claus, Arbeit. zool. Inst. Wien, vol. viii. (1889) p. 367, Taf. i. figs. 1–7.

New to the British fauna.

One specimen of this curious species has recently been obtained among dredged material from the Moray Firth, depth 130 fath.

The structure of the anterior antennæ, with their extremely long filamentous hairs, and the structure of the posterior foot-jaws and first thoracic feet enable the species to be readily distinguished. The species was described by Dr. Claus from a single specimen in 1889 (see *op. cit.*), and, so far as we know, this is the only other record of its occurrence. Dr. Eugene Canu ('Les Copépodes du Boulonnais,' 1892, p. 255) refers to Claus's specimen as a "unique exemplaire." We intend to describe and figure the Moray Firth specimen later on.

Amphipoda.

? *Cyproidia brevirostris*, sp. n. (Pl. XIII. figs. 1–11.)

Natural size 1·54 millim. ($\frac{1}{16}$ of an inch). Like *Cyproidia damnoniensis*, Stebbing, in general appearance. Cephalon about equal to the combined length of the first two segments of the mesosome. Rostrum triangular, short, not reaching to the penultimate basal joint of the superior antennæ; the rostrum, though small, is quite distinct. Second segment of the mesosome not more than half the length of the next. Eyes conspicuous, consisting of numerous lenses, the centre ones only appearing to be pigmented. Superior and inferior antennæ similar to those of *Cyproidia damnoniensis*, but no trace of a secondary appendage could be observed on the superior antennæ even with the aid of a Swift's $\frac{1}{5}$-inch objective; the number of hairs on the first joint of the flagellum of the same antennæ is also greater and they are arranged in six pairs; each pair springs from a small papilliform base (fig. 2). The mandible-palp, if applied to the mandible, extends considerably beyond it, and is therefore proportionally much longer than the mandible-palp of *Cyproidia damnoniensis* (fig. 4). The first and second gnathopods are similar to those of that species, but the fingers are not serrate on the lower concave edge (figs. 5 and 6). The third and fourth pairs of coxal plates are greatly developed (fig. 1). The fourth pair is about one and a half times as deep as the corresponding segment of the mesosome; they also extend laterally beyond the sixth segment, and as their posterior excavation, which is comparatively narrow, is filled up by the fifth pair of coxal plates, the basal portions of the fourth and fifth pereiopods are almost entirely concealed. Third pair of pereiopods slender, basal joint of the last pereiopods lamelliform, becoming wider towards the distal end, and produced downwards posteriorly to an acute angle (fig. 8). Uropoda and telson as in *Cyproidia damnoniensis*.

Hab. Moray Firth; washed from *Filograna implexa* from a depth of over 40 fathoms.

Remarks. This species resembles *Cyproidia damnoniensis*, Stebbing, in several of its characters, but it is at once distinguished by the great size of the third and fourth coxal plates. There are some other, but less obvious, points of difference, as, for example, the absence of a secondary appendage to the superior antennæ, the peculiar arrangement of the hairs at the base of the flagellum of the same antennæ, the longer mandible-palp, and the form of the largely developed basal joint of the last pereiopods.

As was pointed out by the Rev. Mr. Stebbing several years ago, there appears to be comparatively little difference between *Cyproidia*, Haswell, and *Stegoplax*, G. O. Sars. The only characters of any value that appear to separate the two genera are the apparent presence (*Cyproidia*) or absence (*Stegoplax*) of a minute secondary appendage to the superior antennæ, and the hands of the second gnathopods being larger than (*Cyproidia*) or similar to (*Stegoplax*) the hands of the first gnathopods; the difference of length of the rostrum can only be of specific value. The Moray Firth specimen, in possessing no secondary appendage to the superior antennæ, agrees better with Haswell's amended description than with that of the Rev. Mr. Stebbing, as well as exhibits a close affinity with *Stegoplax*.

EXPLANATION OF THE PLATES.

Plate XI.

Diosaccus propinquus, sp. n.

Fig. 1. Female, seen from the side, × 40. 2. Anterior antenna, × 152. 3. Posterior antenna, × 127. 4. Foot of first pair, × 84. 5. Foot of fourth pair, × 84. 6. Foot of fifth pair, × 127.

Laophonte littorale, sp. n.

Fig. 7. Female, seen from above, × 54. 8. Anterior antenna, female, × 190. 9. Foot of first pair, × 254. 10. Foot of fourth pair, female, × 254. 11. Foot of fifth pair, female, × 190. 12. Foot of fourth pair, male, × 254. 13. Foot of fifth pair, male, × 380. 14. Appendage to first abdominal segment, male, × 253.

Remigulus tridens, gen. et sp. n.

Fig. 15. Female (?), seen from above, × 54. 16. Posterior antenna, × 190. 17. Maxilla, × 380. 18. Anterior foot-jaw, × 380. 19. Posterior foot-jaw, × 506. 20. Foot of fourth pair, × 152.

Plate XII.

Remigulus tridens, gen. et sp. n.

Fig. 1. Anterior antenna, × 190. 2. Mandible, × 506. 3. Foot of first pair, × 152.

Pseudocletodes vararensis, subgen. et sp. n.

Fig. 4. Female, seen from above, × 48. 5. Anterior antenna, female, × 253. 6. Posterior antenna, × 253. 7. Mandible and palp,

× 380. 8. Posterior foot-jaw, × 380. 9. Foot of first pair, × 190. 10. Foot of fourth pair, × 127. 11. Foot of fifth pair, female, × 190. 12. Anterior antenna, male, × 253. 13. Foot of third pair, inner branch only, male, × 190. 14. Foot of fifth pair, male, × 190.

Pseudanthessius gracilis, Claus.

Fig. 15. Female, seen from above, × 40. 16. Posterior antenna, × 127. 17. Mandible and (*a*) maxilla, × 190. 18. Anterior foot-jaw, × 190. 19. Posterior foot-jaw, × 190. 20. Foot of fourth pair, × 127.

Plate XIII.

? *Cyproidia brevirostris*, sp. n.

Fig. 1. Female (?), seen from the side, × 48. 2. Superior antenna, × 127. 3. Inferior antenna, × 127. 4. Mandible and palp, × 285. 5. First gnathopod, × 127. 6. Second gnathopod, × 127. 7. Third pereiopod, × 95. 8. Fifth pereiopod, × 95. 9. First uropod, × 127. 10. Third uropod, × 127. 11. Telson, × 190.

XLI.—*A few Synonymical Notes upon African Lepidoptera.* By W. J. Holland, Ph.D., F.E.S.

The seventeenth livraison of Mons. Charles Oberthür's splendid 'Études d'Entomologie' is before me. I am glad to see the discussion on p. 28 in regard to Drury's *Acræa cynthius*. The identification of this species and the species which have borne the names *serena*, Fabr., *bonasia*, Fabr., and *eponina*, Cram., has led to much difficulty in the minds of the students of African Lepidoptera. Having recently had occasion to work out the subject with all the literature pertaining to it before me, and at the same time with long series of the species in question at hand for study and reference, it is a pleasure to me to see that so eminent an authority as Mons. Oberthür has practically attained the same results in his investigations as those at which I have myself arrived. Mons. Oberthür expresses some doubt as to the correctness of his decision; but that it is absolutely correct seems to me to be beyond question.

It is worthy of note that the species which he figures with some hesitation as *Acræa cynthius*, Drury, has for some years past been sold as *Acræa bonasia*, Fabr., by Dr. Staudinger, and thus stands labelled in many collections. Dr. Staudinger was undoubtedly led to this determination by the identification of *A. bonasia*, Fabr., with *A. cynthius*, Drury, by Kirby (see Kirby, Syn. Cat. Diurn. Lep. p. 132. no. 19). Mr. Butler, in his 'Catalogue of the Fabrician Diurnal Lepidoptera,' p. 131, states emphatically that the *Papilio bonasia* of Fabricius is identical with Cramer's *P. eponina*, as evidenced by the type in the Banksian Collection. This view is confirmed by Mr. Trimen in his 'South-African Butterflies,' vol. i. p. 174, footnote.

Mons. Oberthür quotes Trimen, 'Rhopalocera Africæ Australis,' as favouring the view that *A. eponina*, Cram., is a synonym of *A. cynthius*, Drury. Had Mons. Oberthür consulted Mr. Trimen's recent work 'South-African Butterflies,' vol. i. pp. 174 and 175, he would have seen that the recent studies of the learned Curator of the South-African Museum have led him to greatly modify the views expressed in his work published in 1862. The synonymy of the various species of the group which have been confused with one another in this genus may be worked out as follows, and will, I think, be found correct :—

1. *Acræa* (*Papilio*) *cynthius*, Drury.

Acræa (*P.*) *cynthius*, Drury, Ill. Exot. Ent. iii. pl. xxxvii. figs. 5, 6 (1782).
Acræa (*P.*) *cynthia*, Herbst, Naturs. Schmett. iv. pl. lxxx. figs. 1, 2 (1790).
Acræa cynthia, Godt. Enc. Méth. ix. p. 234. no. 13 (1819).
Acræa cynthius, Trimen, South-African Butt. vol. i. p. 175 (1887).
Acræa cynthius ?, Oberthür, Etudes d'Entom. xvii. p. 28, pl. i. fig. 5 (1893).
Telchinia serena (Fabr.), Butl. (pars), Cat. Fabr. Diurn. Lep. p. 130 (1869).
Acræa bonasia (Fabr.), Kirby, Syn. Cat. Diurn. Lep. p. 132 (1871).

2. *Acræa* (*P.*) *serena*, Fabr.

Acræa (*P.*) *serena*, Fabr. Syst. Ent. p. 461. no. 76 (1775).
Acræa (*P.*) *eponina*, Cram., ♀, Pap. Exot. iii. pl. cclxviii. figs. C, D (1782).
Acræa serena, Herbst, Naturs. Schmett. iv. pl. lxxxii. figs. 8, 9 (1790).
Telchinia serena, Butl. Cat. Fabr. Diurn. Lep. p. 130 (1869) (pars).

3. *Acræa* (*P.*) *bonasia*, Fabr.

Acræa (*P.*) *bonasia*, Fabr. Syst. Ent. p. 464. no. 96 (1775).
Acræa (*P.*) *eponina*, Cram. Pap. Exot. iii. pl. cclxviii. figs A, B (1782).
Acræa (*P.*) *serena*, Fabr. Mant. Ins. pp. 14, 16. nos. 133, 164 (1787).
Acræa (*P.*) *serena*, Herbst, Naturs. Schmett. iv. pl. lxxxii. figs. 6, 7 (1790).

4. *Acræa Buxtoni*, Butl.

Acræa Buxtoni, Butl. Ann. & Mag. Nat. Hist. (4) xvi. p. 395 (1875).
Acræa serena (Fabr.), Boisd. App. Voy. de Deleg. p. 590 (1847).

Acræa manjaca (Boisd.), Wallgrn. Lep. Rhop. Caffr. p. 22 (1857).
Acræa serena (Fabr.), pars, Trimen, Rhop. Afr. Aust. i. p. 107 (1862).
Acræa serena (Fabr.), Stdgr. Exot. Schmett. pl. xxxiii. (1888).

5. *Acræa manjaca*, Boisd.

Acræa manjaca, Boisd. Faune Ent. Madag. p. 33, pl. iv. fig. 6, pl. v. figs. 6 & 7.
Acræa serena, var. *a*, Kirby, Syn. Cat. Diurn. Lep. p. 132 (1871).

6. *Acræa cabira*, Hopff.

Acræa cabira, Hopff. Monatsber. d. k. Preuss. Akad. d. Wissench. 1855, p. 640. no. 7, and Peters's Reise nach Mossamb., Ins. p. 378, pl. xxiii. figs. 14, 15 (1862).
Acræa cynthia, Trimen (pars), Rhop. Afr. Austr. i. p. 108. no. 68 (1862).
Acræa cynthia, Boisd. App. Voy. de Deleg. p. 590 (1847).

It appears from the foregoing that the name *eponina*, Cram., falls entirely, being a synonym both of *A. bonasia*, Fabr., and of *A. serena*, Fabr., in the cases where it is employed by Cramer. *A. cynthius*, Drury, was confounded by later writers with a very different insect, which was named *Acræa cabira* by Hopffer. *Acræa Buxtoni*, Butl., is a good species, which was mistaken for a long while, and is still mistaken by careless authors, for *A. serena*, Fabr. *A. manjaca*, Boisd., is a good species, representing *A. Buxtoni*, Butl., in Madagascar. I have large series of all these species in my collection, representing both sexes, and am able to positively affirm from what I know of them that they are valid.

On p. 25 of livraison xvii. 'Études d'Entomologie' Mons. Oberthür describes several forms of an *Acræa* to which he gives the name *proteina*; of which on pl. i. fig. 4 he depicts what he avers is the male, and on pl. ii. figs. 19 and 21 what he claims are varietal forms, presumably of the male, though he does not designate the sex, and on the same plate, fig. 14, what he considers the typical form of the species. On pl. iii. fig. 29 he depicts another varietal form, and on pl. ii. fig. 17 a form which he describes under the name *A. kilimanjara*. I am quite familiar with this insect, a considerable number having passed through my hands which were taken by Dr. Abbott in the region about Kilimanjaro in 1888. It is the insect which was described by Godman, in the 'Proceedings of the Zoological Society of London,' 1885, p. 537, as *A. Johnstoni*, and the female of which was described by Butler in the same journal for 1888, p. 91. From material before me I am able to confidently assert that the black form with well-defined white spots is, as Mr. Butler has determined, the female of the male with the prevalently fulvous wings. *A. kilimanjara*, Oberth., is, as I am forced to believe, a variant female of the species. The synonymy is as follows :—

Acræa Johnstoni, Gdm.

Acræa Johnstoni, Gdm. P. Z. S. Lond. 1885, p. 537 (♂); Butler, P. Z. S. 1888, p. 91 (♀).
Acræa proteina, Oberth. Etud. d'Entom. livr. xvii. pp. 25, 26, pl. ii. fig. 19 (typical *Johnstoni*, Gdm., ♂), fig. 21 (♂), pl. i. fig. 4, pl. ii. fig. 14, pl. iii. fig. 29 (♀).
Acræa kilimanjara, Oberth. *l. c.* p. 26, pl. ii. fig. 17 (♀, var.).

On page 24 of the same work Mons. Oberthür describes an *Acræa* to which he gives the name *A. planesium*, the male of which he figures on pl. i. fig. 11. This is the species which I described from the Abbott Collection as *Acræa minima*. The type is in the U.S. National Museum, a co-type is in my collection. The synonymy is as follows :—

Acræa minima, Holl.

Acræa minima, Holl. Entomologist, Lond., Sept. 1892.
Acræa planesium, Oberth. Etudes d'Entom. livr. xvii. p. 24, pl. i. fig. 11 (1893).

I cannot resist the impression that *Acræa regalis*, Oberth. (Etud. d'Entom. livr. xvii. p. 20, pl. ii. fig. 20), is identical with *A. bræsia*, described by Godman, P. Z. S. 1885, p. 538, and figured by Smith and Kirby, Rhop. Exot., *Acræa*, pl. i. fig. 7. I have a considerable series of *A. bræsia*, Gdm., and they vary considerably, some having the marginal row of spots on the secondaries as in the figure given by Oberthür, and some are without them, as in the figure in the 'Rhopalocera Exotica,' and there are intergrades. I am fully satisfied that the two figures represent one and the same species, in which case Godman's name has the priority.

In turning over the pages of part 23 of the 'Rhopalocera Exotica,' by Smith and Kirby, I find that the learned authors have figured on the twentieth plate illustrative of African Lycænidæ, fig. 6, a species which they name *Epitola rezia*. In the footnote they courteously express the belief that I claim this as the species described by me in 'Psyche,' vol. v. p. 425, as *E. benitensis* (not *benitenais*, as it is misprinted in the 'Rhop. Exotica'). I have taken occasion to compare the figure on the plate with my type, and find that the latter differs in that the blue space upon the secondaries is divided by a black ray running along the lower edge of the cell and along the third median nervule, gradually widening outwardly and coalescing with the broad black marginal border. This is the only point of distinction between it and *E. rezia*, S. & K., except that the primaries are more acute.

In the same finely illustrated work, in connexion with the twenty-second plate of African Lycænidæ I discover that the authors have made a change in a name which is not justified. They describe *Lycænesthes lychnoptera* (sic), and figure it on the plate, concluding that my name *lychnaptes* ('Psyche,' vol. vi. p. 51) is a misprint. In this they are in error. My name *lychnaptes* * (not *lychnoptes*, as misprinted in the 'Rhopalocera Exotica') must stand as it was published in 'Psyche.' The synonymy is therefore as follows:—

Epitola lychnaptes, Holl.

Epitola lychnaptes, Holl. Psyche, vol. vi. p. 51 (1891).
Epitola lychnoptera (err.), S. & K., Rhop. Exot. part xxv. pl. xxii. Afr. Lyc. figs. 1, 2 (1893).

Under the name *Rhadinopasa Udei* Dr. Karsch described, in the 'Entomologische Nachrichten,' 1891, p. 15, a Smerinthine moth which is identical with *Basiana Hornimanni*, Druce, as Karsch himself admits in a later article published in the same journal. It is worthy of notice, however, that while the specific name given by Druce must stand, the insect is dimorphic, and I infer from what I can make out of Dr. Karsch's description that he had the dimorphic form before him. I have a large series of the insect reared *ex larva*. Some of the caterpillars were reddish and produced typical *Hornimanni*, which is a rosy moth; others of the larvæ were dark green and produced a duller-coloured moth. I propose to retain Karsch's name for this form, and suggest the following synonymy:—

Rhadinopasa Hornimanni, Druce.

Basiana Hornimanni, Druce, Ent. Month. Mag. xvi. 1880, p. 268.
Basiana? Hornimanni, Holl. Trans. Am. Ent. Soc. xvi. 1889, p. 66, pl. iii. figs. 5, 6.
Var. dimorph. *Rhadinopasa Udei*, Karsch, Entom. Nachr. xvii. 1891, p. 15, Taf. i. fig. 4.

In the fourth quarterly issue of the 'Berliner entomolo-

* Λυχνάπτης=a lamp-lighter.

gische Zeitschrift' Dr. Karsch makes a new genus, *Orthogonioptilum*, for the reception of three species of moderately large African moths, to which he gives the specific names *adiegetum*, *monochromum*, and *prox*, and refers the genus to the Saturniidæ. This issue of the journal, though it is the fourth for the year 1892, was not published, as shown on the cover, until the middle of May 1893. A note on page vi is dated May 10th, 1893. I make remark of these facts because in the May number of the 'Entomological News' for 1893, which was mailed to subscribers at the end of April, I have described three species which are congeneric with the three published by Dr. Karsch, referring them to a new genus which I propose for their reception and which I name *Goodia* in honour of my excellent friend Dr. Good, who has done more than any other collector in recent years to throw light upon the life-history of the Lepidoptera of Western Africa, and whose voluminous notes upon the transformations of a host of species I hope ere long to publish, with figures of the various larval stages. Inasmuch as the only test of priority is that of publication, and as my name and generic characterization were, in fact, published fully two weeks prior to those of Dr. Karsch, I feel justified in claiming priority for the name under the circumstances relating to it. Were it not for my desire in this way to commemorate the services of a pioneer observer in this field, I should be less tenacious of the claim of priority, which I may nevertheless in strict propriety make. It appears therefore that there are six species which belong to this genus of beautiful moths. They may be arranged as follows:—

GOODIA, Holland. (*Orthogonioptilum*, Karsch.)

1. *Goodia vestigiata*, Holl.

Goodia vestigiata, Holl. Ent. News (April 30th, 1893), p. 179, pl. ix. fig. 1.

2. *Goodia lunata*, Holl.

Goodia lunata, Holl. *l. c.* p. 178, pl. ix. fig. 2.

3. *Goodia nubilata*, Holl.

Goodia nubilata, Holl. *l. c.* p. 178, pl. ix. fig. 3.

4. *Goodia* (*Orthogonioptilum*) *adiegetum*, Karsch.

Goodia (*Orth.*) *adiegetum*, Karsch, Berl. ent. Zeitschr. 1892, p. 501, Taf. xx. fig. 1 (published May 15, 1893).

5. *Goodia* (*Orth.*) *monochromum*, Karsch.

Goodia (*Orth.*) *monochromum*, Karsch, *l. c.* p. 502, pl. xx. fig. 3.

6. *Goodia* (*Orth.*) *prox*, Karsch.

Goodia (*Orth.*) *prox*, Karsch, *l. c.* p. 502, footnote.

My reference of the genus to the Drepanulidæ is, I discover upon a more minute examination of the neuration, erroneous. Dr. Karsch is right in referring it to the Saturniidæ.

Western University of Pennsylvania,
August 16, 1893.

XLII.—*Description of the Anatomy &c. of a new Species and Variety of* Arion. By Walter E. Collinge, Demonstrator of Biology, Mason College, Birmingham.

[Plate IX.]

Arion flagellus, sp. n. (Pl. IX.)

For some months past I have been receiving large series of Irish slugs, mostly belonging to the genus *Arion*, from Mr. R. A. Phillips, of Ashburton, Co. Cork.

In June last I received two boxes of Arions, three examples of which I noticed in particular owing to the small size of the caudal gland. Through the kindness of Dr. Scharff, Mr. Phillips, and Miss Delap I have had opportunities for examining many hundreds of Irish Arioninæ; but nothing approaching this form has previously come under my notice. On July 26th I received a further series of slugs from Mr. Phillips, collected at Schull, Co. Cork, two of which I recognized as agreeing with the form previously noted.

A careful examination satisfies me that it is a new form, which I now describe and figure.

The slug alive measured 50 millim. in length, in alcohol 42 millim., with a mantle 13 millim. long. The head is of a bluish-white colour, which gradually darkens or becomes a greyish blue on the tentacles. In the median line of the body a broad, dark, vandyke-brown coloured band extends from the caudal gland to the mantle and becomes less distinct after passing over about half the length of the mantle. On either side of the body a narrower light brown band borders the median one, and this in turn is bounded by another dark vandyke-brown band about half the breadth of the median one. The sides of the body and the foot-fringe are of a light brownish white, the latter being striped with faint sepia lines. The sole is pale yellow. The rugæ are somewhat oval and flat, separated by deep sulci. The caudal gland is small and inconspicuous.

The alimentary and nervous systems agree very closely with the condition found in *A. empiricorum*, Fér.; there are some slight modifications, however, in the form, position, and branching of the buccal nerve and a number of minor modifications in the muscular system, in both of which features it differs from any known species. Individually, however, I am not inclined to attach much importance to these. The differences in the generative system are the best marked and such as to at once indicate its specific identity. There is a large single vestibule; the upper portion of the receptacular duct is greatly enlarged, but it cannot at all be regarded as a second vestibule. The sperm-duct is a moderate-sized tapering organ continued as the vas deferens, which is noticeable on account of its length. The receptacular duct commences as a much dilated tube, tapering to a small and short duct which opens into a large oval-shaped sac—the receptaculum seminis. There is a large muscle attached to the distal end of this organ (Pl. IX. fig. 2, *r.s.* and *r.m.*). The oviduct is exceedingly large and usually exhibits a series of more or less well-developed constrictions; where this large proximal portion joins the distal portion of the free oviduct there is a small flagellum, to which a muscle is attached. This muscle originates from the right body-wall, posterior to the pericardial cavity, and, as well as being attached to the oviduct, is continued forwards and attached to the upper portion of the receptacular duct. The oviduct and prostate are much convoluted, and in all the specimens dissected were found to have a position quite different to that found in any other members of the genus as far as I am aware. On turning back the body-wall from the left side, the large albumen-gland is noticed lying over the oviduct and prostate, these in turn lying over the free oviduct, sperm-duct, vas deferens, &c. The albumen-gland is exceptionally large, as is also the hermaphrodite gland, which is of a deep slaty-purple colour; it opens into the hermaphrodite duct, a long convoluted tube.

It will readily be seen that *A. flagellus* differs in a number of well-marked anatomical characteristics from any other known species. It may, I think, be regarded as a form intermediate between *A. lusitanicus*, Mabille, and *A. subfuscus*, Drap., both of which species occur in Ireland. It also forms a link between the *empiricorum* and *subfuscus* group of Pollonera.

Arion flagellus, Collinge, var. nov. *Phillipsi*.

This form differs from the type in having the whole of the back and mantle of a deep mahogany-brown colour and the sides of the body white with black dashes. It was found in company with the specimens collected at Schull, Co. Cork. I have much pleasure in associating with it the name of the finder, Mr. R. A. Phillips.

EXPLANATION OF PLATE IX.

Fig. 1. *Arion flagellus*, Collinge, × 1½.
Fig. 2. Generative system of the same, × 3.
Fig. 3. Distal portion of the free oviduct, showing flagellum, × 9.
Fig. 4. Proximal portion of the generative system, showing enlarged portion of the receptacular duct.

alb.gl. Albumen-gland.
fl. Flagellum.
h.d. Hermaphrodite duct.
h.g. Hermaphrodite gland.
ov. Oviduct.
ov'. Free oviduct.
pr. Prostate.
r.m. Retractor muscles.
r.d. Receptacular duct.
r.s. Receptaculum seminis.
s.d. Sperm-duct.
v. Vestibule.
v.d. Vas deferens.

XLIII.—*New Species of Oriental Lepidoptera.* By Col. C. Swinhoe, M.A., F.L.S., &c.

RHOPALOCERA.

Family **Nymphalidæ.**

Subfamily *Limniinæ.*

Genus Danisepa, Moore.

Danisepa niasana, sp. n.

♂. Black. Fore wings with a large square white patch filling up the end of the cell, but not touching the disco-cellulars; a long white spot immediately above it with a small white spot in front, both divided from the cell-patch by the subcostal vein; a long pale blue spot just below centre of first median veinlet and five round blue spots submarginal. Hind wings with a white basal patch as in *D. rhadamanthus*;

two small blue spots near the middle of the outer margin and a blue submarginal dot near the anal angle. Underside brown; fore wings with white spots as above, with three additional—a large one below the cell-patch and two small ones outside its lower end; submarginal spots on fore wing white, also apical marginal white dots; submarginal spots and marginal dots on hind wings blue.

Expanse of wings $2\frac{3}{10}$ inches.

Island of Nias. Type in O. M.

Allied to *D. Lowei*, Butler, but can at once be distinguished by the entire absence of any of the usual white streaks on the abdominal area of the hind wings.

Subfamily *Satyrinæ.*

Genus Melanitis, Fabr.

Melanitis gylippa, sp. n.

♂. Fore wing with the apex more acute than in *M. aswa*, but without any subapical falcation, the outer margin being quite straight; general coloration of body and wings deep bright brown and very uniform. Fore wings with a dull orange-ochreous outer band, rather broad and diffuse on both margins, from near costa one third from apex, curving outwardly, and running down to the hinder angle; two whitish spots near the margin in the second median and lower discoidal interspaces, the latter the larger. Hind wings with the tail not produced, but much as in *M. leda*, with three pure white submarginal dots in the first three interspaces; brown, mottled and striated with dark brown and with ochreous grey, the latter colour predominating on the upper portion of fore wings, and costal, basal, and abdominal areas of hind wings; on the fore wings the yellow-grey forms bands from the costa downwards, and there are four submarginal white spots ringed with brown from the apex downwards; on the hind wings there are six submarginal spots, black with orange rings and white centres, the apical one the largest, the one near the angle duplex.

Expanse of wings $3\frac{3}{10}$ inches.

Ké Island. One example (*Halliburton*).

Allied to nothing I know of.

Subfamily *Nymphalinæ.*

Genus Kallima, Westw.

Kallima chinensis, sp. n.

♂ ♀. Fore wings with the apex produced in both sexes, as usual much more so in the female than in the male, nearest in coloration to *K. Huegeli*, Kollar, but different in colour to any Indo-Malayan species; the yellow band on fore wings is more ochreous and the blue particles with which the base and lower portions of fore wings are densely covered and with which the whole of the hind wings is more or less suffused is of a very peculiar shade of colour. The underside represents the usual varieties of the dried leaf pattern.

Expanse of wings, ♂ $3\frac{6}{10}$, ♀ $4\frac{3}{10}$ inches.

Omei-shan, China (*Stevens*). Five examples.

I called Mr. Leech's attention to the distinctive character of this species last November; but he has included it in the species *K. inachis* in his fine work on the Lepidoptera of China, Japan, and Corea. No doubt the genus *Kallima* has been split up into too many so-called species, but this insect is very distinctive, and I venture to say one could at a glance pick out all the examples of this species from a collection of Kallimas, however large it might be.

Genus Neptis, Fabr.

Neptis disopa, sp. n.

♂ ♀. Upperside brown-black, bands orange-red. Fore wings with a longitudinal streak from base of wing, indented above at end of cell; a subapical oblique band divided by the veins into three parts; a large discal spot with the second median veinlet running through its upper portion and a band of three smaller spots below it inwardly oblique, touching the hinder margin and merely divided by the submedian vein. Hind wings with an inner band slightly recurved and an outer band nearly even with the outer margin, both bands of about the same width; a very faint indication of a submarginal line. Underside dark ferruginous, with the longitudinal and oblique bands on fore wings ochreous, and two submarginal grey lines or thin bands. Hind wings with a thin grey band below the inner band which is nearly pure white, the outer band tinged with ochreous, and the submarginal line distinct and grey.

Expanse of wings, ♂ $2\frac{3}{10}$, ♀ $2\frac{6}{10}$ inches.

Omei-shan, China (*Stevens*). Two examples.

Mr. Leech, in the 'Lepidoptera of China, Japan, and Corea,' calls this insect *Neptis miah*, Moore. I have a long series of *N. miah*, which is a species apparently confined to the Indian region. This species constantly differs from *N. miah* in many respects, particularly in the character of the bands of the hind wings above, the inner and outer bands being of almost equal breadth, which is never the case in

N. miah, the outer band being very narrow, sometimes little better than a fine line.

Genus JUNONIA, Hübn.

Junonia orbitola, sp. n.

♂. Upperside: fore wings with all except the apical part deep black-brown; this colour is very uniform, very nearly pure black, and covers all the lower surface of the wing up to the submarginal line, includes the lower half of the lower submarginal ocellus, and from thence extends to the costa on the inner side of the oblique discal pale yellow band, which is very narrow and broken above the lower ocellus; the apical portion of the wing is paler brown and the upper ocellus has a broad red band encircling its lower portion, and runs up a little on the outer side along the subapical yellow spots; a red subcostal spot one third from base, a submarginal band of pale yellow lunules, double in the middle; cilia pale yellow, patched with brown. Hind wings blue, black on the abdominal area, round the two ocelli, and at the apex; a pale yellow outer margin and cilia, with three lunular black bands in the yellow portion. Underside very bright, somewhat as in *J. orthya*, the bands on fore wings and a very prominent discal broad band on hind wings bright chestnut-red; the ocelli all large and prominent.

Expanse of wings $2\frac{1}{10}$ inches.

Sapareea Island, near Celebes (*Snellen*). One example.

Nearest to *J. albicincta*, Butler.

Family **Papilionidæ.**

Genus CHARUS, Moore.

Charus rotalita, sp. n.

♂. Blackish brown; fore wings with the apical and outer marginal space pale between the veins and with two yellowish-white oblique subapical spots. Hind wings with a yellowish-white medial outwardly curved band, commencing with a lunular mark on the costa, then three large squarish spots divided by the veins, the centre one the largest, followed by a thin band to the abdominal margin, also divided by the veins into three pieces; a reddish-ochreous spot beneath this termination of the band, two similarly coloured submarginal lunules in the first and third interspaces; cilia of both wings black and yellowish white, the latter colour in the scallops. Underside brown; fore wings as above; hind wings with the central band reduced to a thin lunule on the costa, followed by three small spots and some patches of blue atoms; a complete submarginal set of reddish-ochreous lunules and cilia as above.

Expanse of wings $4\frac{2}{10}$ inches.

Ké Island (*Halliburton*). One example.

I do not know any near ally.

Genus MENELAIDES, Hübn.

Menelaides thessalia, sp. n.

♀. Black; head, face, collar, and tip of abdomen crimson, thorax, rest of abdomen, and both wings above pure bright black. Fore wings with whitish streaks in the interspaces from the discoidal cell to the margin, and a short broad streak in the interno-median interspace. Hind wings with a patch of white in the centre, divided into seven long spots by the discocellular and median veinlets; a small crimson streak at the bottom of the spot near the abdominal margin; a submarginal series of very large crimson lunular spots in the interspaces, decreasing in size upwards. Underside: thorax with crimson sides, abdomen with crimson bands, legs black; fore wings as above, but some short whitish streaks extend into the outer portions of the cell; hind wings as above, but the crimson spots very bright and large; tails almost non-existent, the wing being produced very slightly.

Expanse of wings $4\frac{2}{10}$–$4\frac{8}{10}$ inches.

Ké Island (*Halliburton*). Two examples.

Above it is something like *M. polyphontes*, Boisd., without tails; it is, however, much blacker, and the white streaks do not extend into the cell. The male will probably be very similar, the sexes not varying much in this group.

HETEROCERA.

Family **Drepanulidæ**.

Genus DREPANA, Schrank.

Drepana berenica, sp. n.

♂. Red, tinged with grey and sparsely striated with black; plumes of antennæ grey, palpi and legs crimson; wings with but very few markings, some black dots near the costa and a few here and there over both wings; an indistinct blackish smear at end of cell in fore wings and an indistinct blackish streak upwards from the hinder margin near the angle; cilia darker red. Underside pale pinkish grey, with a few blackish striations.

Expanse of wings $1\frac{2}{10}$ inch.

Singapore (*Davison*). Two examples.

Allied to *D. quadripunctata*, Walker, from Sarawak.

Family **Nycteolidæ.**

Genus CHIONOMERA, Butler.

Chionomera quensta, sp. n.

♂. Antennæ, palpi, and head ochreous red, body and wings silvery white; fore wings with ochreous-red bands, commencing on the costa at the base, throwing out an inner transverse straight band of the same width across the wing to the hinder margin; the costal band continues to the apex, where it thickens, includes a white apical spot, and then is continued rather more broadly down the outer margin to the hinder angle. Hind wings pure white without markings. Underside silvery white without markings; fore legs ochreous red above.

Expanse of wings $\frac{8}{10}$ inch.

Johor, Malayana (*Davison*). One example.

Family **Noctuidæ.**

Genus CRYMODES, Guén.

Crymodes endroma, sp. n.

♀. Antennæ, palpi, head, thorax, and fore wings dark shining pinkish chestnut-colour, orbicular and reniform pale, ringed with chestnut-red, the former nearly round, the latter large and square; antemedial and postmedial lines red-brown, the former nearly straight from hinder margin near the middle to the costa one fourth from base; postmedial line with a pale outer margin from hinder margin at two thirds to costa at three fourths, outwardly bent above the middle; immediately beyond this in one female example is a pale band or shade, but not in the other. Hind wings pale pinkish grey, unmarked; cilia dark pinkish chestnut. Underside of a uniform pale pinkish grey, shining, with indications of an outwardly curved middle line in all the wings, and with the costa and cilia of both fore and hind wings pinkish chestnut.

Expanse of wings $1\frac{4}{10}$ inch.

Sikkim (*Möwis*). Two examples.

Crymodes herchatra, sp. n.

♂. Palpi ochreous on the inner sides, covered with dark brown hairs outwardly; thorax and fore wings dark olive-brown, fore wings with an ochreous mark at the base and an ochreous patch below it; orbicular small, ringed with ochreous, reniform larger, nearly square, with bright ochreous sides; veins whitish, antemedial and postmedial lines whitish, the former upright, sinuous, and indistinct, the latter curving outwardly and slightly dentated, followed by a paler space on which are submarginal black spots, each spot containing an ochreous lunule; cilia brown and ochreous, with ochreous spots at the ends of the veins. Hind wings ochreous grey, with indications of a medial line and ochreous cilia. Underside: fore wings brown; hind wings ochreous grey, with a brown cell-spot and medial sinuous line, beyond which the wing is more or less suffused with brown; cilia of both wings ochreous, with brown patches.

Expanse of wings $1\frac{4}{10}$ inch.

Sikkim (*Möwis*). Two examples.

Genus Euplexia, Steph.

Euplexia icamba, sp. n.

♂. Head and collar grey; palpi and thorax black, thorax with white stripes on each side and in the centre. Fore wings black, with broad pale olive-grey bands and patches; first basal and second antemedial with the outer margin elbowed outwardly in its middle, followed by a large elongated spot which bends obliquely down from the elbow; above this is a square orbicular with grey sides, a very large reniform (also with grey sides), and a marginal band including some black dentations below the middle and a small black patch on the margin just above the middle; cilia black, with white points at the extremities of the veins. Hind wings pale blackish grey, darker on the margin; cilia whitish, with some blackish patches. Underside grey, suffused with brown; fore wings with greyish-yellow outer marginal border; cilia of both wings black, with white spots; body and legs black, the latter with white bands.

Expanse of wings $1\frac{6}{10}$ inch.

Sikkim (*Möwis*). Three examples.

A pretty insect, quite distinct from any other Indian species of this genus.

Genus Minucia, Moore.

Minucia olista, sp. n.

♀. Cupreous brown, with a slight pinkish tinge. Fore wings with a small brown dot for the orbicular; reniform large, ear-shaped, with pale border; inner line pale sinuous, oblique, from hinder margin at one third to costa at one fifth; postmedial line composed of pale dots, nearly erect, bends slightly outwards outside the reniform; submarginal line pale, zigzag, more or less edged with brown and with two or three black marks. Hind wing blackish brown, paler towards the base; cilia of both wings ochreous. Underside grey; fore wings with a darker spot at end of cell; both wings with the outer border broadly darker.

Expanse of wings $1\frac{9}{10}$ inch.

Nanchuan, China (*Jansen*). One example.

Allied to *M. cuprea*, Moore, but quite distinct; the lines on the fore wings in that species are complete, nearly straight, and the first two meet together in the centre of the hinder margin.

Genus Sypna, Guen.

Sypna olena, sp. n.

♂. Dark brown, inside of palpi, top of head, and thorax tinged with ochreous red. Fore wings crossed by several indistinct bands, slightly paler than the ground-colour of the wing; transverse lines deep black, first two rather close together and antemedial slightly sinuous, curving a little outwardly, and a little further apart from each other on the costa than they are on the hinder margin; a pure white dot on the reniform; orbicular ear-shaped, very large, and ringed with black; submarginal line also slightly sinuous, elbowed outwardly in the centre, nearly touching the outer margin. Hind wings with indications of a medial line; a submarginal brown line just below an indistinct discal band; marginal festoon on both wings brown, with white points, most distinct on fore wings. Underside ochreous grey, suffused with brown; fore wings with the cell brown, a large brown square mark at the end, followed by a pale spot, then a black discal sinuous band, which is continued across the centre of the hind wings, followed by a pale band, a broad black band, and a pale marginal space; the cell-spot on the hind wing is pale, ringed with brown.

Expanse of wings $2\frac{2}{10}$ inches.

Nanchuan, China (*Jansen*). Two examples.

Allied to *S. fuliginosa*, Butler, from Japan.

Genus Carea, Walker.

Carea costiplaga, sp. n.

♀. Pinkish fawn-colour. Fore wings with a small black mark at the base on the costa, a larger black costal patch just before the middle, and a very large subapical costal black patch which is nearly square; the entire wing sparsely irrorated with very fine brown atoms. Hind wings pinkish, unmarked, paler towards the base and abdominal margin. Underside of a uniform pale pinkish colour, the subapical black costal patch on the fore wings above represented by an indistinct whitish patch.

Expanse of wings $1\frac{4}{10}$ inch.

Sibsaghor (*Cotes*). One example.

Carea moira, sp. n.

♂. Palpi pale pinkish, frons pure white, head, thorax, and fore wings dark pinkish red. Fore wings sparsely irrorated with very fine brown atoms, a brown point at end of cell, antemedial and postmedial pale brown, slightly sinuous, transverse lines, which widen a little towards the costa; an indistinct submarginal pale brown band; cilia marked with pure white. Hind wings paler and more pinkish, palest towards base and abdominal margin. Underside: fore wings pinkish, whitish at the base; hind wings whitish, with pinkish apical and outer marginal borders.

Expanse of wings $1\frac{4}{10}$–$1\frac{5}{10}$ inch.

Selangor and Singapore (*Davison*). Three examples.

Allied to *C. obsolescens*, Moore.

Carea ocyra, sp. n.

♂. Antennæ, palpi, head, thorax, and fore wings brown-pink, dark and bright. Fore wings with a central band of white scales, an indistinct discal band or shade of dark brown-pink, and a submarginal slightly sinuous thin band of white scales, ending in a small white smear at the apex. Hind wings pinkish grey, paling inwardly, and nearly white at the base; abdomen pinkish grey, with white segmental bands. Underside: fore wings suffused with dark pinkish; a white subcostal streak from the base, a white apical patch, and the basal portions of the hinder marginal space whitish; hind wings pinkish outwardly, pale on the inner portions; cilia of both wings dark; body and legs nearly white.

Expanse of wings $1\frac{3}{10}$ inch.

Singapore (*Davison*). Three examples.

Genus Dinumma, Walker.

Dinumma vexilla, sp. n.

♂ ♀. Antennæ, palpi, head, thorax, and fore wings chocolate-red, thorax with a grey band in front. Fore wings with indistinct antemedial, postmedial, and submarginal transverse sinuous lines, also subbasal and medial bands of white scales; a patch of white on the outer margin at the hinder angle, and in some specimens white dots on parts of the wings; the white markings, however, vary much in different examples of both sexes, some being without the basal medial bands and some without any white at all. Hind wings and abdomen brown, unmarked, with pinkish cilia. Underside pinkish grey, base of wings whitish; costa of fore wings pale, with some brown marks; hind wings with a submarginal brownish band, which is sometimes obsolete; cilia of fore wings white at the angle and spotted with white on the upper portion of the wing.

Expanse of wings $1\frac{2}{10}$ inch.

Singapore (*Davison*). Thirteen examples.

A very variable species.

Dinumma villiana, sp. n.

♂ ♀. Antennæ, palpi, head, thorax, and fore wings blackish brown. Fore wings crossed by an antemedial sinuous black band, composed of two black sinuous lines inwardly edged with grey atoms; orbicular a black dot edged with grey atoms, reniform large, black-lined, edged with grey; discal band of the same pattern as the inner band, but edged with grey on the outer sides of the lines; submarginal band zigzag, composed of grey atoms shaded with deep black on the inner side; marginal points black. Hind wings and abdomen reddish brown; cilia ochreous grey. Underside pale ochreous brown; costa of fore wings yellowish; indications of a brown discal band across both wings.

Expanse of wings $1\frac{1}{2}$ inch.

Singapore (*Davison*). Six examples.

Genus Platyja, Hübn.

Platyja ciacula, sp. n.

♂. Dark brown, slightly pink-tinged. Fore wings irrorated with grey atoms, crossed by an antemedial, nearly upright, pinkish-grey line, edged with brown; orbicular rather large, round, blackish brown, edged with pale pinkish grey; reniform very large, ear-shaped, blackish brown, edged with pinkish grey; a pinkish-grey line from middle of hinder margin to inner edge of the reniform, along the bottom of which it runs, then downwards, turns sharp round near the angle, includes two ochreous spots, runs up the disk towards the apex, then angled sharply in on to the costa, this portion of the line being the inner margin to a large black subapical patch. Hind wings with a submarginal pale sinuous line, brown-bordered, which extends from anal angle towards the apex; the outer portion of the wing thickly irrorated with grey, the inner portion clear and paler in colour. Underside of a uniform pale brown; both wings crossed by a discal line of white dots; legs with ochreous and black hairs.

Expanse of wings $2\frac{3}{10}$ inches.

Port Blair, Andamans (*Wimberley*). One example.

Genus Gyrtona, Walker.

Gyrtona yucca, sp. n.

♂. Palpi brown, with white hairs and white tips; frons white, with brown specks; body and fore wings chocolate-brown, speckled with white. Fore wings with three whitish bands, subbasal, postmedial, and submarginal; these bands are traversed by several brown thin sinuous lines—the first has a deep black oblique streak on its outer side, the second has a very deep black-marked sinuous line in its centre, and the last is outwardly black-edged; there are several other black points and marks on the wing, black marginal lunules, and grey interlined cilia. Hind wings brown, with white cilia. Underside brown, with three white points on costa of fore wings near apex; body and legs whitish.

Expanse of wings $\frac{9}{10}$ inch.

Singapore (*Davison*). Two examples.

Allied to *G. hylusalis*, Walker.

Gyrtona xista, sp. n.

♂. Antennæ, palpi, and frons black; body and fore wings grey. Fore wings with a black mark on costa at base, a stripe just before middle, and a black subapical smear; the wing crossed by several nearly upright, slightly sinuous, equidistant brown lines—first subbasal, single, second before the middle, double, third in the middle, single, curves slightly outwards, fourth discal, double; a black submarginal straight band; a grey dentated line with black points very near the margin; marginal line black; cilia grey, interlined. Hind wings and abdomen grey, wing semihyaline, with a broad black marginal border; cilia white.

Expanse of wings $1\frac{1}{10}$ inch.

Singapore (*Davison*). Eight examples.

Genus MARMORINIA, Guen.

Marmorinia tipula, sp. n.

♂. Brown, irrorated with very minute grey atoms. Fore wings with two outwardly curved sinuous brown lines, antemedial and postmedial, rather close together, the latter angled in on to the costa, the line from angle to costa being white and the inner border of a grey costal patch; a brown indistinct transverse fascia between the lines, nearest to the outer one; three subapical costal white dots. Hind wings with the costal space pale and with indications of two central transverse lines. Underside paler than upperside, with faint indications of the two central lines on both wings.

Expanse of wings $1\frac{1}{10}$ inch.

Koni, Shan States, Sept. 1888 (*Manders*). Two examples.

Allied to *M. obscurata*, Butler.

Family **Geometridæ.**

Genus EUSCHEMA, Hübn.

Euschema selangora, sp. n.

♂. Colour as in *E. militaris*; thorax with a similar band. Fore wings with similar basal bands and spots, except that the hinder band is absent; in one example there is a slight indication of it at the base; the black apical half of the wing with the spots smaller. Hind wing without the spot at the end of the cell, the inner spot also absent; marginal band as in *E. militaris*; discal band absent, merely indicated by a black lunular mark towards its upper end.

Expanse of wings $3\frac{1}{2}$ inches.

Selangor, Malayana (*Davison*). Two examples.

The type specimens in my collection will all be presented to the British Museum as usual.

XLIV.—*Description of a new Species of the Butterfly Genus* Charaxes. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

For many years a species of the genus *Charaxes* has been confounded with the well-known *C. ethalion* of Natal and Delagoa Bay. As I have recently been through the whole of the literature relating to the genus and have failed to identify it, I now propose to describe it as

Charaxes Hollandii, sp. n.

♂. Chiefly differs from *C. ethalion* ♂ (*ephyra*, Godt.) in the deeper excavation of the outer margin of the primaries and the longer abdominal margin of the secondaries; on the under surface, however, the wings are much richer in colouring, the black markings much more heavily delineated, and the central belt washed with silvery glaucous; the spots beyond this belt are also darker and, on the primaries, more numerous.

Expanse of wings 72 millim.

♀. Above far more like a dwarfed female of *C. imperialis* than like *C. ethalion*; blue-black, the primaries with three small lilacine spots in a triangle beyond the cell, the apex of the triangle being directed obliquely downwards towards the base of the third median branch; below these two increasing spots of the same colour in the median interspaces; between the latter and the inner margin a bright blue band, constricted above the submedian vein; nearer to the outer margin a biangulated almost ≶-shaped series of seven spots, of which the upper six are lilacine with white centres and the seventh bright blue; central belt of secondaries bright blue; in other respects tolerably close to *C. ethalion*: below the wings have a glaucous gloss, especially on the paler bands, and in some respects the pattern more nearly resembles that of *C. etheocles*.

Expanse of wings 82 millim.

Sierra Leone.

I have named this pretty little species after my valued friend Dr. Holland, of Pittsburg, whose many important contributions to our knowledge of the Lepidopterous fauna of West Africa are widely known.

XLV.—*Descriptions of Two new Rodents from the Victoria Nyanza.* By Oldfield Thomas.

By the kindness of Canon Tristram I have had the opportunity of examining some small mammals obtained at Nassa, on the Speke Gulf of the Victoria Nyanza, by Mr. F. C. Smith, of the Church Missionary Society. These prove to consist of three species—a mungoose (*Helogale undulata* *, Peters), a dormouse, and a hare, the two latter being new to science.

Myoxus (*Eliomys*) *Smithii*, sp. n.

Size very small. General colour above uniform pale ashy grey, without darker markings of any kind. Head like back; no dark rings round eyes or patches between eyes and ears. Cheeks, sides, and under surface white, but the hairs here, as on the back, slaty grey basally. Hands and feet pure white. Tail thick and bushy, apparently intermediate in form between those of *M. crassicaudatus* and *murinus*; but, owing to the manner in which the tail of the type has been prepared, an exact description of its form and proportions is not practicable. Tail-hairs dull rufous brown with white tips.

Ears extremely small, smaller apparently than in any other dormouse, naked, flesh-coloured. Hind feet short and broad, their soles with six pads, whose positions appear to be much as in *M. murinus*.

Skull broad, short, and rounded; muzzle very short, but, owing to the anterior part of the nasals being slightly damaged in the type, it is difficult to give exact dimensions; in any case, however, the muzzle is decidedly shorter and broader than in the allied species; anterior palatine foramina rather shorter than the combined upper molar series. Upper branch of the anterior zygoma-root further forward than the lower, agreeing in this respect with *M. murinus* and differing from *M. crassicaudatus*.

Dimensions of the typical skin:—

Head and body 86 millim.; tail without hairs (approximate) 49, with end hairs 73; hind foot without claws 16·5.

Skull: back of bulla to front face of incisors 21; greatest breadth 13·6; nasals, length (c.) 7·3, greatest breadth 3·2;

* Three specimens of *Helogale* were killed at one shot, thus confirming Emin's observation (P. Z. S. 1890, p. 444) that this mungoose hunts in packs like some of the smaller Mustelidæ.

interorbital breadth 3·8; breadth of brain-case 12; height of anteorbital foramen 2·2; palate, length 9·5; diastema 5·1; length of upper molar series 3·1.

Hab. Nassa, Speke Gulf, S. Victoria Nyanza. Coll. F. C. Smith, Esq.

This beautiful little dormouse differs from *M. murinus*, *M. microtis*, and *M. Kelleni* by its much paler colour, smaller ears, and by the entire absence of black orbital rings, while from *M. crassicaudatus* it is distinguished by its longer tail and more rounded skull. From all of them it is also distinguished by its much shorter muzzle and proportionally broader nasals. It is unfortunate that the skinning of the tail has so distorted it that one cannot say whether in form it most resembles that of *M. crassicaudatus* or *M. murinus*; but I trust that spirit-specimens may soon be obtained to enable this and other points to be cleared up.

On the whole I suspect that *M. Smithii* will prove to be most nearly allied to the Angolan *M. Kelleni* described in Dr. Reuvens's admirable monograph of the group; but without seeing a specimen of that form it is difficult to appreciate the exact relationship of the two to one another.

Lepus victoriæ, sp. n.

Size and general proportions, length of ears, feet, and tail as in *L. capensis*.

Colour of back intermediate in tone between the fulvous suffused *L. capensis* and the pallid hares characteristic of the more desert regions of North Africa. The longer hairs ringed with black and pale cream-colour, not fulvous. Sides of muzzle, patches in front of and behind eyes, and chin white. Forehead grizzled black and cream-colour, a frontal white spot present. Ears with the anterior halves of their backs smoky grey, their extreme apical margins black, their anterior edges cream-coloured and their posterior white. Back of neck pale rufous. Underfur of back pale smoky grey basally, black terminally. On the sides of the body the grey of the back passes gradually into the pure white of the belly without any rufous line marking the transition. The outer sides of the forearms, the back of the hands, and an indistinct line passing down the front of the hind limb from the hips on to the feet pale fulvous, very different from the deep rufous of these parts in *L. capensis*. Tail long, deep black along the top, pure white on the sides, below, and at the tip.

Dimensions of the type (skin):—

Head and body 460 millim.; tail 73; hind foot without claws 102; ear 105, from notch 87.

Hab. Nassa, Speke Gulf, S. Victoria Nyanza. Coll. F. C. Smith, Esq.

This hare seems to be a pallid form of the *L.-capensis* group, approximating in its general colour to *L. tigrensis* and some of the other northern species, but differing from these latter by its shorter ears, which are of only about the same length as in *L. capensis.* The hare of Mount Kilima-njaro, of which the Museum owes a specimen to Messrs. Rowland Ward and Co., appears to be so closely allied in colour and proportions to the typical *L. capensis* that I agree with Mr. True * that it should be referred to that species.

Heuglin's *Lepus microtis* †, from the Bahr-el-Gazal, in 7° N., 30° E., is clearly founded on so young a specimen that it will probably never be satisfactorily determinable; but, whatever it may prove to be, its more rufous colouring and shorter ears appear to separate it from *L. victoriæ.*

XLVI.—*On some of the Larger Species of* Geomys. By Oldfield Thomas.

Owing to the impression prevailing until quite recently that the species of *Geomys* might be easily and satisfactorily determined merely by the characters presented by the grooves on their incisor teeth, their skulls have been but little attended to by authors in general, while, so far as the British Museum material is concerned, the skins examined by Mr. Alston during the preparation of the 'Biologia Centrali-Americana' have had their skulls left in them until now.

It is therefore not surprising that, on extracting a series of skulls, the specimens referred to *G. hispidus* prove to belong to two perfectly distinct species, a large and a small; and the same appears to be the case with those referred to *G. mexicanus.*

Of the *G. hispidus* group, with harsh hair, one species has roughly a skull length (basal) of almost 70 millim., while the smaller has this same dimension at most only about 56 or 58 millim. To this latter species there belong the original *G. hispidus* of Le Conte, as shown by Baird's description of the type, and also Peters's *G. heterodus*, of which Dr. Matschie has kindly sent me the typical measurements. Finally the two original specimens of Gray's "*Saccophorus quachil*" prove

* Proc. U. S. Nat. Mus. xv. p. 468 (1892).

† N. Act. Akad. Leopold. 1865, p. 32.

to be the same smaller form, although a third skin received shortly afterwards, and also referred to *S. quachil*, now appears to be a young individual of the larger.

Of this larger form the Museum possesses some excellent skins from Guatemala, collected by Mr. Salvin in 1865 and 1873, being those mentioned by Mr. Alston *, and I propose to take the best of them as the type.

Geomys grandis, sp. n.

Size very large, exceeding that of any other known species. Fur coarse, as in *G. hispidus*. Colour smoky chocolate-brown throughout, except on the muzzle, cheeks, and chin, where the hairs are white or pale whitish brown. Intermixed with the brown dorsal hairs there are, however, a certain number of pure white ones, and these seem to be most numerous in summer specimens. No darker patches round ears. Hands and feet very thinly haired, the few scattered bristles whitish. Tail absolutely naked.

Skull large and heavily built (see measurements). Ascending processes of premaxillaries surpassing the nasals by about a quarter of an inch; the space between them behind the nasals less than the breadth of one of them. Interorbital space broad, as broad as the muzzle, its edges anteriorly rounded and inflated in a manner quite unique †. Zygomata not very widely expanded in proportion to the size of the skull.

Incisors pale yellow or whitish, in marked contrast to the deep orange found in the allied species. Their single groove deep and very widely open, so that its greatest width on the cutting-edge amounts to 2 millim.; in position the bottom of the groove is internal, the breadth of the inner portion of the tooth being about 43 to 45 per cent. of the whole ‡; owing, however, to the great breadth of the groove itself, it considerably overlaps the median line, but the above percentage is

* Biol. Centr.-Amer., Mamm. p. 160.

† Most unfortunately the "blow of a machete or bush-knife," with which the Indians killed the specimens brought by Mr. Salvin, has exactly destroyed the interorbital region in all the specimens except the type; I am therefore unable to vouch for the constancy with which the peculiar supraorbital inflation is present.

‡ The position of the incisor grooves both in this and other genera may be accurately defined by measuring the distance from the bottom of the groove to the outer edges of the tooth, and then, the whole breadth of the tooth being taken as 100, the proportional breadths of the inner and outer portions may be readily calculated. The inner portion percentage of *G. mexicanus* rises to 47–50, while in *G. hispidus* it sinks to about 33.

taken strictly from the bottom of the groove. Molar teeth large.

Dimensions of the type (an adult skin, B.M. 65.5.18.65):—

Head and body 320 millim., tail 135, hind foot without claws 50*, length of longest fore claw 23.

Skull (see table below).

Hab. Dueñas, Guatemala. Coll. O. Salvin, Esq.

Of the four Dueñas specimens of *G. grandis* two, collected in 1865, are undated, but the other two are marked August and December 1873, and these two show that the species becomes much less thickly clothed in the summer, the August specimen having its belly very nearly naked, with only a sparse covering of hairs not hiding the skin. The type is intermediate in the amount of its covering between the two dated specimens.

In their tone of coloration all the specimens seen are precisely alike.

Besides the Dueñas examples there is, as already noted, a young specimen of *G. grandis* in the Museum from Coban, and the Museum also contains another from Tehuantepec, which, with some doubt, I refer provisionally to the same species.

Dr. Merriam's *G. gymnurus*† is perhaps allied to *G. grandis*, but the differences in the colour will readily distinguish the two.

Of the large soft-haired species of *Geomys* the Museum possesses unfortunately but a very small series; among them, however, is one which differs from the rest so much both in size and the characters of the incisors that, even apart from cranial characteristics, it is difficult to understand how it could have been referred to *G. mexicanus*. I would propose to call it

Geomys Merriami, sp. n.

Size large. Fur soft but short. Colour reddish fawn, quite unlike the chestnut tone of *G. mexicanus*; the hairs pale, slate-coloured basally, then with a subterminal band of fawn, their extreme tips brownish. A patch round and behind each ear dark brown. Belly and feet similar to back, but paler. Tail thinly haired, neither so absolutely naked as in *G. hispidus* and *grandis* nor so well clothed as in *G. mexicanus*; the latter species is, however, very variable in this respect.

Skull stout and heavy, with the zygomata very widely

* With claws 57.

† Proc. Biol. Soc. Wash. vii. p. 166 (1892).

expanded anteriorly, but converging very rapidly posteriorly; ascending processes of premaxillæ surpassing the nasals behind by about a quarter of an inch, the space between their posterior ends, behind the nasals, broader than they are. Interorbital region very much contracted, considerably narrower than the muzzle, its edges rounded, neither ridged nor inflated.

Anterior face of incisors orange-yellow; their single groove narrow and shallow, less developed than in any other species, its position decidedly inward of the middle line, the inner portion of the tooth being only 43 per cent. of the whole; front face of the inner portion very faintly flattened as compared to the evenly convex outer portion. Molars proportionally much smaller than in *G. grandis*.

Dimensions of the type skin (B.M. 70. 6. 20. 2):—

Head and body 295 millim., tail 95, hind foot without claws 41 *, length of longest front claw (much worn) 15.

Skull (see below).

Hab. S. Mexico. Coll. A. Boucard.

The specimen on which this species is founded is that referred to by Mr. Alston † under "Mexico (*Geale*; *Mus. Brit.*), and came from the same source and probably the same place as the type of *Oryzomys fulgens*, Thos.‡

I have named this handsome animal in honour of Dr. C. Hart Merriam, to whose energy and scientific enthusiasm the recent enormous increase in our knowledge of North-American mammals is mainly due.

G. Merriami is readily distinguishable from *G. mexicanus*, of which Dr. Matschie has kindly sent me the original measurements, by its much larger size and by the internal position of its incisor groove. The latter character will also separate Dr. Merriam's own *G. gymnurus*, which has, like *G. mexicanus*, its "upper incisors with a single median furrow."

* With claws 47·5; the claws are, however, much worn and, as usual, but little value can be attached to the "with claw" measurement, at least as compared to the far more exact and reliable one without claws. This latter has not, I believe, been much used in America, but the majority of the Old World zoologists are gradually taking to it, and no one who has once tried it, and found its simplicity, convenience, and exactitude, would return to the loose and old-fashioned way of including the claws, which act as a second variable factor in the most important external measurement that can be given of a mammal.

† *Op. cit.* p. 159.

‡ Ann. & Mag. Nat. Hist. (6) xi. p. 403.

Skull-measurements of Geomys grandis, Merriami, *and* hispidus (*all old individuals*).

	grandis. millim.	*Merriami.* millim.	*hispidus.* millim.
Basal length	68·0	(c.) 64	57
Zygomatic breadth	43·8	47·5	39·6
Posterior breadth	44·2	43·2	(c.) 39
Nasals, length	(c.) 29	24·3	23·3
Least breadth of muzzle above maxillo-premaxillary suture	16·2	15·0	11·6
Interorbital breadth	16·0	9·3	10
Palate, length	50·7	47·8	42·2
Diastema	25·5	26	22·1
Length of upper tooth-series (crowns only)	14·5	11·2	11·7

XLVII.—*Description of a new Snake from the Gold Coast.* By G. A. Boulenger.

Uriechis anomala.

Rostral twice as broad as deep, visible from above; a single præfrontal, forming a very short suture with the præocular, the supraocular nearly reaching the internasal; frontal once and two thirds as long as broad, longer than its distance from the end of the snout, shorter than the parietals; one præ- and one postocular; seven upper labials, third and fourth entering the eye, fifth and sixth in contact with the parietal; four lower labials in contact with the anterior chin-shields, which are as long as the posterior. Scales in 15 rows. Ventrals 170; anal entire; subcaudals 52. Pale brown above, speckled with darker; two dorsal series of small dark brown spots; posterior half of each scale of the outer row yellowish, surrounded by crowded dark brown dots; ventrals yellowish, speckled with dark brown in the middle; subcaudals closely speckled with dark brown.

Total length 440 millim.; tail 80.

Closely allied to *U.* (*Metopophis*) *lineata*, Peters.

A single male specimen from the Gold Coast; presented to the British Museum by Mr. Linnæus Greening.

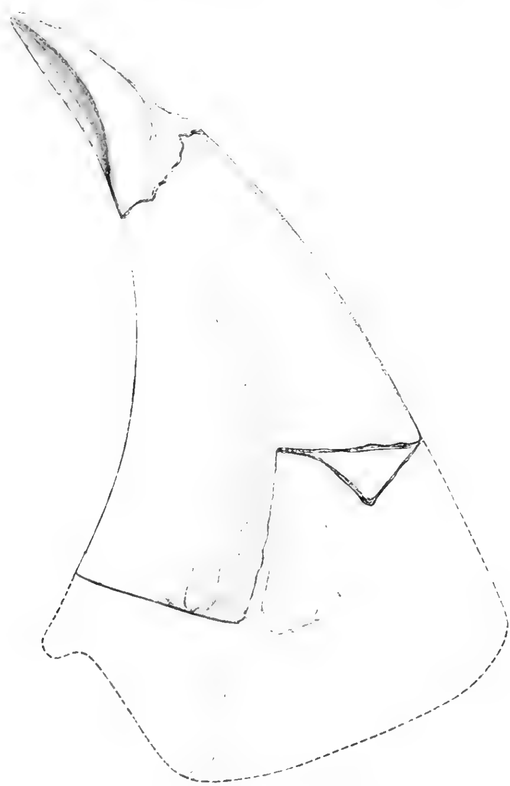
XLVIII.—*Supplemental Note on a Double-rooted Tooth from the Purbeck Beds in the British Museum.* By H. G. Seeley, F.R.S.

In describing this specimen no reference was made to the possible resemblance of the tooth to the canine teeth of Mammals. The division of the root, and the absence from the margins of the crown of the serrations, seen in well-preserved teeth of *Nuthetes*, not unnaturally raised the question whether the tooth may not be mammalian; in which case its interest would be increased, since no example of such a structure has been figured, though it is affirmed to exist in the Jurassic Mammals of this country and America. Such doubts have already arisen; and Mr. Arthur Smith Woodward, F.L.S., has mentioned to me his belief that the tooth is a mammalian canine, and ought therefore to be removed from the series of teeth of *Nuthetes*. I have gone over the evidence with Mr. Smith Woodward, and give the results.

First, examples of the teeth of *Nuthetes* occur which have lost the serrations of the crown. Secondly, a tooth of *Nuthetes*, of which only a small portion of the crown is preserved, shows an impression which is so like a divided root, that it closely approximates the condition of the fossil which I figured. Other teeth of *Nuthetes* have the root vertically furrowed, and it sometimes happens that there is a distinct pit of some size at the base of the crown; so that with close correspondence of the shape of the crown of the figured tooth in question to certain undoubted teeth of *Nuthetes*, the modification is not a remarkable one which would give a divided root as an abnormal condition; and though the evidence is small in amount, it arrests attention.

On the other hand, the crown of the tooth has some resemblance to the crown of a canine of one of the small mammals from the Purbeck beds; and the comparison has this advantage that those teeth show no trace of serrations upon their lateral margins. Secondly, Professor Marsh (Amer. Journ. Sci., April 1887, vol. xxxiii. pls. 9 & 10) has affirmed the divided condition of the roots of the canines in the allied American genera, as a common character. It is difficult, in the absence of specimens, to determine what importance to attach to these observations, since no example of a divided root, so far as I remember, has been figured. It is stated that in the Dryolestidæ the canine is inserted by two roots *more or less distinct*. *Laodon* in this family is mentioned as having two roots to the canine. In the Diplocynodontidæ the canine is said to have two roots, and the character is recognized in the genera *Diplocynodon*, *Docodon*, *Euneodon*; and in the Spalacotheridæ *Menacodon* is said to have two roots to the canine. In all these forms no further evidence is available from Professor Marsh's figures of a divided root, than the appearance of division at the base of the crown.

Professor Osborn has also affirmed the division of the root of the canine in an English genus, of which examples are preserved in the British Museum. First, with regard to the genus *Kurtodon* the side of the tooth is stated to show "a faint median groove which may indicate a double fang"



Maxillary canine of *Triconodon ferax*. Enlarged 10 times.

[root]. Secondly, there is a portion of the jaw of *Triconodon ferox*, which Professor Osborn describes, and he states that it shows "as an important character the bifanged upper

canine," and it is subsequently added that the canine is "a powerful tooth implanted by two stout fangs." The tooth as figured (Journ. Acad. Nat. Sci. Philad. 2nd ser. vol. ix. pl. ix. fig. 4) does not bear out the alleged double-rooted character. I have accordingly made an enlarged drawing of this tooth, so as to compare with the tooth of *Nuthetes*. It is exposed on the inner side; the crown is enamelled at its summit, with ridges and a slight cinguloid thickening at the base of the enamel; the extremity of the root of the tooth is lost. I have no doubt it is channelled in the way Professor Osborn's figure indicates; but, from the impression left where the anterior angle of the root is lost, which appears to be that of the external surface of the jaw, I cannot regard it as better evidence of a divided root for that particular tooth, than the corresponding impression of a tooth of *Nuthetes*, already referred to, would give for division of the roots in that specimen. There is a similar pit to that figured by Owen in *Nuthetes* apparently, on the external side, and a compression of the part of the root beyond it. In any case the evidence is not conclusive that the root was divided in this tooth of *Triconodon ferox*, which is the only example available for examination in this country. If the fossil gave such evidence, then the roots indicated would be dissimilar in form to those figured in the fossil tooth in the British Museum, No. 48,208. It is possible that a nearer comparison with the crown of that fossil might be found in *Plagiaulax medius* (Owen), but no one has yet affirmed that the roots of the tooth are divided in that genus.

It was from considerations of this kind that I judged, when originally comparing the specimen with the teeth of Purbeck Mammalia, that there was no sufficient ground for discussing the question of it being possibly mammalian. And now, having figured the evidence for such a comparison, it must be left to future discovery to determine whether the tooth, which has the mammalian character of two roots, can be identified as a Mammal, or whether it must still be regarded as an abnormal form of a tooth of *Nuthetes destructor*. If the evidence for the double-rooted canine in the Purbeck mammals remains no stronger than I have recorded, then the weight of evidence is against the suggested mammalian interpretation; but the resemblance in the form of the crown in these two types of teeth is sufficient to make further evidence desirable of the root character in those mammals, before the tooth which has hitherto passed unchallenged as *Nuthetes* is accepted unreservedly as a reptile-tooth which has abnormally developed a divided root.

XLIX.—*Observations on the Genus* Sphenia, *with Descriptions of new Species.* By Edgar A. Smith.

[Plate XV. A.]

The genus *Sphenia* was originally founded by Turton * in 1822 for the well-known *S. Binghami*. It was founded on conchological grounds only, and it was not until 1853 † that an account of the soft parts was published. The genus has relationship, either as regards the shell or the animal, with *Mya* and *Corbula*; indeed it is considered synonymous with the former by Jeffreys ‡. On the other hand, M. Petit § upholds its validity, observing that it differs from *Mya* by its thin shell, which is less gaping behind and very inequivalve. The animal has relatively short siphons, and, at the base of the foot, a true byssus. The Sphenias live attached in holes in rocks, whilst the Myæ rest buried in the sands.

Mr. Clark ‖, although admitting the genus, appears to have found very slender reasons for so doing. He observes:—"This animal has great affinity to *Saxicava*, besides alliances with *Corbula* and *Mya*; indeed, the genus *Sphænia* is almost unnecessary, and its animal is nearly identical with *Saxicava arctica*, and the structure of the hinge and the other hard parts have much the same generalities."

Sphenia is admitted as a distinct genus by Forbes and Hanley, Tryon, Fischer, H. and A. Adams, and others. It is united with *Mya* by Jeffreys, and considered as a subgenus of *Corbula* by Philippi and Woodward.

After careful consideration I am inclined to agree to the separation of this genus. Besides the differences between it and *Mya* pointed out by M. Petit it is worth noting that all the species at present known are very small in comparison with the *Myæ*.

M. Petit refers to the presence of a byssus as a distinguishing character; but I would point out that *Mya* in the young stage also secretes that appendage ¶.

Corbula does not form a byssus, and, judging from the *C. gibba*, the siphons appear to be shorter than in *Sphenia*; also, like *Mya*, it lives buried in sand or mud, not in holes in rock like *Sphenia*.

* Conch. Ins. Brit. p. 36.
† Forbes and Hanley, Brit. Moll. i. pp. 189–193.
‡ Brit. Conch. iii. pp. 60 and 70.
§ Cat. moll. test. Europ. 1869, p. 245.
‖ Brit. Marine Test. Moll. (1855), p. 150.
¶ Jeffreys, Brit. Conch. vol. iii. p. 66.

Seventeen recent species have been described as belonging to this genus, as follows:—

1. *Sphenia Binghami*, Turton. 1822.
2. —— *Swainsoni*, Turton. 1822.
3. —— *decussata* (Mont.), Turton. 1822.
4. —— *californica*, Conrad. 1837.
5. —— *Cleryana*, d'Orbigny. 1846.
6. —— *ornatissima*, d'Orbigny. 1846.
7. —— *alternata*, d'Orbigny. 1846.
8. —— *Rüppellii*, A. Adams. 1850.
9. —— *princeps*, A. Adams. 1850.
10. —— *elliptica*, A. Adams. 1850.
11. —— *decurtata*, A. Adams. 1850.
12. —— *philippinarum*, A. Adams. 1850.
13. —— *fragilis*, Carpenter. 1857.
14. —— *bilirata*, Gabb. 1861.
15. —— *ovoidea*, Carpenter. 1865.
16. —— *perversa*, Blanford. 1867.
17. —— *pacifica*, Folin. 1867.

Of the above, no. 2 has been shown to be the young of *Mya truncata*, no. 3 equals *Petricola lithophaga*, nos. 5, 6, and 7 are species of *Cuspidaria*, nos. 4, 9, 10, 11, and 12 have since been removed to Conrad's genus *Cryptomya*, and no. 14 appears to be a young *Saxicava*, as suggested by Carpenter*; this, however, is uncertain until the type, if preserved, has been reexamined.

The following species—*decussata*, Deshayes, *semistriata*, Hanley, and *mindorensis*, Adams and Reeve—originally described by their respective authors as *Myæ*, were subsequently referred to *Sphenia* by A. Adams, but have since been definitely located in *Cryptomya*. In the Paetel Catalogue, 1890, iii. pp. 20, 21, *Rupicola distorta*, Montagu (=*concentrica*, Fleur. de Bellev.), is erroneously classed with *Sphenia*. The shells of nearly all the species are very similar and liable to great variation in form, arising from the locality in which they live. The following are the species which belong to *Sphenia* as now understood.

Genus Sphenia, Turton.

1. *Sphenia Binghami*, Turton. (Pl. XV. A. fig. 1.) B.M.†

Sphenia Binghami, Turton, Conch. Ins. Brit. p. 36; Fischer, Man. Conch. p. 1122, pl. xxxiii. fig. 4.

* Moll. West. North America, 1872, p. 118.
† Species marked B.M. are in the British Museum.

Sphænia Binghami, Forbes and Hanley, Brit. Moll. vol. i. p. 190, pl. T. fig. 3, and pl. ix. figs. 1–3.
Mya Binghami, Jeffreys, Brit. Conch. vol. iii. p. 70, pl. L. fig. 3.

Hab. Great Britain, France, Spain, Piedmont, Algeria, Tunis.

2. *Sphenia Rüppellii*, A. Adams. (Pl. XV. A. figs. 2, 3.) B.M.

Sphænia Rüppellii, A. Adams, Proc. Zool. Soc. 1850, p. 89.

Hab. Red Sea.

This is a true *Sphenia*, and has been wrongly transferred to *Cryptomya* in the Paetel Catalogue, p. 21. It is clothed more or less with a yellowish epidermis, and is peculiar on account of a few radiating lines upon the anterior end of the valves.

3. *Sphenia fragilis*, Carpenter. (Pl. XV. A. figs 4, 5.) B.M.

Sphænia fragilis, Carp. Mazatlan Cat. p. 24.
Sphenia fragilis, De Folin, Les Méléagrinicoles, p. 15, pl. ii. figs. 7–9.

Hab. Mazatlan, west coast of Mexico.

The types of this species in the British Museum are rather more equilateral than the shell figured by De Folin. *Corbula luticola*, Valenciennes (Voy. Vénus, Zool. Atlas, pl. xxiv. figs. 6, 6 *a*), has never, as far as I can discover, been described. Carpenter suggests that it may be the same as his *S. fragilis*. This may be so, but without examining the type it is impossible to determine definitely The form and size of the shell, its position in a crypt, and the tooth of the left valve are characteristic of *Sphenia*.

4. *Sphenia bilirata*, Gabb.

Sphenia bilirata, Gabb, Proc. Ac. Nat. Sci. Philad. 1861, p. 369.

Hab. Santa Barbara, California.

Perhaps the young stage of *Saxicava*.

5. *Sphenia ovoidea*, Carpenter.

Sphænia ovoidea, Carp. Proc. Ac. Nat. Sci. Philad. 1865, p. 54.

Hab. Puget Sound.

S. ovalis, Carp. (Moll. West. North Amer. p. 168), apparently is a misprint for *ovoidea*.

6. *Sphenia perversa*, Blanford. (Pl. XV. A. fig. 6.) B.M.

Sphenia perversa, Blanford, Journ. Asiat. Soc. Bengal, vol. xxxvi. (ii.) p. 68, pl. xiv. figs. 4–6 (1867).

Hab. Delta of the Irawady, Pegu; in burrows in stone, apparently the holes of *Martesia*.

Mr. Blanford makes a curious mistake with regard to the hinge. He says, "In every respect, except the position of the lamellar tooth in the hinge of the left valve instead of the right, the shell appears to be a true *Sphenia*." In Mr. Blanford's figure the "lamellar tooth" is properly depicted in the left valve; in specimens of this species in the British Museum it is also in the left, and in every other species and specimen examined by the writer it is in the same valve.

7. *Sphenia pacifica*, De Folin. (Pl. XV. A. fig. 7.)

Sphenia pacificensis, De Folin, Les Méléagrinicoles, p. 15, pl. ii. figs. 10, 11.
Sphenia pacifica, Martens, Zool. Rec. 1867, p. 586.

Hab. Panama, on pearl-oysters.

8. *Sphenia Sowerbyi*, sp. n. (Pl. XV. A. fig. 8.) B.M.

Testa paulo inæquivalvis, postice rostrata, et anguste hians, antice rotundata, elongata, transversa, alba, epidermide tenui præcipue marginem versus induta; valvæ tenues, mediocriter convexæ, concentrice striatæ, carina obliqua ab umbone usque ad extremitatem posticam decurrente instructæ; margo dorsi anticus obliquus, arcuatus, posticus concavus, ventralis late curvatus; umbones prominentes, fere mediani, ad apicem antrorsum inclinati; valva dextra subedentula, sinistra dente compresso subquadrato marginali pone umbonem instructa; linea pallii infra cicatricem posteriorem oblique descendens, vix sinuata.
Longit. $10\frac{1}{2}$ millim., alt. 6, diam. $4\frac{1}{2}$.
Testa junior minus elongata, haud rostrata.
Longit. 7 millim., alt. 5, diam. $3\frac{1}{2}$.

Hab. Ariancoupan, near Pondicherry.

In the right valve the hinge-margin immediately in front of the umbo is somewhat thickened, but the incrassation is hardly enough to be termed a tooth.

Specimens of this and the following species have been presented to the British Museum by Mr. G. B. Sowerby, after whom I have much pleasure in naming that now described.

9. *Sphenia similis*, sp. n. (Pl. XV. A. fig. 9.) B.M.

Testa *S. Sowerbyi* similis, sed minor, angustior, carina umbonali postica acutiore instructa, magis inæquilateralis, postice in rostro longiore et latiore terminans, margine dorsali postico minus incurvato, ventrali minus arcuato.
Longit. 8 millim., alt. 5, diam. $3\frac{1}{2}$.

Hab. ——?

Although very like the preceding species, I believe that the present form is quite distinct. It is a longer and narrower shell, with a longer, straighter, and broader rostrum, and the oblique umbonal keel is much more evident and acute. The character of the hinge is the same.

10. *Sphenia inæqualis*, sp. n. (Pl. XV. A. fig. 10.) B.M.

Testa valde inæquivalvis, subtrigona, æquilateralis, antice rotundata, postice rostrata, concentrice rugose striata, alba, epidermide tenui pallide lutea plus minus induta; valvæ mediocriter crassæ, sinistra fere plana præter umbonem versus, dextra conspicue major, profunda, postice carinata, edentula; dens cardinalis valvæ sinistræ compressus, mediocriter validus; pagina interna alba, incrassata; cicatrix antica elongata, postica ovata.
Longit. 11 millim., alt. 8, diam. $4\frac{1}{2}$.

Hab. Singapore. Coll. Cuming.

This species, judging from the single specimen in the Museum, is remarkable for the great inequality of the valves, the left being almost flat and fitting within the margin of the right, which is considerably convex. In this respect it links *Sphenia* with *Corbula*; and the rostrate form also recalls certain forms of the latter. Near the inner edge of the posterior adductor a short linear oblique scar is observable; it probably indicates the point of adherence of the pedal retractor.

EXPLANATION OF PLATE XV. A.

Fig. 1. *Sphenia Binghami.*
Figs. 2, 3. —— *Rüppellii.*
Figs. 4, 5. —— *fragilis.*
Fig. 6. —— *perversa.*
Fig. 7. *Sphenia pacifica.*
Fig. 8. —— *Sowerbyi.*
Fig. 9. —— *similis.*
Fig. 10. —— *inæqualis.*

L.—*Palæichthyological Notes.* By A. Smith Woodward, F.L.S., of the British Museum (Natural History).

[Plate X.]

1. *On some Ichthyolites from the Keuper of Warwickshire.*

Remains of fishes are so rarely met with in the British Trias, and so little is known of the genera of the period, that even fragmentary specimens are worthy of notice. Having had the privilege of examining the largest collection hitherto made, that of the Rev. P. B. Brodie, of Rowington, the writer thus offers a few notes on some detached teeth and spines as yet unknown or incompletely described. The same collection has on former occasions yielded new Ganoids *, and

* *Dictyopyge superstes*, Egerton, Quart. Journ. Geol. Soc. vol. xiv. p. 164, pl. xi. figs. 1–3 (*Palæoniscus*); and *Semionotus Brodiei*, E. T. Newton, *ibid.* vol. xliii. p. 539, pl. xxii. figs. 1–8.

lately added considerably to our knowledge of the dentition of a Triassic shark *; but Mr. Brodie's discoveries in the Upper Keuper of Shrewley and the Lower Keuper of Coten End, Warwickshire, afford still further opportunity for a contribution to Triassic ichthyology †.

Ceratodus lævissimus, Miall. (Pl. X. figs. 1, 1 *a*.)

The first specimen of interest is an imperfect tooth of *Ceratodus*, shown of the natural size in Pl. X. fig. 1. The teeth of this dipnoan fish, as is well known, are very abundant in the Lettenkohle of Würtemberg, and it is therefore remarkable that only a single example has hitherto been recorded from the uppermost Trias of Britain. Besides the tooth from Ripple, Worcestershire, in the British Museum, described by Professor Miall under the name of *C. lævissimus*, the present writer is acquainted only with Mr. Brodie's specimen; and, so far as can be determined, the two fossils are specifically identical.

The new tooth, like the type specimen of *C. lævissimus*, evidently pertains to the left side of the upper jaw, and is imperfect anteriorly. It originally possessed five or six "horns" or denticles, the two posterior ones being small and incompletely divided; and these "horns" are more satisfactorily preserved than in the previous specimen. As already remarked by Miall, the tooth is low-crowned and of the same type as the German *C. Kaupi*; but the possibility of the English Keuper tooth belonging to the latter species now seems to be disproved. As shown by Mr. Brodie's fossil, the "horns" are more acute and the ridges more compressed than in *C. Kaupi*; and the name of *C. lævissimus* may therefore be retained for the Keuper species.

Form. and Loc. Lower Keuper, Coten End, Warwick.

Phœbodus Brodiei, sp. n. (Pl. X. figs. 2–4.)

The survival of at least one ancient Palæozoic type of shark until the latter part of the Triassic period has already been suggested by the discovery of teeth indistinguishable

* Smith Woodward, "On the so-called *Hybodus keuperinus*, Murch. and Strickl.," Ann. & Mag. Nat. Hist. [6] vol. iii. pp. 297–299, pl. xiv. figs. 1–3 (1889).

† For descriptions of the section at Shrewley see Rev. P. B. Brodie, "On some Additional Remains of Cestraciont and other Fishes in the Green Gritty Marls immediately overlying the Red Marls of the Upper Keuper in Warwickshire," Quart. Journ. Geol. Soc. vol. xlix. pp. 171–174 (1893).

from *Diplodus* in the Keuper of Somersetshire (*D. Moorei*, A. S. Woodw.*). It is now of much interest to be able to add possible evidence of the survival of another ancient type in the form of true Cladodont teeth from Warwickshire.

All the known examples of these teeth are very small, a series of four being shown of twice the natural size in Pl. X. fig. 2. The crown (fig. 4) consists of three robust conical cusps, vertically striated except towards the apex, and about equal in width at the base; the median cusp is nearly vertical and slightly shorter than the outer pair, which incline a little outwards and are almost symmetrical. The root, as shown from above (fig. 3), is horizontally expanded, straight at its outer border, where the coronal cusps arise, bounded by a semicircular border within. When the teeth are in series (fig. 2) the expanded roots overlap, as in *Diplodus*, the Cladodonts, and the modern *Chlamydoselache*, there being evidently several teeth in function simultaneously in each transverse row. There appears to be no smooth articular facette on the root.

As in the case of the Diplodont teeth, the new specimens are of course insufficient to prove the survival of an ancient Palæozoic genus of sharks in the Trias; they merely suggest that some of the Cladodonts were still to be met with in early Mesozoic seas. The form of the teeth, however, differs in no essential respect from the Middle Devonian and Lower Carboniferous type named *Phœbodus* in America †, the most important differences apparently being the complete suppression of intermediate denticles and the absence of an articular facette on the root in the Triassic specimens. It is therefore proposed to assign to the teeth now described the provisional name of *Phœbodus Brodiei*.

Form. and Loc. Upper Keuper, Shrewley, Warwickshire.

A Hybodont Fin-spine. (Pl. X. figs. 5, 5 *c*.)

It has already been pointed out that the Triassic Hybodont fin-spines described by Agassiz under the name of *Leiacanthus* are provided with small posterior denticles. No good figure of an unabraded specimen has, however, hitherto been published, and a drawing of the finest example of the so-called *Hybodus keuperinus* in Mr. Brodie's collection is therefore appended (fig. 5). This spine, like those from the Muschelkalk, is much laterally compressed, with a sharp anterior border; the lateral ribbings are fine and numerous, and the

* Ann. & Mag. Nat. Hist. [6] vol. iii. p. 299, pl. xiv. figs. 4, 5 (1889).
† St. John and Worthen, Palæont. Illinois, vol. vi. p. 251 (1875).

posterior face appears slightly convex when viewed in transverse section (figs. 5 *b*, *c*). Towards the distal extremity of the spine the hinder face also exhibits a small, sharp, longitudinal, median ridge (fig. 5 *a*), and it is between this ridge and the lateral borders that the diminutive pointed denticles are placed, at wide and not very regular intervals.

The Triassic fin-spine thus agrees with those of the Mesozoic Hybodonts, and differs from all known Palæozoic spines * in having the posterior denticles within the postero-external margin. The sharp median ridge, however, is quite different from the broad elevation of the posterior face in *Hybodus*, *Acrodus*, and *Asteracanthus*, and the denticles do not approach the median line so nearly as is usual in the latter genera. *Leiacanthus* may therefore eventually prove to be a valid genus, especially if the hollow *Acrodus*-shaped teeth commonly ascribed to "*Hybodus keuperinus*" are correctly placed as part of the same fish.

Form. and Loc. Upper Keuper, Shrewley, Warwickshire.

2. *On* Nemacanthus monilifer *from the Rhætic Formation.*

The fish-remains from the Rhætic bone-beds both of Britain and the continent are usually so much broken and abraded that their determination and description is not very satisfactory. Occasionally, however, better preserved specimens occur in the associated limestones and shales, and features readily lost by abrasion are then observable. Among other fossils, the Elasmobranch dorsal fin-spines named *Nemacanthus monilifer* are met with in especial abundance as abraded fragments; and since a diagrammatic section of one fo these has been published to support an untenable theory †, it seems advisable to offer a brief illustrated description of a fine spine in Rhætic limestone in the British Museum.

The fossil in question is shown of the natural size in Pl. X. fig. 6, and is exposed from the right side. The large ganoid anterior keel is preserved along the greater part of the exserted portion, and there is no mark on the fibrous-looking lateral face dividing the latter from the inserted basal portion.

* Every Palæozoic spine, with posterior denticles, hitherto described by American and European authors exhibits these denticles on the postero-external margin, as in the modern *Chimæra*. Every sufficiently well-preserved specimen that the present writer has examined with reference to this feature confirms the published descriptions. The unique specimen on which Dr. O. Jaekel founds a diagrammatic section contradicting all other authors (Neues Jahrb. 1892, vol. i. p. 146, fig. *b*) still remains to be described.

† O. Jaekel, Neues Jahrb. 1892, vol. i. p. 146, fig. *a*.

The external ornament consists of large ganoine-coated tubercles arranged in irregular longitudinal series, often partly wanting; and a regular series of these tubercles, somewhat enlarged, pointed, and hooked downwards, is arranged along the postero-external margin of the spine. As shown by other specimens, the hinder face is flat or slightly concave, and the transverse section of the spine thus precisely resembles that of the dorsal spine of the recent *Chimæra*.

3. *On* Gyrolepis dubius, *sp. n., from the Rhætic Formation of Scania.*

So far as fragmentary specimens admit of being compared, it appears that the Rhætic fish-remains of Southern Scania, Sweden, are very similar to those of Britain and Germany *. In the collection of the Geological Survey of Sweden, however, there is one large fragment of a ganoid fish that does not appear to have been discovered elsewhere; and the writer is indebted to the kindness of Dr. N. Olaf Holst for the opportunity of closely studying the specimen.

The fossil in question exhibits only a large portion of the squamation in impression, with a few imperfect scales and part of the dorsal fin; and the large dimensions of the fish are indicated by Pl. X. figs. 10–12, which show respectively, of the natural size, part of the squamation, an isolated scale, and part of the dorsal fin-rays. The flank-scales, as observed in the imperfect impression (fig. 10), are scarcely, if at all, deeper than broad; and the few scales that remain exhibit a narrow overlapped anterior margin, with a nearly smooth external ganoid face, only marked by some small punctuations and by a few short oblique wrinkles at the anterior border (fig. 11). Whether or not the scales were serrated cannot be determined; and though the peg-and-socket articulation can be distinctly seen, the inner vertical rib appears to be feeble. The rays of the dorsal fin (fig. 12) are stout and closely articulated, and each joint is ornamented with two or three longitudinal streaks of ganoine.

It is, of course, not possible to determine the generic position of so fragmentary a fossil with certainty; but it will probably prove to belong to *Gyrolepis*. The provisional name of *G. dubius* is therefore proposed for the fish in question, the characters of the scale-ornament and fin-rays distinguishing it from the known species of *Gyrolepis*.

* B. Lundgren, Minneskr. Kong. Fysiogr. Sällsk. Lund, no. v. (1888).

4. *On a new Palæoniscid Fish from Siberia.*

Fish-remains have already been described by Dr. J. V. Rohon * from some yellowish fissile marls in the neighbourhood of the Upper Jenissei, in the Government of Tomsk, and the present writer has had the privilege of examining the original specimens in the Museum of the Imperial Academy of Sciences at St. Petersburg. The collection is only small, and a Swedish geologist, Herr Martin, has thus done good service by obtaining a further series of specimens apparently from the same formation, and presenting them to the Royal State Museum, Stockholm. Herr Martin's collection was made at Medwiesko, near Atjinsk, in the Government of Jenissei, not very far from the locality whence Dr. Rohon's fossils were discovered; and the present writer is indebted to the kindness of Professor Gustav Lindström for the opportunity of carefully studying the new series. Only two genera and species are represented, one an Acanthodian described by Dr. Rohon under the name of *Acanthodes Lopatini*, the other a Palæoniscid not hitherto determined.

Dr. Rohon regards the stratum in which the Acanthodians occur as probably Devonian. The species just mentioned, however, has the reduced pelvic fin-spines only found in the typical Permian and Carboniferous forms of *Acanthodes*; the associated *Gyrolepidotus Schmidti* has not an early Palæozoic aspect; and the Palæoniscid now to be described is most nearly related to Permian and Triassic genera. It is therefore very probable that the fish-bearing marls of the Upper Jenissei will eventually prove to belong to the Permian formation.

Ganolepis, gen. nov.

Trunk elegantly fusiform, more or less elongated. Mandibular suspensorium oblique, and dentition comprising conspicuous well-spaced conical laniaries; external head and opercular bones completely ornamented with striations, vermiculating rugæ, and dots of ganoine. Fins small, without fulcra, and the rays delicate, distally bifurcated. Dorsal and anal fins triangular, the former opposed to the space between the pelvic and anal fins; upper caudal lobe slender and the caudal fin forked. Scales large and thick, covered with ganoine and ornamented with transverse ridges, usually serrated at the hinder border; principal flank-scales not much deeper than broad, and no enlarged series of ridge-scales; lateral line conspicuous.

* J. V. Rohon, "Ueber fossile Fische vom oberen Jenissei," Mém. Acad. Imp. Sci. St.-Pétersbourg, [7] vol. xxxvi. no. 13 (1889).

The genus as thus defined is evidently to be placed in the group of Palæoniscidæ comprising *Acrolepis*, *Elonichthys*, *Gyrolepis*, and their allies *.

Ganolepis gracilis, sp. n. (Pl. X. figs. 7–9.)

The type and only known species, of diminutive size, apparently not exceeding 0·05 metre in length. Length of head with opercular apparatus about equal to the maximum depth of the trunk and one fourth of the total length of the fish; external ornament very conspicuous. Dorsal fin arising slightly in advance of the middle point of the back and much larger than the anal fin. Scales marked by fine parallel horizontal or oblique ridges, terminating in serrations at the hinder border and often flexed upwards in front parallel to the anterior border.

The least fragmentary and distorted specimen of this species is shown of the natural size in fig. 7. It exhibits apparently the original form of the trunk, the attenuated upper caudal lobe, the thick squamation, the prominent lateral line, and parts of the median fins. The form, proportions, and ornament of the maxilla are well seen in a detached specimen, enlarged twice, in fig 8, and the characters of the scale-ornament are indicated in fig. 9.

EXPLANATION OF PLATE X.

Fig. 1. *Ceratodus lævissimus*, Miall; left upper tooth, oral aspect. Lower Keuper, Coten End, Warwick. Collection of Rev. P. B. Brodie, M.A., F.G.S., Rowington.

Fig. 1 *a*. Ditto; outer aspect of a " horn " or denticle.

Figs. 2–4. *Phœbodus Brodiei*, sp. n.; teeth in series from the anterior aspect, twice nat. size (2), one imperfect tooth viewed from above, twice nat. size (3), and restored tooth from the anterior aspect, thrice nat. size (4). Upper Keuper, Shrewley, Warwickshire. Coll. of Rev. P. B. Brodie.

Fig. 5. Hybodont fin-spine ("*Hybodus keuperinus*, Murch. and Strickl."), lateral aspect. *Ibid.* Coll. of Rev. P. B. Brodie.

Fig. 5 *a*. Ditto; posterior view of extremity of spine.

Figs. 5 *b*, *c*. Ditto; transverse sections of spine.

Fig. 6. *Nemacanthus monilifer*, Ag.; dorsal fin-spine, lateral aspect. Rhætic, Aust Cliff. British Museum, No. P. 2854.

Figs. 7–9. *Ganolepis gracilis*, gen. et sp. n.; lateral view of fish (7), right maxilla, twice nat. size (8), and scale of flank, thrice nat. size (9). Permian (?), Medwiesko, near Atjinsk, Government of Jenissei, Siberia. Royal State Museum, Stockholm.

Figs. 10–12. *Gyrolepis dubius*, sp. n.; internal impression of squamation of flank (10), an imperfect scale (11), and portion of dorsal fin-rays (12). Rhætic, Scania. Museum of Swedish Geological Survey, Sweden.

[Unless otherwise stated, all the figures are of the natural size.]

* Cat. Foss. Fishes Brit. Mus. pt. ii. (1891) p. 429.

LI.—*Descriptions of new Coleoptera from New Zealand.* By Captain Thos. Broun.

[Continued from p. 195.]

Group Elateridæ.

Chrosis eximia, sp. n.

Body moderately elongate, rather broad, shining, sparsely clothed with short brassy hairs; head, thorax, and antennæ pitchy black, elytra rufo-piceous.

Head uneven, irregularly punctured. *Antennæ* short, reaching the base of the thorax; third joint slightly longer than the fourth, one third longer than the second. *Thorax* evidently longer than broad, gradually narrowed anteriorly, but with a deep notch at each side before the middle; posterior angles divergent, the space near each is broadly depressed; its surface finely and distantly punctured, with pale yellow or ash-coloured pubescence. *Elytra* gradually narrowed posteriorly, apices truncate; they are striate, the outer striæ only are distinctly punctured, interstices finely punctured.

Prosternum punctate, its flanks nearly smooth, but near the sides and front rather closely punctured. *Abdomen* finely punctured, more distinctly and closely near the sides and on the fifth segment, with numerous erect black hairs. *Coxal lamina* much longer near the base than at the sides, with a small deep notch near the trochanter.

C. impressa is most like this species; the punctuation of its elytral interstices is closer, coarser, and rugose. *C. reversa* has impunctate prosternal flanks; in *C. barbata* they are closely punctured.

Length 9½, breadth 2½ lines.

Capleston, Westland.

Described from an example found by Mr. A. T. Cavell.

Group Diaperidæ.

Menimus vicinus, sp. n.

Oval, not short, moderately convex, sparingly clothed with minute greyish hairs, most easily seen near the sides; moderately shining, rufo-piceous, the legs, antennæ, and the margins pale red.

Head minutely yet quite distinctly, but not closely punctate. *Eyes* small. *Thorax* nearly twice as broad as it is long, rather narrower in front than behind; the sides, however, are nearly straight; the punctuation is slightly finer than that of the head. *Scutellum* triangular, not broad. *Elytra* gradually narrowed posteriorly, lateral margins broad at the shoulders, but becoming very narrow behind the posterior femora; the suture near the scutellum is slightly elevated; they are finely punctured, but not so as to form series, and there are four or five ill-defined shallow striæ on each.

In shape like *M. Batesi*, the elytral punctuation much finer; the striæ, though shallow and irregular, are quite easily detected. No. 1497 is more like this species, but it has a very broad short scutellum, rather smaller eyes, a longer and more anteriorly narrowed thorax, longer antennæ, and more slender legs, and the elytra are subopaque.

Length 2, breadth quite 1 line.

Howick. One individual.

Obs. The following remarks will help any one to separate the species:—

No. 660 is the most convex; the punctuation of the elytra is not arranged in lines as in No. 659; it is minutely pubescent.

No. 661, the thorax has two large shallow basal impressions.

No. 662 is rather narrow and elongate; its thorax is a good deal and quite regularly rounded at the sides, and the elytral margins near the shoulders are finely serrate. These characters will enable it to be separated from *M. cæcus* (No. 657).

Group **Helopidæ.**

Edalus pleuralis, sp. n.

Opaque, fuscous, the margins sometimes obscurely rufescent; legs pale reddish or testaceous, antennæ dull red; sparingly clothed with erect infuscate setæ.

Head more or less irregularly punctured. *Thorax* almost as long as it is broad, widest before the middle, a good deal narrowed behind, its sides somewhat flattened and crenate, base sinuate; the surface rather irregularly and coarsely punctured, with three shallow longitudinal impressions, one of which is in the centre, the others (near the sides) are deepened at the base. *Scutellum* either short or indistinct. *Elytra* oblong, slightly narrowed towards the base, lateral margins more or less crenate, the shoulders slightly prominent and wider than the thorax; their sculpture ill-defined, appearing when examined sideways to consist of rows of rather small punctures, which, however, do not form well-marked striæ; there are many small indefinite elevations as well; the third interstices, on the top of the hind slope, are rather broad and very slightly raised, and the sides of the summit are somewhat prominent; two or three striæ can be seen there. *Tibiæ* straight, with paler and finer setæ than the body. *Antennæ* with outstanding slender setæ; the last three joints, however, are more densely and finely clothed; the first joint is but little exposed above, second transverse, third not as long as the following three, fourth and fifth short, almost transverse, sixth rather smaller than the contiguous ones, ninth and tenth obconical, obviously larger than the preceding ones, eleventh largest, not acuminate.

Underside piceous, with short yellow setæ. *Abdomen* indistinctly sculptured. *Pleuræ* much inflexed, broad, with two series of punctures, the row nearest the body consists of fewer punctures (and finer) than the other. The *front coxæ* are placed near the hind margin of the prosternum, so that the frontal portion seems elongate; it has some shallow coarse punctures and is only very slightly incurved in front.

In *E. opacus* the pleuræ are punctured all over.

In the genus *Periatrum* the eyes extend below the sides of the head; in *Edalus* they do not, they are, in fact, quite small. In *Mesopatrum* the eyes extend downwards below the sides of the head and are then directed a little forwards.

Length $2\frac{1}{2}$, breadth 1 line.

Ohaupo, Waikato. Three, December 1892.

Group Œdemeridæ.

Sessinia thoracica, sp. n.

Shining, testaceous, very pale; the outer half of each elytron fuscous; this dark streak does not, however, reach the lateral margin; head and thorax glabrous, elytra densely covered with pale depressed hairs.

Head very much narrowed and depressed behind, its punctuation fine and shallow. *Thorax* about one fourth longer than broad, feebly incurved medially at the apex; its frontal portion (nearly half the whole length) is as broad as the head (including the large eyes), and is rounded laterally; the hind part has nearly straight sides, and appears as if it were abruptly contracted to about half the width of the other; the thickened basal margin is curved towards the sides; the surface is uneven, being broadly depressed at each side of the middle and again in front of the scutellum; near each side behind the middle there are numerous shallow punctures, but the rest of the surface seems smooth and glossy. *Scutellum* longer than broad. *Elytra* elongate, broader than the thorax, subparallel, shoulders rounded; they cover all but the extremity of the abdomen and are subopaque; the sculpture is close and fine, there is an indistinct sutural stria on each behind, the inner side of the dark space is limited by an ill-defined raised line, and there is another nearer the suture. *Legs* elongate and slender; tibiæ straight, bispinose at apex. *Antennæ* filiform, reaching the hind thighs. Fifth *ventral segment* not notched. *Eyes* large, prominent, distinctly faceted, transverse, their greatest bulk below; they are only feebly emarginated. *Maxillary palpi* elongate, the terminal joint slightly longer than the second, nearly quite straight along the outside; the inside is almost regularly curved, it is not notched, but it is broadly grooved along the inner and front face for half its length.

The eyes, thorax, and palpi differentiate this species from its allies; indeed it is doubtful if it can remain in *Sessinia.*

Length $6\frac{1}{2}$–7, breadth $1\frac{1}{2}$ lines.

Ohaupo. Two specimens, January 1893, under bark.

Sessinia reversa, sp. n.

Elongate, rather dull, pale testaceous; the vertex, middle of thorax, and sides of elytra very faintly infuscate, tips of the mandibles piceous; elytra covered with depressed pallid pubescence. *Head* finely and rather closely punctured. *Thorax* longer than broad, finely and closely punctured, only slightly uneven, widest near the front. *Elytra* very finely and closely sculptured, with two indistinct longitudinal lines on each. *Legs* very pale and slender; tibiæ straight, with two apical spines.

Somewhat similar to *S. thoracica*; the sculpture differs, the thorax is less dilated in front, and consequently appears less narrowed behind. There are, moreover, some more important differences. The *antennæ* extend only to between the middle and hind thighs. The *eyes* are shorter in the longitudinal direction; they are quite transverse and not in the least emarginate in front. The last joint of the *maxillary palpi* is narrow at the base, it is gradually dilated, and its apex is entire, curvate, and grooved; the outside for a short space is somewhat truncate, and this part seems to be more deeply grooved than the front face. The fifth *ventral segment* is broadly depressed, it is irregularly emarginate (not notched) behind. The *metasternum* has a deep, narrow, longitudinal groove.

Length $5\frac{3}{4}$, breadth $1\frac{3}{8}$ lines.

Capleston. Two; one much mutilated, this is mounted on its back, and it is from this specimen that the sexual characters have been derived. Both were sent to me by Mr. A. T. Cavell.

Group **Otiorhynchidæ.**

Hygrochus oculatus, sp. n.

Subopaque, fuscous, antennæ and tarsi ferruginous; elytra clothed with very minute scales of an obscure pale reddish colour, the raised parts with yellowish setæ; legs with minute squamæ and erect longish setæ.

Rostrum rather shorter and about one third narrower than the thorax, rather flat, with a fine central carina; there are also two broad ill-defined grooves covered with minute reddish scales. *Scape* gradually thickened, opaque, covered with very small and a few longer erect setæ. *Funiculus* red, shining, with yellowish hairs, the two basal joints of equal length, third distinctly longer than broad, seventh bead-like, slightly broader than sixth. *Club* densely pubescent, elongate-oval, acuminate, indistinctly four-jointed. *Thorax* longer than broad, a little contracted in front, slightly wider near the front than it is elsewhere, behind nearly straight-sided, base and apex truncate; the surface slightly uneven, not visibly punctate, with a few minute scattered black warts; covered with small, depressed, slender, obscure reddish scales. *Elytra* cordiform, widest behind the shoulders; these are curvate, so that the base scarcely exceeds the thorax in breadth; they are gradually narrowed backwards, the posterior declivity is much narrowed but not quite vertical, the sides are inflexed; their sculpture consists of rather shallow irregular series of punctiform impressions and a few small wart-like elevations; the dorsum is a little uneven, the humeral regions are depressed, there are two indistinct basal elevations, and four slight setigerous elevations on the top of the declivity, two on each elytron. *Tibiæ* a little flexuous, mucronate. *Tarsi* with the third joint deeply lobate, but only moderately broad, it is more evidently pilose than the others.

Underside with some fine depressed yellowish scales. Front coxal cavities large, open in front. Basal segment of abdomen truncate between the coxæ, flattened, nearly twice the length of the second, the suture between these two arcuate; third and fourth moderately short, with deep sutures.

Scrobes quite open above, they extend from the apex and are directed obliquely downwards, but in front of the eyes, from the upper to the lower margin, there is a broad depression. *Posterior corbels* not cavernous. There is just the merest trace of *ocular lobes*. *Eyes* moderately distant from the thorax, nearly round, large, and very convex; this last character will serve to distinguish this from all the allied species; No. 2149 is, however, the nearest.

The scape attains the hind margin of the eye. The mandibular scar is indistinct, but I think the genus should be placed in the Otiorhynchidæ, as in a broken specimen of another species the scar, though shallow, can be seen.

In No. 1238 the corbels of the posterior tibiæ are narrowly cavernous.

Length (rostr. incl.) $2\frac{3}{4}$, breadth nearly $1\frac{1}{8}$ lines.

Mount Pirongia. One, December 1892.

All the species unfortunately are exceedingly rare.

Rhynchogonus germanus, sp. n.

Robust, piceous, a little shining, clothed with small greyish depressed scales and short semierect setæ.

Rostrum short and broad, with a central carina; the finely punctate glabrous apical portion distinctly limited by oblique sutures. *Eyes* large, broadly longitudinally oval, very convex and prominent. *Thorax* broader than long, more narrowed, but not abruptly, in front than behind, its sides moderately rounded; disk convex, with a slightly raised, smooth, central, linear space; it is slightly rugose, the sculpture seems to consist of small granules with a minute puncture in each; from these the setæ arise. *Scutellum* invisible. *Elytra* ample, suboblong, evidently broader than the thorax; the shoulders, however, are much rounded, the sides are subparallel, behind they are narrowed and declivous; on each elytron there are six dorsal series of rather shallow subquadrate punctures, these almost form striæ; the interstices are not narrow and they are a little elevated, the third and fifth are rather more raised than the others behind, but are not distinctly nodose. *Legs* stout, tibiæ a little flexuous, the inner extremity somewhat angulate or prolonged; tarsi setose, their third joint bilobed. *Antennæ* elongate, with fine grey setæ; second joint of the funiculus obviously longer than the first, both elongate, joints 3 to 7 nearly equal, each longer than broad; club elongate-oval, three-jointed.

Length (rostr. incl.) $3\frac{1}{2}$, breadth $1\frac{5}{8}$ lines.

Mount Egmont, near Stratford. My specimen was found by Mr. A. T. Urquhart.

This may be easily separated from the New-Zealand species that are placed in the first division of the group by its remarkably outstanding *eyes*, these are widely separated above and distant from the thoracic margin. The *scape* reaches some distance beyond the front of the thorax, it is somewhat flexuous and only slightly incrassate towards the extremity. The *scrobes* are quite open above; they extend from near the apex towards the eyes, but become shallow behind. There are no *ocular lobes*. The posterior *corbels* are not cavernous.

This is an interesting discovery, as the genus was supposed to be confined to the Sandwich Islands.

Inophlœus medius, sp. n.

Piceous, densely covered with small round flat scales of a greyish-brown colour; there are also many decumbent setæ, which are usually paler, the posterior declivity of the hind body is greyish; the legs, antennæ, and the tip of the rostrum are obscure red.

Rostrum about one third shorter than the thorax, its central carina distinct, the apex bears numerous fine setæ. *Scape* with fine yellowish setæ, very gradually thickened, it attains the back of the eye. *Funiculus* with erect slender setæ, its first joint rather longer than the second, fourth distinctly shorter than the third, hardly any longer than the fifth; *club* elongate-oval, pubescent. *Thorax* nearly a third broader than it is long, widest near the front, rugose near the sides. *Scutellum* distinct, suboblong. *Elytra* evidently broader than the thorax at the base, hardly any wider near the middle than they are elsewhere, only moderately narrowed towards the base; they are quite vertical and much narrowed behind; disk but little convex, yet not flat, with regular series of distinct, moderately distant punctures; third and fifth interstices more or less elevated and, on top of the declivity, nodiform; the sides, though well defined, can scarcely be termed costate; each side of the suture is horizontally prolonged, but the protuberances hardly extend beyond the summit of the declivity.

Underside clothed like the upper surface. Prosternum incurved in front. Head with a median fovea.

The *ocular lobes* are well developed. The *corbels* of the posterior tibiæ are cavernous, with double ciliæ.

Smaller than *I. suturalis*, which has the fourth joint of the funiculus as long or almost as long as the third, and evidently longer than the fifth; it bears erect fuscous setæ. In *I. rhesus* the second, third, and fourth joints of the funiculus are subequal and the elytra seem to be very coarsely punctured ("seriatim foveatis").

Length (rostr. incl.) 4–4¼, breadth 1⅝ lines.

Upper Waimakariri.

Professor Hutton, who sent me some specimens, informed me that they were taken off *Aciphylla latifolia*.

Geochus setiger, sp. n.

Convex, broadly oval, slightly glossy, sparsely clothed with moderately fine yellowish curled setæ; the thorax, the middle of the elytra, and the legs pale castaneous, the rostrum and the tarsi reddish, the sides of the elytra piceo-fuscous; antennæ testaceous or pale red, the last two joints of the club sometimes fuscous.

Rostrum narrowed behind, with four indistinctly raised lines converging towards the eyes, its sculpture ill-defined. *Eyes* nearly rotundate, flat, coarsely faceted, placed almost wholly on the upper part of the head. *Thorax* much broader than long, narrowed and constricted in front; nearly smooth, but without any distinctly raised line along the middle, its punctuation neither close nor very coarse. *Elytra* with rounded sides, the middle portion not dilated, the base hardly at all wider than that of the thorax, the lateral margins not explanate; each with six series of moderate punctures, which, not far from the base, form striæ; interstices simple, only slightly uneven. *Legs* with rather fine pale setæ; anterior tibiæ narrowed near the extremity, without prominences, the outer face slightly asperate or serrate. *Tarsi* with the basal two joints short and transverse, third very slightly emarginate at the apex; there is no trace of a fourth joint and there are no claws. *Antennæ* slender, nearly glabrous, second joint of the funiculus about as long as the first, but much more slender; eighth joint larger than the seventh, but only half the width of the large club; it is paler in colour and less pubescent than the club, so that it is merely a matter of individual opinion whether the funiculus is seven- or eight-jointed.

Underside rufo-castaneous, shining, nearly glabrous, there being only a few extremely fine pallid setæ. *Mesosternum* quite straight and well-limited in front. *Metasternum* short, obtusely rounded, sometimes truncate, between the middle coxæ it is distantly punctured. *Abdomen* large, basal segment somewhat infuscate, its frontal suture very slightly curved, its punctuation moderate; second segment about one third shorter than the first, much curved in front in the middle, with only a few punctures; third and fourth short, with straight deep sutures, fifth finely and densely sculptured, with a broad shallow impression at each side of the middle.

Var. A.—Reddish, with a broad dark vitta on each elytron, not touching the side.

Var. B.—Piceous or nearly so.

No. 1239 bears elongate greyish or brassy depressed scales. No. 2151 has more oviform eyes, placed more at the sides of the head, and, consequently, more separated above. In No. 2539 the clothing consists of depressed squamiform setæ. These are the only near allies.

Length (rostr. incl.) $\frac{7}{8}$, breadth quite $\frac{1}{2}$ line.

Mount Pirongia. A good series, December 1892.

Obs. If any European entomologist would like to make a special study of this curious genus and to make a new group for its location, I will, if asked, place some well-mounted specimens at his disposal.

Group **Rhyparosomidæ.**

Bradypatæ armiger, sp. n.

Piceous, legs and antennæ slightly rufescent; clothed with yellow setæ, these are of unequal size and distribution.

Rostrum quite the length of the thorax, a little dilated before the antennal insertion (just in front of the middle), it bears some very small brassy scales; along the frontal portion there are two not very distinct costæ; behind a broad groove extends along each side, so that the middle seems ridged. *Head* globose below, very small and pinched in above behind the eyes; between these there is a small setigerous elevation. *Thorax* rather longer than broad, a little wider before the middle than it is elsewhere, a little constricted in front, gradually narrowed behind, apex nearly truncate, evidently wider than the head (eyes inclusive); its surface uneven, with rather coarse shallow punctures; near the front two impressions are separated by a setigerous elevation, and behind each of these impressions there is a more rounded one; its sides are fringed and the apex is crested with yellowish setæ; at the base in the middle there is a moderately elongate depression. *Elytra* subcordate, base truncate, with a scutellar depression, which is smooth, not wider than the thorax, humeral angles not prominent, the posterior portion nearly vertical and very scantily clothed; at either side of the basal depression there is a slightly curved longitudinal elevation with yellow setæ, on the disk there are about four series of coarse punctures, only two or three punctures in each row; the setæ there are extremely small and scale-like; the coarser setæ are somewhat concentrated on top of the posterior declivity, without, however, forming separated crests; immediately below the summit the surface is bare or nearly so, and the sculpture is much finer and substriate; near the sides of the dorsum there are three or four rounded elevations. *Legs* stout, with depressed and erect setæ; along the hind or inner face of the middle and hind *tibiæ* the setæ form a distinct fringe, the external ciliæ are interrupted near the middle, the inner extremity of the tibiæ is considerably produced. The *tarsi* are short, and their claws are much bent, so that they are not always easily seen.

The *antennæ* bear fine setæ; the second joint of the funiculus is more slender but about as long as the first; 3 to 6 are transverse; seventh large, gradually dilated, so as to become as broad as the base of the club.

Underside piceous; abdomen impunctate, basal segment a little depressed in the middle near the apex; between the hind coxæ there are two depressions, the second segment has a small setose elevation on the middle, the fifth is red and medially impressed.

♀. *Tibiæ* not prolonged inwardly at the extremity. Second abdominal segment not raised in the middle.

This differs materially from No. 1512. It is smaller, the eyes are more convex, the antennæ are rather shorter and stouter, the shoulders are narrower and are without setose elevations.

The male is an interesting discovery, as its structure confirms the genus as distinct from *Phrynixus* and its allies.

♂. Length (rostr. excl.) $1\frac{1}{8}$, breadth $\frac{5}{8}$ line.

Mount Pirongia. Seven examples, December 1892.

Cuneopterus tenuicornis, sp. n.

Body gradually and uninterruptedly widened from the front of the thorax to the truncate perpendicular apex of the hind body, the sides much inflexed; opaque, piceous, tarsi and antennæ infuscate red; it is covered with small, dull, pale brown squamæ.

Rostrum as long as the thorax and about half the width; apex nude, with a slight ridge along the middle, so that its sides appear depressed. *Mandibles* prominent. *Thorax* longer than broad, apex straight, base rounded, sides not uneven; apparently impunctate, with a slight central ridge in front, this along the middle becomes a bare smooth space which ends in the basal depression, the surface is only a little uneven. *Elytra* deeply incurved at the base, closely applied to the thorax; the shoulders clasp the thoracic angles, but are not prominent laterally; the scutellar region is only slightly depressed; along the top and sides of the apical declivity the squamæ are rather coarse, along the middle of each elytron there are four small squamose elevations, a fifth (close to the declivity) is larger and forms part of the transverse ridge, a similar series occurs nearer the side, and there are some other inequalities on the side itself behind the middle; near the suture one or two series of shallow punctures can be seen, the sides have coarser punctures, on the posterior face there are some small tufts. *Legs* long and slender, tibiæ not produced at the inner extremity; in repose, the front legs are extended forwards and the knees reach the tip of the rostrum. *Tarsi* setose below, third joint longer than broad, deeply hollowed above, not distinctly emarginate at the apex. *Antennæ* very slender; scape clavate towards the extremity; funiculus with very long basal joints, second longer than the first, 3 to 6 small, seventh slightly larger than sixth; club elongate-oval, acuminate, four-jointed.

Underside rather plane, seemingly impunctate, with small dull ochry scales. *Prosternum* incurved, not notched, in front. *Abdomen* very long, the two basal segments marked off by a distinct arcuate suture, the first the longer, third and fourth not very short, fifth medially emarginate at apex, squamose at each side of the notch, sixth very short.

I do not feel sure whether this curious insect agrees exactly with Dr. Sharp's *Cuneopterus*, which has "less effaced scrobes" than *Phrynixus*. In this species the *scrobes* begin near the apex, they are open above, deep, elongate, and oblique, and a shallow squamose groove extends towards the lower part of the eye. The *scape* just reaches the front of the eye. There are no *ocular lobes*. The *scutellum* is absent. The *eyes* are moderately small, subrotundate; they are distant from the thorax and from each other.

In the figure given by Dr. Sharp the thorax and elytra are truncate or almost truncate at the base, the elytra appear broader than the thorax, and the shoulders are free and do not embrace the hind angles of the thorax.

Length (rostr. incl.) 6, breadth $2\frac{1}{8}$ lines.

Mount Pirongia, December 1892.

One, evidently of the male sex, was found on the ground amongst decaying leaves.

Erymneus probus, sp. n.

Oblong-oval or nearly so, dull black; clothed with small rust-red scales, those near the elytral suture quite minute, the raised parts with squamiform setæ; near the suture, in line with the hind thighs, there are two obvious oblique yellowish crests; antennæ and tarsi rufo-piceous.

Rostrum covered with sordid tawny squamæ, these sometimes form four small crests near the antennal insertion (before the middle); the costæ are indistinct. The *scape* reaches the middle of the eye, it bears fine, depressed, brassy setæ. The *funiculus* with the second joint quite as long as the first; seventh large, slightly broader than sixth, nearly twice its length; *club* short, ovate, indistinctly annulate. *Thorax* with coarse shallow punctiform sculpture, about as long as it is broad; the central ridge extends to the large basal depression, the oblique ridge near each side becomes obsolete behind the middle. *Elytra* oblong, base deeply emarginate, so that the shoulders extend forwards, the sutural region depressed in front; there are two rows of large punctures along each side of the suture, outside these the surface is uneven, on each side between the middle and hind thighs there is a squamose prominence; on the top of the nearly vertical apical portion the third interstices are quite prominent, at each side, but lower down, there is a still larger elevation; a few minute black tubercles are distributed over the surface. *Legs* with coarse curled setæ.

Prosternum emarginate in front. *Abdomen* rather flat, coarsely punctate, with narrow ferruginous scales; first and second segments connate, thrice the length of the metasternum.

Most nearly allied to No. 2131, and most likely only a varietal form thereof.

Length (rostr. incl.) $3\frac{1}{8}$, breadth $1\frac{1}{4}$ lines.

Mount Pirongia, December 1892.

ARÆOSCAPUS, gen. nov.

Body rather narrow, without coarse squamæ and tubercular elevations. *Rostrum* rather slender, arched, longer than thorax. *Scrobes* foveiform at the point of antennal insertion (before the middle), behind this a broad groove extends to the eye, and in front another groove is directed obliquely upwards, but does not reach the apex. *Scape* rather slender, its extremity clavate; it is nearly glabrous and somewhat bent near the base, it attains the front of the eye. *Funiculus* 7-articulate, finely pubescent, its two basal joints about equal, seventh about twice the size of the sixth. *Club* rather long, widest near the end, indistinctly jointed, its basal portion hardly as broad as the seventh joint. *Eyes* nearly round, placed close to the thorax. *Head* short, narrow above, globose below. *Thorax* bisinuate and sharply limited at the base, without ocular lobes, usually oviform. *Scutellum* absent. *Elytra* of the same width as the thorax at the base, shoulders not porrect, with a sharp slender basal margin. *Tarsi* short, finely setose underneath; their third joint entire below, not broadly excavate above, rather narrow.

Prosternum moderately long, slightly incurved at apex. *Anterior coxæ* prominent and contiguous, placed just behind the middle of the prosternum. *Metasternum* short; hind coxæ widely distant. *Abdomen* long, its first segment evidently shorter than the second, the intervening suture very oblique towards the sides.

The form, the position of the eyes, the rostrum, antennal insertion, the gradual slope of the posterior declivity, and other characters prove that this genus is not very close to *Phrynixus* or its immediate allies. *Chamæpsephis* may be separated by its large broad head, which is not globose below, by its more prominent and widely separated middle coxæ, and by the position of the eyes; these are distant from the thorax and from each other, but in *Aræoscapus* they are more approximated.

In addition to the species described below this genus will include Nos. 2552, 2553, and 2554, which were placed temporarily in *Chamæpsephis* until more specimens could be found.

Aræoscapus ovipennis, sp. n.

Elongate, subovate, slightly convex; fuscous, thorax a little rufescent, rostrum, antennæ, and tarsi red, femora obscure testaceous; sparingly clothed with minute yellowish scales and patches of short, erect, coarse, pale setæ.

Rostrum rather longer than the thorax, finely punctured in front, indistinctly carinate behind; it is subparallel, but minutely swollen where the antennæ are inserted. *Club* densely and finely pubescent. *Thorax* slightly longer than broad, oviform, but little wider before the middle than it is elsewhere; its punctuation rather shallow, somewhat rugose, indistinct in front; there is a longitudinal but not deep depression at the middle of the base. *Elytra* oval, not broad, considerably narrowed behind, their posterior portion forms a gradual slope; the sutural region is a little depressed near the base, there are two series of moderately large but not deep punctures at each side of the suture, the lateral sculpture is irregular, the interstices are very slightly and interruptedly raised; the numerous small patches of setæ occur near the sides and on the hind slope. *Legs* sparsely setose.

No. 2552 is most like this species, which, however, has straight anterior tibiæ, a more elongate and slender scape, a longer and narrower thorax, and rather deeper and more numerous elytral punctures.

Length (rostr. incl.) $1\frac{7}{8}$, breadth $\frac{5}{8}$ line.

Mount Pirongia. One, December 1892.

Obs. At the same time and place I found what appears to be the male of No. 2554. The front tibiæ are a little arched externally, the others are obviously and acutely prolonged at the inner extremity. The club is more elongate. The thorax is as broad at the base as it is in the middle. The elytra are widest near the hind thighs. The rostrum has three lines of fine yellow setæ, the central one most distinct.

In this genus the palpi are short and rigid, the mentum is subquadrate, and the buccal cavity appears to be completely filled. The species are very rare.

Dacnophylla variegata, sp. n.

Variegate, fuscous or rufo-piceous, a little shining; clothed, but not densely, with scale-like hairs and erect fuscous setæ; legs and antennæ infuscate red.

Rostrum nearly nude, shining, and reddish in front, covered with yellow hairs behind; it is shorter than the thorax, convex near the middle, but depressed near the eyes. *Thorax* as long as broad, widest before the middle, gradually narrowed behind; its surface slightly uneven, there being an indistinct swelling near each side in line with the widest part, it is rather deeply and closely punctured; the fulvous hairs are most conspicuous along the middle and there are a few grey ones near the sides. *Elytra* nearly cordiform, widest behind the shoulders, these are narrowed, so that the base barely exceeds that of the thorax in width; their sculpture is not well defined, it appears to consist of interrupted striæ and slightly asperate interstices; their clothing is bright fulvous and greyish, more or less intermingled. *Legs* robust, bearing hairs and erect setæ; *front tibiæ* rather longer than the others, slightly curved outwardly, distinctly mucronate inwardly, with conspicuous yellow pubescence near the apex; the middle pair thicker, flexuous, and with long hairs along their inner face; the posterior still thicker, a good deal incrassate and bent at the extremity, the apex quite open behind;

outside there are erect setæ, but along the inside there are numerous long pale hairs; *posterior tarsi* with the basal joint rather slender, the third lobate. *Scape* flexuous, slender near the base, with outstanding setæ. First joint of the *funiculus* longer than the second, both elongate, third rather longer than broad, 5 to 7 bead-like; *club* ovate, its fourth joint very small.

Underside reddish, more or less closely punctate. *Metasternum* short, depressed in the middle, and with a large fovea behind. *Abdomen* elongate, the two basal segments rather broadly and deeply depressed, the sides of the depression near the coxæ seem elevated, the second is at least one third shorter than the first, fifth punctate, as long as the first; sixth well-developed, transversely concave.

♀. Hind tibiæ moderately thick, without long hairs on the inside, not swollen at the extremity. The elytral striæ less evident, sometimes looking like series of ill-defined punctures. Underside fuscous, shining, with yellow hairs; metasternum nearly plane; first segment flattened in front, fifth punctate, simple; there is no supplementary segment.

The more robust legs, the differently formed and clothed tibiæ, the shorter thorax, and broader elytra distinguish the male of this species from the typical one, No. 2550.

♂. Length (rostr. incl.) $1\frac{3}{4}$, breadth $\frac{5}{8}$ line.

Mount Pirongia. Two males and three females, December 1892.

Obs. No. 2559 (*Nestrius serripes*).—Having found two males and a female, and as it is a distinct genus, I think it will be useful to define the sexual characters.

♂. *Legs* robust, the front and hind femora much swollen beyond the middle; the *posterior tibiæ* serrate along the inner face and strongly angulate and prolonged at the inner extremity, the intermediate less so. *Claws* large, much bent downwards. The *metasternum* and two *basal segments* are depressed, the suture between these segments is obsolete, third and fourth short, fifth nearly truncate and minutely ciliate at the apex; between this and the end of the elytra the supplementary segment, which is concave at the base, is quite exposed. The vestiture of the *tarsi*, though slender, is very conspicuous.

♀. *Metasternum* with a transverse depression behind, so that the middle appears elevated. The suture between the two basal ventral *segments* is distinct, the third and fourth are less abbreviated, the fifth (the last) is broadly impressed. *Posterior tibiæ* not serrate and not prolonged at the apex. The legs are more slender.

[To be continued.]

LII.—*Notes on the Classification of Scorpions, followed by some Observations upon Synonymy, with Descriptions of new Genera and Species.* By R. I. POCOCK, of the British (Natural History) Museum.

[Plates XIV. & XV. B.]

PART I.—*Notes on Classification.*

THE first part of the following paper is a brief summary of my views respecting the mutual relationships of the genera of Scorpions. But since no special attention has been here devoted to the Buthidæ and Bothriuridæ, most of what is new is expressed in the rearrangement of the genera of the groups that Thorell ascribed to his two families Pandinoidæ and Vejovoidæ.

The characters I have used are taken exclusively from the external structure *. With one exception all have been pointed out before or utilized, with a varying measure of success, by my predecessors, Peters, Thorell, Simon, Lankester, and Karsch. The character that I believe to be new and, I hope, of considerable importance is the presence or absence of one of the spurs of the pair that is found upon the articular membrane connecting the foot or terminal segment of the legs with the segment that precedes it. These I call the pedal spurs. It is necessary to distinguish carefully between these spurs and the spines or thickened hairs which frequently project downwards over the foot-joint from the distal extremity of the segment to which the foot is articulated. In the Scorpionidæ, as recognized by me, there is only one of these spurs, the anterior; in the Iuridæ, Bothriuridæ (with one exception), and the Buthidæ both are present, and they attain their maximum of development in the Buthidæ, where we find the anterior one frequently double.

Of course it is hardly expected that this character, more than any other, will prove invariable; but it adds one more to the sum of characters upon which, as I have long suspected, the families or subfamilies of Scorpions must be based. Especially important has it been in my estimation in showing the relationship between such genera as *Urodacus* and *Hemi-*

* I have consequently not mentioned the anatomical features connected with the innervation and structure of the lung-books described by Prof. Lankester in 1885. It would be a highly interesting study for any one with the time to devote to it to see how far a classification based upon internal anatomy would agree with one such as that put forward here.

scorpius and, e. g., *Scorpio*, and the wide difference between *Euscorpius* and the Ischnurine group.

It is not my intention on the present occasion to enter upon any criticism of the classifications proposed by the authors mentioned above. I will merely represent these classifications in tabular form, so that a glance will suffice to show how the new grouping of the genera agrees with or differs from those that have been published before.

PETERS, Mon. Ak. Wiss. Berlin, 1861 *, pp. 509–513.

Group 1. TELEGONINI.
Telegonus, Cercophonius, Bothriurus.

Group 2. SCORPIONINI.
A. *Vejovis.*
B.—a. *Broteas, Euscorpius, Scorpiops, Urodacus.*
b. *Hemiscorpius, Ischnurus, Opisthacanthus, Heterometrus, Diplocentrus.*

Group 3. CENTRURINI.
Centrurus (*Tityus, Isometrus*), *Uroplectes.*

Group 4. ANDROCTONINI.
Prionurus, Buthus.

THORELL, Ann. & Mag. Nat. Hist. (4) xvii. pp. 3 &c. (1876).

Fam. I. **Androctonoidæ.**
Subfam. 1. ANDROCTONINI = *Androctonini*, Pet.
Subfam. 2. CENTRURINI = *Centrurini*, Pet., + some more genera.

Fam. II. **Telegonoidæ** = *Telegonini*, Pet.

Fam. III. **Vejovoidæ.**
Vejovis, Hadrurus.

Fam. IV. **Pandinoidæ** = *Scorpionini*, Peters, – *Vejovis.*
Subfam. 1. IURINI.
Iurus, Uroctonus.

Subfam. 2. PANDININI.
A. *Diplocentrus, Heterometrus, Pandinus, Palamnæus, Miæphonus, Opisthophthalmus, Opisthacanthus, Hormurus, Ischnurus, Hemiscorpius.*
B. *Urodacus, Broteas, Scorpiops, Ioctonus, Chactas, Euscorpius.*

---

* Until 1861 there can scarcely be said to have been a classification of Scorpions at all.

SIMON, 'Les Arachnides de France,' vii. pp. 92 &c. (1879).

Fam. I. **Buthidæ** = *Androctonoidæ*, Thor.

Fam. II. **Telegonidæ** = *Telegonini*, Pet.

Fam. III. **Vejovidæ** = *Vejovoidæ*, Thor.

Fam. IV. **Heterometridæ** = *Pandinoidæ*, Thor., in part.
Scorpio, Heterometrus, Opisthophthalmus, Nebo, Iurus.

Fam. V. **Ischnuridæ** = *Pandinoidæ* in part.
Ischnurus, Euscorpius, Belisarius.

Fam. VI. **Broteidæ** = *Pandinoidæ* in part.
Broteas.

M. Simon unfortunately does not assign any position in this system to many important genera.

KARSCH, Mitth. Münch. ent. Ver. 1879, pp. 17–22.

This classification is a copy of the one proposed by Thorell, the only alterations of any value that are made being concerned with the location of some of Peters's genera, which Thorell had not seen.

In the Zeitschr. Naturwissen. (3) v. p. 408 (1880), Dr. Karsch suggested the name *Diplocentrini* for the genera *Diplocentrus* and *Cyphocentrus*.

RAY LANKESTER, Trans. Zool. Soc. ii. (1885), pp. 379, 380.

Fam. **Scorpionidæ.**

Subfam. 1. SCORPIONINI.
Genus 1. *Scorpio*, including as subgenera *Euscorpius*, *Buthus* (*Heterometrus*), and *Broteas*.
Genus 2. *Telegonus*.

Subfam. 2. ANDROCTONINI.
Genus *Androctonus*, with subgenera *Prionurus* and *Centrurus*.

The value of this paper consists in the excellence of the figures and in the attention that is drawn to some new points of structure.

The Classification here proposed.

Fam. I. **Scorpionidæ.**

Subfam. 1. SCORPIONINI = *Heterometridæ*, Sim., – *Nebo* and *Iurus*.
Scorpio, Heterometrus, Miæphonus, Œcopetrus, Opisthophthalmus, Palamnæus.

Subfam. 2. ISCHNURINI = *Ischnuridæ*, Sim., – *Euscorpius* and *Belisarius*.

Ischnurus, Opisthacanthus, Opisthocentrus, Cheloctonus, Chiromachus, Hormurus, Iomachus.

Subfam. 3. DIPLOCENTRINI = *Diplocentrini*, Karsch, + *Nebo*.

Diplocentrus, Oiclus, Nebo (*Cyphocentrus*).

Subfam. 4. HEMISCORPIINI, nov.

Hemiscorpius.

Subfam. 5. URODACINI, nov.

Urodacus (*Iodacus*), ? *Ioctonus.*

Fam. II. **Iuridæ.**

Subfam. 1. IURINI = *Iurini* + *Vejovoidæ*, Thor.

Scorpiops, Iurus, Uroctonus, Anuroctonus, Vejovis, Hadrurus, Caraboctonus, Hadruroides.

Subfam. 2. CHÆRILINI = *Iurini*, Karsch, in part.

Chærilus.

Subfam. 3. CHACTINI.

a. *Euscorpius.*
b. *Chactas, Hadrurochactas, Heterochactas, Teuthraustes, Broteochactas, Broteas.*

Fam. III. **Bothriuridæ**, Sim., = *Telegonidæ* auct.

Bothriurus, Brachistosternus, Mecocentrus, Cercophonius, Timogenes, Thestylus, Urophonius, Phoniocercus.

Fam. IV. **Buthidæ**, Sim.

Prionurus, Buthus, Parabuthus, Grosphus, Butheolus, Archisometrus, Isometroides, Uroplectes (*Lepreus, Tityolepreus*), *Tityobuthus, Pseudobuthus, Isometrus, Tityus, Centrurus, Heteroctenus, Ananteris, Charmus, Heterocharmus, Stenochirus.*

Family **Scorpionidæ.**

The *feet* furnished with a single anterior pedal spur.
Sternum large, pentagonal.
Halves of the genital operculum united in the ♀, separated in the ♂.
Stigmata elongate, narrow.
A single row of teeth on each digit of the chelicerae.

Subfamily *SCORPIONINI.*

Median eyes not in front of the middle of the carapace, sometimes very much behind the middle; three lateral eyes on each side.

Sternum longer than wide, its sides parallel or slightly converging anteriorly.

The penultimate tooth on the movable digit of the cheliceræ small, very rarely approaching the size of the terminal.

Digits of the chelæ with their opposable edges angularly notched.

Bases of the claws of the legs concealed laterally by lobate expansions of the extremity of the feet; feet furnished beneath with two subparallel series of strong spines (the anterior series sometimes obsolete, e. g. *Miæphonus*).

Pectines of medium length.

Tail powerful or moderately so, without a spine beneath the aculeus.

In the male the tail and chelæ are often elongate, the hands being thinner than in the female; the digits, however, do not appear to be lobate and sinuate basally as in many other scorpions.

Genera: *Scorpio*, Linn.; *Heterometrus*, Hempr. & Ehrenb.; *Miæphonus*, Thor. (syn. *Mossamedes*, Sim.); *Œcopetrus*, nom. nov.*, *Opisthophthalmus*, C. Koch; *Palamnæus*, Thor.

Distribution. Ethiopian and Oriental Regions.

Subfamily *Ischnurini.*

Resembling the Scorpionini, but differing in having:—

The *feet* not distally lobate and not armed beneath in the same way.

The penultimate fang of the *chelicerœ* subequal to the terminal.

The *sternum* very wide, with parallel or diverging sides.

The *pectines* usually shorter.

The *tail* weaker and distinctly compressed.

Characters of male as in the Scorpionini, except that the digits are generally lobate and sinuate at the base.

Genera: *Ischnurus*, Gervais; *Opisthacanthus*, Peters; *Opisthocentrus*, nov.; *Cheloctonus*, Pocock; *Chiromachus*, nov.; *Hormurus*, Thorell; *Iomachus*, nov.

Distribution. Ethiopian, Oriental, Australian, and North Neotropical Regions.

Subfamily *Diplocentrini.*

Differs from the Scorpionini in having:—

A distinct tubercle beneath the aculeus of the tail.

* For *Petrooicus*, Karsch, preoccupied as *Petroica* (*Petræca*) in Aves.

The ocular tubercle in front of the middle of the carapace.
The feet not or at least less lobate.
Male with a longer tail and longer pectines; digits sinuate and lobate in *Nebo*, but apparently not in *Diplocentrus*.

Genera: *Diplocentrus*, Peters; *Oiclus*, Simon; *Nebo*, Simon (syn. *Cyphocentrus*, Karsch).

Distribution. Northern Neotropical, Arabia.

Subfamily *Hemiscorpiini*.

A subfamily presenting interesting annectent features.
The median eyes in advance of the middle of the carapace, as in the Diplocentrini.
The penultimate fang of the cheliceræ large, as in the Ischnurini and Diplocentrini.
Feet armed beneath, as in the Diplocentrini, but with the claws entirely free, as in the Ischnurini, and with a fine median series of spicules.
Sternum elongate, parallel-sided.
Tail with a median keel, as in the Urodacini.
Male with a long tail, the vesicle symmetrically dilated at the base of the aculeus.

Genus: *Hemiscorpius*, Peters.

Distribution. Arabia.

Subfamily *Urodacini*.

Resembling the Scorpionini, but differing in having:—
Two lateral eyes on each side.
A single inferior median keel on the tail.
The digits of the chelæ not angularly notched.
Male with a long tail and long pectines; chelæ apparently unmodified.

Genus: *Urodacus*, Peters (syn. *Iodacus*, Pocock); *Ioctonus*, Thorell.

Distribution. Australia.

Family **Iuridæ**.

Feet furnished with two distinct pedal spurs.
Sternum pentagonal, very variable as regards its length and breadth, but nearly always wider than long.
The lower surface of the feet nearly always compressed and furnished with a median series of spicules or tufts of hair.

Subfamily *Iurini.*

Sternum longer than wide or wider than long, its posterior half with a deep median longitudinal groove.

Feet not laterally spined beneath, but furnished with a median series of spinules or tufts of hair.

Three lateral eyes on each side.

The movable digit of the cheliceræ is very generally furnished with a tooth or teeth on its inferior edge, but the corresponding border of the immovable is unarmed.

Genera: *Scorpiops*, Peters; *Iurus*, Thorell; *Uroctonus*, Thorell; *Anuroctonus* *, gen. nov.; *Vejovis*, C. Koch; *Hadrurus*, Thorell; *Caraboctonus*, Pocock; *Hadruroides* †, gen. nov.

Distribution. Mediterranean, N. India and Burma; S. Nearctic to Chili.

Considering the wide geographical range of this group and the difference of aspect presented by such of its members as *Scorpiops* and *Hadrurus*, one would be inclined to think the assemblage an unnatural one. But the intermediate forms that exist seem to show that this is not the case. For instance, from *Scorpiops* to *Iurus* is not a great leap; and similarly we can proceed from *Iurus* through *Uroctonus* and *Anuroctonus* to *Vejovis*, or through *Hadruroides* and *Caraboctonus* to *Hadrurus*. *Hadrurus* undoubtedly differs very much from *Iurus*, but no one will probably dispute that it is nearly allied to *Caraboctonus*; and the similarity that obtains between *Caraboctonus* and *Iurus* with respect to armature of the mandible, the hairy clothing of the soles of the feet, &c., may surely, when taken in conjunction with the other features already pointed out as characteristic of the Iurini, point to real kinship between the two.

Subfamily *Chærilini.*

Sternum long, as long or longer than wide, with a posterior rounded impression, the lateral portions of its posterior half not thrust up on each side of the middle line.

Pectines very short, with all the intermediate lamellæ except a proximal piece obsolete, and the teeth very large.

Stigmata circular.

Two lateral eyes on each side.

* For *Centrurus phæodactylus*, Wood, *cf. infrà*

† For *Hadrurus charcasus*, Karsch, *cf. infrà.*

A series of small teeth on the lower edge of both the digits of the cheliceræ.

Digits of the chelæ furnished with a number of short overlapping series of denticles.

The lower surface of the feet furnished with two rows of spines, and a very fine median series of spicules.

Genus: *Chœrilus*, Simon, with which *Chelomachus*, Thorell, and *Uromachus*, Pocock, are in all probability synonymous.

Distribution. From N. India, through Burma to Java and Sumatra.

The genus *Chœrilus* appears to have its nearest ally in *Scorpiops* of the subfamily Iurini. The two agree in geographical distribution as well as in some structural features, such as the form of the sternum, shortness of the pectines, and dentition of the movable digit of the cheliceræ.

Subfamily *Chactini*.

With two lateral eyes on each side of the carapace.

Inferior edge of the movable digit of the cheliceræ unarmed.

a. S. European forms, with flattish body and chelæ, compressed weak tail, large sternum, distinct fulcra, and intermediate lamellæ on the pectines, small oval stigmata, and the feet compressed beneath and furnished with a row of spicules.

Genus: *Euscorpius*, Thor.

b. Neotropical forms, with the body and palpi more convex, the median eyes more forward, the sternum not so large, the intermediate lamellæ of the pectines undivided, and the fulcra small and often membranous; the stigmata are either elongate as in *Broteas*, or subcircular as in the rest; the feet as in *Euscorpius*, or with two rows of spines.

Genera: *Broteas*, C. Koch; *Broteochactas*, Pocock; *Teuthraustes*, Simon; *Heterochactas*, Pocock; *Chactas*, Gerv.; *Hadrurochactas*, Pocock.

It is possible that *Euscorpius* may not belong to this subfamily; but it is not easy to see where else to place the genus unless a special subfamily be erected for its reception.

Family **Bothriuridæ**, Simon.

Scorpions of small or medium size.

Carapace with the median eyes situated in the middle or a little in front of it; 3 lateral eyes.

Sternum reduced to a transverse anteriorly angularly convex and posteriorly concave sclerite, transversely but scarcely longitudinally impressed, wedged in between the genital operculum and the ingrown coxæ of the appendages of the fourth pair.

Genital operculum large.

Pectines moderately or very long, with clearly defined fulcra and intermediate lamellæ.

Appendages.—The penultimate tooth on the movable digit of the cheliceræ very short; the digits of the chelæ not angularly notched; the denticles arranged in three series—an external and internal, consisting of larger separated teeth, and a median, consisting of a single or double, rarely (*Cercophonius*) a multiple series of smaller teeth.

Feet with two pedal spurs (rarely the posterior obsolete, *Phoniocercus*); the lower surface furnished with more or fewer lateral spines and a median series of hairs or spicules.

Tail mostly powerful, its keels largely obsolete, with no spine beneath the aculeus.

♂ (? in all genera) with a tooth on the inner surface of the hand; digits not lobate.

♀ with cleft genital operculum.

Genera: *Bothriurus*, Peters; *Brachistosternus*, Pocock; *Cercophonius*, Peters; *Mecocentrus*, Karsch; *Phoniocercus*, Pocock; *Thestylus*, Simon; *Timogenes*, Simon; *Urophonius*, Pocock.

Distribution. S. Neotropical, Australia, Sumatra.

The scorpions of this group seem to be little more than an exaggeration of some of the American members of the Iurini, for some of them show many points of resemblance to *Caraboctonus* and *Hadrurus*.

Family **Buthidæ**, Simon.

Feet furnished with two pedal spurs, the anterior of which is often double.

Sternum small, triangular or pentagonal.

Ocular tubercle in front of the middle of the carapace; 3 to 5 lateral eyes on each side.

The movable digit of the cheliceræ with the penultimate fang subequal to the terminal; its inferior edge armed with teeth; the lower edge of the immovable also generally armed.

The hands of the palpi are rounded and the digits long.

♂. With the tail and palpi usually longer and thinner or much thicker and scarcely longer; pectines longer; operculum divided in both sexes.

Distribution. Tropical and temperate countries.

Genera: *Prionurus*, Hempr. & Ehrenb.; *Buthus*, Leach; *Parabuthus*, Pocock (syn. *Heterobuthus*, Kraep.); *Grosphus*, Sim.; *Butheolus*, Sim. (syn. *Orthochirus*, Karsch); *Archisometrus*, Kraep.; *Isometroides*, Keys.; *Uroplectes*, Pet. (? syn. *Lepreus*, Thor., and *Tityolepreus*, Kraep.); *Tityobuthus* *, gen. nov.; *Pseudobuthus*, nom. nov.†; *Isometrus*, Hempr. & Ehrenb.; *Tityus*, C. Koch; *Centrurus*, Hempr. & Ehrenb.; *Heteroctenus*, Pocock; *Ananteris*, Thor.; *Charmus*, Karsch; *Heterocharmus*, Pocock; *Stenochirus*, Karsch.

In many respects this family, like the preceding, shows signs of relationship with the Iurini. One of the genera even—*Charmus*—was referred by its author to the latter subfamily of the Pandinidæ.

A few of the above genera are unknown to me and others I have not attempted to locate.

Timogenes and *Thestylus* are referred to the Bothriuridæ on the authority of Simon (Ann. Soc. Ent. Fr. 1880, p. 392 &c.).

Megacormus.—This genus was established by Karsch in Arch. Naturgeschichte, 1881, p. 17, for a species named *granosus* by Gervais. It was compared by Karsch to *Urodacus*. Possibly it belongs to the Chactini, but nothing is known respecting the armature of its feet.

Belisarius, Sim. (Arach. de France, vol. vii.), referred to the Ischnuridæ, should perhaps constitute a distinct family or subfamily.

Hoplocystis, of which there is a single species, *scintilla*, was characterized by Karsch (Abh. nat. Ver. Bremen, ix. p. 69, 1884), and was referred by its author to the Iurini. I would suggest, however, that it may be one of the Buthidæ. The locality is unknown.

Ioctonus of Thorell, from Australia, I have questionably united with *Urodacus*, principally relying upon the locality

* For *Rhoptrurus Baroni*, Pocock, from Madagascar, differing from *Rhoptrurus*, i. e. *Pseudobuthus*, at least in having a spur on the tibiæ of the legs of the third pair.

† For *Rhoptrurus*, Karsch, preoccupied by Peters for a snake.

and upon what is stated respecting the situation and structure of the ocular tubercle.

Ananteris, Thor., I have not seen. *Charmus*, *Heterocharmus*, and *Stenochirus* are, I suspect, identical.

PART II.—*Descriptions of new Genera and Species.*

Family **Buthidæ**.

Tityus asthenes, sp. n.

Upper surface of the trunk lurido-fuscous; tail fulvous, fulvo-brunneous towards its posterior end; legs, palpi, and lower surface flavous, with the exception of the digits which are fuscous.

The upper surface of the trunk much more finely granular than in *T. americanus*.

Tail longish and slender, about five and a half times the length of the carapace, the second segment about the same width as the fifth, the intercarinal spaces very finely granular, the keels not very strong, granular, the terminal granule of the superior keels not larger than the rest; the median lateral keel not present on the second segment; the vesicle a little narrower than the fifth segment, wider than it is high, with a large spine beneath the sting as in *T. americanus*.

Palpi long and slender, finely granular, and normally carinate; on the hand the external of the three keels which run from the immovable digit is entire as in *T. stigmurus* (Thor.); hands a little wider than the brachium, the digits long, slender, in contact, furnished with 14–15 median rows of teeth, the movable twice the length of the hand-back, longer than the fifth caudal segment, and much longer than the carapace.

Pectines furnished with 19 teeth, the basal intermediate lamella internally expanded. The sterna coriaceous, being studded with low smooth-topped granules.

Legs long; the lower surface of the feet studded with a few setæ.

Measurements in millimetres.—Total length 55, length of carapace 5·8, of tail 34; width of first segment 2·6, of fifth 2·3; length of fifth segment 7; width of vesicle 2, of hand 2; length of hand-back 4, of movable digit 8.

A single female example from Poruru (Peru).

This species belongs to the same category as *T. americanus*, but from this last-named it may be recognized by its much greater smoothness, difference in colour, slender tail, &c.

Tityus Quelchii, sp. n. (Pl. XIV. fig. 1.)

Closely allied to *T. columbianus* (Thor.).

Colour fulvous or flavous, nigro-maculate.

Carapace blackish laterally and mesially behind the black ocular tubercle, the interocular portion and the sides of the upper surface lurid and almost immaculate; the tergites with their posterior angles widely flavous, with two other conspicuous flavous spots along the posterior border on each side of the middle line; the tail obscurely variegated with fuscous patches and spots; the fifth segment and the vesicle much darker, sometimes uniformly fuscous; cheliceræ fuscous distally; palpi fusco-flavo-maculate; the brachium darker at its distal end and the immovable digit at the base; digits fusco-maculate; legs nigro-maculate; apices of the maxillary lobes of the first and second pairs of walking-legs fuscous. Sterna fulvo-brunneous, obscurely mottled with fuscous.

Carapace and *tergites* granular throughout; the sides of the ocular tubercle granularly carinate, and the carapace posteriorly bicarinate; tergites with a posterior median granular keel, and a curved transverse granular crest; the seventh tergite with the keel well developed.

Tail nearly parallel-sided, rather more than four and a half times the length of the carapace, the intercarinal spaces granular, the keels strong and granular; the second segment with only a posterior vestige of the median lateral keel, the superior keels of the second, third, and fourth segments strongly elevated behind and terminating in a larger tooth, the upper surface of the fifth weakly sulcate in the middle, nearly smooth behind, the edges squared and granular; vesicle compressed, much narrower than the fifth segment, smooth and punctured above, serially granular beneath, mesially carinate, the spine beneath the sting deep and compressed, very conspicuous, armed above with two spinules.

Palpi finely and closely granular throughout, all the normal keels well developed and granular; hand strongly carinate, rounded, a little narrower than the brachium; the movable digit long and slender, twice the length of the hand-back, furnished with 11–12 rows of teeth along the middle series.

Legs carinate and granular, the soles of the feet furnished with long closely-set hairs.

Sterna finely granular throughout, the fifth furnished with four granular keels, the fourth obsoletely bicarinate posteriorly, and the third furnished with a median posterior smooth polished area.

Pectines furnished with 15–16 teeth; the basal intermediate lamella not produced.

Measurements in millimetres.—Total length 40·5, length of carapace 4·8, of tail 23; width of second and fifth caudal segments 2·3, of vesicle 1·5.

Two female specimens from British Guiana collected by Mr. J. J. Quelch, to whom I have great pleasure in dedicating the species.

This species differs from *T. columbianus* in being paler in colour, especially beneath, but chiefly in having the spine on the vesicle of the tail very large and triangular.

The British Museum has also a dried specimen of a scorpion which I believe to be the male of *T. Quelchii*, from Para. In this specimen the tail is long and slender, being nearly six times the length of the carapace. The whole animal measures about 34 millim.

Tityus pusillus, sp. n.

♀. Nearly related to the preceding, but more distinctly spotted with black; the maxillary lobes, however, are not fuscous, and the fifth caudal segment and the vesicle of the tail are of the same tint as the rest of the tail and not conspicuously infuscate as in *T. Quelchii* and *T. columbianus*.

Trunk carinate and granular above as in the preceding species; the lower surface perhaps rather more coarsely and closely granular.

Tail a trifle more than five times the length of the carapace, slender, nearly parallel-sided, the fifth segment being only very slightly wider than the second; the vesicle a little more globular than in *T. Quelchii*, with proportionately larger tooth, but with much less distinctly defined granules; the fifth caudal segment also less distinctly granular, and the terminal tooth of the superior caudal keels is only a little larger than the rest upon the third and fourth segments.

Palpi and *legs* as in *T. Quelchii*, but with 14–15 rows of teeth along the middle series of the digit.

Pectines with 16–17 teeth, the basal intermediate lamella slightly produced.

Measurements in millimetres.—Total length 32, length of carapace 4, of tail 20+; width of fifth caudal segment 1·6, of vesicle 1·3.

♂. A little smaller and slenderer than female, with tail slightly longer, being a little more than five and a half times the length of the carapace. Pectines much larger, with 17–18 teeth.

Two specimens in alcohol, collected by Mr. G. A. Ramage at Iguarassu.

Family **Scorpionidæ**.

Subfamily *Ischnurini*.

Opisthocentrus, gen. nov.
(Pl. XIV. figs. 2 and 3.)

Differs from *Opisthacanthus*, Peters, of which *elatus*, Gervais, is the type, in that the anterior border of the carapace is less deeply excised, the lateral eyes less prominent and either subequally spaced or with the distance between the posterior and median greater than that between the median and anterior, in having only a small projection on the anterior aspect of the brachium, in having the genital operculum very much smaller, being shorter, in fact, than the side of the sternum, and much wider than long, in having the pectines narrower at the base, and the tactile area of the teeth limited to the posterior distal extremities of these organs.

Type, *O. africanus* (Simon).

I establish this genus for those species of *Opisthacanthus* that have been described from Africa. So far as my examination extends these African species differ in a number of characters from the South American form *Opisthacanthus elatus*. It may be that these characters are of small value in themselves, and it would be bold to assert that every one of them is of itself of generic importance. But the aggregate value of them all, coupled with the wide difference in the geographical distribution of the two types, is sufficient, I think, to justify the adoption of the view of their importance that is here put forward.

In *Opisthacanthus elatus* the carapace is deeply excised in the middle line, the lateral eyes are prominent, the space between the anterior and median being greater than that between the median and posterior; there is a large dentiform prominence upon the brachium as in *Ischnurus* and *Hormurus*; the genital operculum is large, being nearly as long as wide, and longer than the side of the sternum, in the female it is heart-shaped, being noticeably produced posteriorly; the pectines are generally very wide at the base, owing to the size of the basal intermediate lamella, and the teeth appear to have been rotated so that the tactile areas which generally look distally and externally are entirely external and extend over nearly the whole of the exposed surface of the organ (at least in the male).

Opisthocentrus africanus, Simon.

Opisthacanthus africanus, Simon, Bull. Soc. Zool. Fr. i. p. 221 (1876).
Opisthacanthus 7-dentatus, Karsch, Zeits. Naturwiss. 1879, p. 372; and Berl. ent. Zeits. xxx. p. 79 (1886); but not *Scorpio 7-dentatus*, Pal. de Beauvois, Ins. rec. en Afr. et Amér. &c. p. 191, pl. v. fig. 5 (1805).

This species seems to be not uncommon in the neighbourhood of the Congo. The British Museum has two examples ticketed Guinea, four ticketed Congo, seven from Cette Cama (Gaboon), and one from Stanley Falls.

Dr. Karsch, who has more than once discussed this species, can scarcely be congratulated upon the success of his attempt to establish its synonymy. This author made two suggestions on this head—firstly, that Simon had described as *africanus* the species named *Lecomtei* by Lucas, and secondly, that *Lecomtei* had been previously described as *septcm-dentatus* by Palisot de Beauvois.

The last view, however, is really too extravagant for serious discussion, for a glance at Palisot de Beauvois's figure is sufficient to show that the scorpion represented is a thick-tailed form which can have no near relationship with any of the genera of the *Opisthacanthus* group; while, brief though the description is, it nevertheless asserts quite plainly that the specimen examined had six eyes; and seeing that all the species of *Opisthacanthus* have eight eyes, we may without further comment dismiss the question and may pass on to consider the learned author's first supposition, namely, that *africanus* is a synonym of *Lecomtei*. But although this opinion is not, like the other, *primâ facie* absurd, it will nevertheless not bear the light of close criticism; for the description of *Lecomtei* fails to apply to specimens of *O. africanus* in one or two particulars—notably in the fact that Lucas's specimens had a larger number of pectinal teeth, a smooth carapace, and apparently the frontal lobes of the carapace more triangular and separated by a deeper excision. Perhaps these considerations left in Karsch's mind that element of doubt respecting the synonymy which is expressed by a mark of interrogation; but if so it seems a pity that without further light being shed upon the matter the questionableness of the accuracy of the synonymy should be apparently entirely forgotten before seven years were over. For in 1886 we find a species of *Opisthacanthus* described by Karsch and named as new *duodecim-dentatus*. This scorpion came from the same locality as *Lecomtei* and *africanus*; and it is, I should say, certainly distinct from the latter, with which, as 7-*dentatus*, Karsch compares it, entirely forgetting apparently the possibility of the existence of *Lecomtei*. As a matter of fact, the characters that are given to distinguish 12-*dentatus* from 7-*dentatus*, i. e. *africanus*, are precisely those which one would pick out as distinguishing *Lecomtei* from *africanus*. So that it is only reasonable to suppose that 12-*dentatus* is a synonym of *Lecomtei*, and such I shall consider it to be until evidence to the contrary is forthcoming.

Opisthocentrus Lecomtei (Lucas).

Ischnurus Lecomtei, Lucas in Thomson's Arch. Ent. ii. p. 428 (1858).
Opisthacanthus duodecim-dentatus, Karsch, Berl. ent. Zeits. xxx. p. 79 (1886).

This species, which like *africanus* is a West-African form, is unknown to me. Nevertheless there can, I think, be little doubt that the synonymy given above is correct (cf. *suprà* sub *O. africanus*).

This species differs from the preceding, *africanus*, as well as from the following *validus*, in having 10–12 pectinal teeth and a smooth carapace; possibly also in other characters which will be pointed out when specimens fall into competent hands for examination.

Opisthocentrus validus (Thor.).

Opisthacanthus validus, Thor. Act. Soc. Ital. p. 243 (1877).
Opisthacanthus capensis, id. ibid.
Hormurus diremptus, Karsch, Mitth. Munch. ent. Ver. 1879, p. 129.
Hormurus asiaticus, Keyserling, Die Arachn. Austral., Scorpiones, p. 24, pl. iii. fig. 1 (1885).

This species is evidently not uncommon in South Africa. Thorell's *validus* and Karsch's *diremptus* were from Caffraria, and the former author's var. *capensis* from the Cape of Good Hope. The British Museum has examples from S. Africa (*Drs. Smith and Quain*), Port Elizabeth (*Messrs. Leslie and Drège*), King Williamstown (*Mr. Trevelyan*), East London and Natal (*Mr. Howlett and Prof. Lankester*), as well as two others which are without history. One of these latter, a young form, agrees exactly with Karsch's description of *H. diremptus*. As for Keyserling's *H. asiaticus*, there can be no doubt that it is the same species, though the vague locality, East Indies, is in all probability erroneous.

This species varies a good deal in the colouring of its legs, the compression and denticular armature of its poison-vesicle, &c., and it is possible that it may ultimately be capable of being split up into several local forms.

It may be at once recognized from the W.-African *O. africanus* by its much smaller median eyes and the much greater development of the keels on the lower surface of the tail.

Opisthocentrus lævipes, sp. n.

Most nearly allied to *O. validus*, Thor.

Colour olivaceo-ochraceous; palpi more ferruginous; legs, lower surface, and vesicle pale ochraceous.

Carapace rather flat, finely punctured throughout, and finely granular behind at the sides and in front of the ocular tubercle; the anterior excision rather shallow; the frontal lobes not so triangular as in *validus*; *eyes* as in that species.

Trunk smooth, minutely punctured throughout; the last wrinkled; *sternites* also smooth and minutely punctured, the last furnished with a shallow groove.

Tail of the ordinary form, less than three times the length of the carapace, which is as long as the first two segments and half the third; its upper surface mesially grooved, weakly granular at the sides, but scarcely carinate except on the fourth; lateral surface smooth, punctulate, with an obsolete keel; the inferior surface distinctly keeled, the keels granular on the fourth, denticulate on the fifth; vesicle compressed, serially granular below.

Palpi rather flat; the normal keels coarsely granular, and the dorsal intercarinal spaces finely so; *hand* flatter than in *validus* or *africanus* and much smoother, the reticulated pattern finer and much less deep; hand-back considerably longer than the width of the hand, of which the inner border is lightly convex and coarsely and sharply tubercular; digits moderately long, the immovable more strongly bent at the apex than in *africanus* or *validus*.

Legs smooth and minutely punctulate; the femora of the anterior three pairs granular and carinate below.

Pectines furnished with eight teeth.

Measurements in millimetres.—Total length 97, of carapace 15, of tail 43·5; width of brachium 5·5, of hand 10·5; length of hand-back 13, of movable digit 14.

A single female example from the Sheba Mine, Transvaal, collected and presented by Dr. W. Percy Rendall.

The following synopsis of the African members of this genus will show some of the characters of the species recognized by me:—

a. Carapace smooth; pectinal teeth 10–12 .... *Lecomtei* (Lucas).
b. Carapace finely granular in parts; pectinal teeth 6–8.
  a^1. Median eyes very large; inferior caudal keels obsolete .... *africanus* (Sim.).

b^1. Median eyes smaller; inferior caudal keels retained.
  a^2. Carapace and palpi not so flat; hand coarsely reticulated above; femora of legs granular externally .... *validus* (Thor.).
  b^2. Carapace and palpi flatter; hand smooth and only finely reticulated above; femora externally smooth .... *lævipes*, sp. n.

Chiromachus, gen. nov. (Pl. XIV. fig. 4.)

Allied to *Opisthacanthus* and *Opisthocentrus*, but with the lower surface of the feet studded irregularly behind with long stiff setæ; the series of setæ diverging and becoming regularly arranged upon each side of the socket for the inferior claw.

In *Opisthacanthus* and *Opisthocentrus* the feet are armed below with two distally diverging series of spines.

Type, *C. ochropus* (C. Koch), of which the synonymy is, I believe, as follows:—

Chiromachus ochropus (C. Koch).

Ischnurus ochropus, C. Koch, Die Arachn. iv. p. 69 (1838), ♂.
Ischnurus asper and *chrysopus*, Peters, Mon. Ak. Wiss. Berlin, 1861, pp. 513–514, ♀.

This species appears to be an East-African form. The British Museum has six examples from Zanzibar, two without any history, and one which was brought from Round Island, near Mauritius, by Sir Henry Barkly.

Iomachus, gen. nov. (Pl. XIV. figs. 5 and 6.)

Allied to *Hormurus*, but differing in having the lower surface of the feet compressed and armed with a single series of spiniform teeth. The lateral setæ, which are characteristic of the feet in *Hormurus*, are fewer in number.

Type, *Hormurus læviceps* (Pocock), from S. India.

Subfamily *Urodacini*.

Genus Urodacus, Peters.

Urodacus, Peters, Mon. Ak. Wiss. Berlin, 1861, p. 511.
Iodacus, Pocock, Ann. Mag. Nat. Hist. (6) viii. p. 245.

Since establishing the genus *Iodacus*, I have found that the characters upon which it was based, namely, the longer sternum and flat hand, can scarcely be regarded as of generic importance, for an examination of recently received specimens of *U. novæ-hollandiæ* has shown that the length of the sternum is liable to considerable variation, and the new *Uro-*

dacus described below as *planimanus* reveals the same fact with respect to the flatness of the hand.

Urodacus abruptus, Pocock.

Urodacus abruptus, Pocock, Ann. Mag. Nat. Hist. (6) ii. p. 174.
Urodacus Keyserlingii, id. op. cit. viii. pp. 244, 245.

This species is smaller than *U. novæ-hollandiæ*, smoother, with more elevated superior caudal crests, a relatively stouter hand with weaker keels upon it. Moreover, the frontal lobes are rounder, separated by a deeper excision, and the ocular tubercle is shorter and better defined in front and behind.

This species seems to be common in S. and S.E. Australia. The type of the species (a dried specimen) came from Adelaide; but since it was described I have seen others in the Museum of Owens College, Manchester, which are ticketed Mt. Lofty, S. Australia, and Victoria.

One from the latter locality is a male, the sex which has not been hitherto described. It has 16–17 pectinal teeth, with a carapace measuring 6 and a tail 32 millim., the total length being 55 millim. A female from the same locality, measuring 63 millim., has the carapace 7·3 and the tail 31, and only 11 pectinal teeth; the genital operculum is very large, more than a semicircle, and longer than the sternum. This same form of genital operculum is shown in the types of *U. Keyserlingii*, a species which I now regard as identical with *abruptus*. In the male above referred to the superior caudal keels are elevated almost to the same extent as in *U. armatus*.

Urodacus planimanus, sp. n.
(Pl. XIV. fig. 7; Pl. XV. B. figs. 1, 1 *a*.)

Colour brunneo-ochraceous; legs, vesicle, cheliceræ, and lower surface paler.

Carapace a little shorter than the first two caudal segments, its anterior border deeply and abruptly mesially excised, the lateral eyes not prominent; the halves of the ocular tubercle terminating behind the eyes; the area between the median and lateral eyes polished and finely punctured; the rest of the surface finely granular.

Tergites finely granular, the last with two granular keels on each side.

Sternites smooth, polished, the last marked with two subcrenulate keels and very finely, closely granular posteriorly.

Tail four times as long as the carapace; posteriorly narrowed, compressed, slender, with finely granular intercarinal spaces, the keels finely denticulate; the upper keels of the first four segments elevated and terminating behind in strong teeth; the segments straight-sided, the first a trifle longer than wide, the second much longer than wide, the fourth twice as long as wide; the median lateral keel of the fifth extending throughout half the length of the segment; vesicle as wide as the second segment, wider than the third, fourth, or fifth.

Palpi, humerus, and *brachium* flattish, normally keeled, finely granular above, the brachium with a smallish bifid tubercle on its anterior aspect, and with 8–9 pores on its lower surface in front of the keel; *manus* less than twice as wide as the brachium, keeled as in *novæ-hollandiæ*, but flat above, the upper and external surfaces being at right angles to each other as in *U. Darwinii*, the lower surface also flat and furnished with a series of 8–9 pores; the length of the hand-back greater than the width of the hand, but a good deal less than the length of the movable digit; the digits in contact, elongate, the immovable with three pores above, the posterior of which is well on the digit, and four externally.

Legs finely granular, the femora granularly carinate beneath.

Pectines just reaching the extremity of the posterior coxæ, furnished with 14 teeth.

Genital operculum a little shorter than the sternum, its posterior border semicircular.

Measurements in millimetres.—Total length 64, of carapace 8·5, of tail 35; width of first segment 3, of fourth 2·7, of fifth 2·5, of vesicle 2·8; manus, width of the upper surface 4·5, height 3·3; length of hand-back 7·2, of movable digit 8·2.

Locality. "Within 30 miles of Perth, W. Australia" (*H. W. J. Turner, Esq.*).

At once to be recognized from all the hitherto described species of *Urodacus* by its flat hands and thin tail. In both these characters it approaches *U. Darwinii*; but easily distinguishable on account of being finely granular, in having strongly elevated superior caudal keels, &c.

Urodacus Woodwardii, sp. n. (Pl. XIV. figs. 8 and 9.)

Allied to *U. novæ-hollandiæ* and to *U. abruptus*.

♀. *Colour* ochraceo-ferruginous, palpi redder, legs yellower. Upper surface of the trunk very weakly granular, the tergites almost entirely smooth and polished.

Tail with the keels developed almost exactly as in *U. novæ-hollandiæ*, but the whole organ shorter, being only three and a half instead of four times the length of the carapace, and stouter, the segments more excavated above; *vesicle* much more globular than in *novæ-hollandiæ*, being wider, higher, and shorter; aculeus also shorter and rather more curved.

Palpi almost as in *novæ-hollandiæ*, but the hands more robust.

The following measurements in millimetres of the type of this species (A) and of an example of *novæ-hollandiæ* (B) of the same sex and nearly the same size will show the differences between the two species with respect to the size of the tail and hands:—

A. Total length 48·5, of carapace 6·8, of tail 26; length of tail-segments 1 to 5, 2·7, 3·1, 3·5, 3·8, 5·8; width of the same segments, 3·5, 3·1, 3, 2·7, 2·5; vesicle, width 2·6, height 2, length 3·3; length of aculeus 2·3; width of brachium 2·1, of manus 5·5; length of hand-back 5·1, of movable digit 6·5.

B. Length of carapace 7, of tail 29; length of tail-segments 1 to 5, 3, 3·5, 3·9, 4·2, 7; width of the same segments, 3·2, 3, 2·9, 2·7, 2·5; vesicle, width 2·4, height 1·9, length 3·8; length of aculeus 3; width of brachium 2·5, of manus 4·5; length of hand-back 5·6, of movable digit 6·2.

Unfortunately I have only the one specimen of *U. Woodwardii* for examination; but small examples of *novæ-hollandiæ* from Perth, both older and younger than the one measured, show similar differences to it from the type of *U. Woodwardii*. This species also differs from *novæ-hollandiæ* in being much smoother and in having the frontal lobes of the carapace more rounded. In both these respects, as also in the robustness of the hand, it approaches *U. abruptus*, but in the latter the superior caudal keels are more elevated and posteriorly spiniform.

A single female example from the Darling Range (north of Perth), collected by B. H. Woodward, Esq.

Family **Iuridæ**.

Subfamily *Iurini*.

Scorpiops Petersii, sp. n. (Pl. XIV. fig. 10.)

Scorpiops Hardwickii, Peters and Karsch (not of Gervais).

Colour blackish brown; feet, vesicle, and cheliceræ yellow, with a smooth yellow spot at the extremity of the upper edge of the femur and a similar spot on the anterior face of the second segment of the palpi.

Carapace granular throughout, but not coarsely, the median groove smooth; the anterior border deeply excised, with rounded lateral portions; the ocular tubercle small and low, the eyes also small and separated by a distance which is nearly twice a diameter; the distance between the posterior lateral eyes subequal, the posterior eye being a little further removed from the median than the latter is from the anterior.

Tergites studded in the posterior half with low smooth granules; a prominent subgranular median keel; the last furnished with 4 granular keels.

Sternites smooth, somewhat coarsely punctured and impressed, the last furnished with 4 weakly granular keels.

Tail nearly four times the length of the carapace, which is about as long as the first and second segments taken together, slender, posteriorly narrowed, all the segments except the first longer than wide, the fourth about twice as long as wide; the fifth segment about twice as long as the second; the normal keels well developed and coarsely granular, the spaces between them weakly granular, the terminal granule of the superior keels not enlarged; the median lateral keel complete on the first segment, just visible on the second, and extending throughout the anterior half of the fifth; the upper surface of the fifth nearly flat, with squared granular keels, the lower keels denticulate; the *vesicle* and *aculeus* a little longer than the fifth segment; the aculeus curved in its posterior half, about half as long as the vesicle; vesicle very large and swollen, a little wider than the second segment, its height equal to its width, coriaceous below.

Palpi large; humerus granular throughout, the keels sharp and coarsely granular, the anterior and posterior surfaces furnished with an extra abbreviated keel, which on the first is composed of about six sharp tubercles: brachium also granular, furnished with five strong granular keels, its anterior surface armed with two denticles, of which the inferior is considerably the larger; the lower surface furnished with a series of 7 setiferous pores: manus twice as wide as the brachium, the length of the hand-back about equal to that of the movable digit and less than that of the carapace, the manus granular throughout, its upper surface flat and bordered externally (behind) by a strong and internally by a weaker granular keel, which take their origin from the immovable digit, the external surface of the hand convex and carinate; keel of the hand-back strong and granular; the movable digit as long as the fifth segment of the tail, with a large lobe in the middle of its length, the immovable correspondingly notched.

Legs very finely granular.

Pectines short, furnished with 5 teeth.

Stigmata elongate, the aperture crescentic.

Measurements in millimetres.—Total length 68, of carapace 9, of tail 36·5; width of first segment 3·5, of fifth 2·5, of vesicle 3·5; width of brachium 3·2, of manus 6; length of hand-back 8, of movable digit 9·8.

Loc. Simla, in the Himalayas. Coll. Schlagintweit.

Two female examples, the one above described and a second smaller one measuring 47 millim., of which the carapace is 6·2 and the tail 24.

There are also two more adult female specimens of approximately the same size as the one described, but without localities. These are blacker in colour, with the palpi rather more robust. There is, in addition, a small example, the carapace of which measures only 5·5 millim., while the fingers are scarcely lobate and the manus is only one third wider than the brachium.

This species may be recognized from *Hardwickii**, of which the type is preserved in this Museum, by its much larger size, the average length of *Hardwickii* being 36 millim. (one example in the collection is 46 millim.), its thinner and longer tail, thinner hand, &c.

The specimens that I have described differ from those examined by Karsch in the proportions of the fifth caudal segment and in having the carapace about as long as the first two caudal segments. These differences, however, are, I suspect, merely sexual.

Scorpiops leptochirus, sp. n. (Pl. XIV. fig. 11.)

Colour nearly black; cheliceræ and vesicle infuscate, distal tarsal segment ferruginous.

Carapace weakly granular, the ocular tubercle shallowly cleft, the eyes on it rather large and separated by a space which is rather larger than a diameter; the lateral eyes distinct, the posterior the smallest and close to the median one.

Tergites studded with low, smooth, shining granules, a median granular keel; the last with 4 short weak keels.

Sternites smooth, the last furnished with 4 granular keels.

Tail robust, less than three and a half times the length of the carapace, which is almost as long as the first two segments and half the third, posteriorly attenuated; the second segment as long as wide, the fourth about one fourth longer than wide, the fifth not twice the length of the second, the normal keels well developed and granular, the intercarinal spaces weakly granular, these granules arranged in a reticulated pattern;

* ? Syn. *solidus*, Karsch.

the posterior granule of the superior keels a little larger than the rest and bifid; the median lateral keel complete and posteriorly down-curved on the first segment, represented by merely a few granules on the second, and extending over about two thirds of the fifth segment, the inferior keels of the fifth posteriorly denticulate. *Vesicle* of moderate size, about as high as wide and a little narrower than the fifth segment, finely granular or coarsely coriaceous below.

Palpi with the keels well developed and granular and with the intercarinal spaces closely and finely granular, the granules being arranged in a reticulated pattern; the humerus nearly smooth behind, its inferior keel absent distally and with only a few granules, forming a short upper crest on its distal half; the keels of the brachium granular; seven inferior piliferous pores and a single small inferior tubercle in front; manus rather narrow, not twice the width of the brachium, the hand-back a little shorter than the carapace but a little longer than the fifth caudal segment, shorter than the movable dactylus, which equals the carapace in length; the keels of the hands not strong, the external aspect of the segment convex, only weakly crested.

Legs externally weakly granular.

Pectines furnished with 6 or 7 teeth.

Measurements in millimetres.—Total length 49·5, of carapace 8, of tail 27·5; width of first segment 3·5, of fifth 2·5, of vesicle 2·3, of brachium 3, of hand 5; length of hand-back 7, of movable digit 8.

A single (probably female) example without locality.

Differs from *S. Petersii* in its stouter and shorter tail, narrower vesicle, larger eyes, less strongly carinate palpi, &c. From *S. Hardwickii* by the granular keels on the external surface of the brachium, narrower, less strongly crested hands, larger and closer eyes, &c.

Scorpiops longimanus, sp. n. (Pl. XIV. fig. 12.)

Colour (dried) a uniform dull brown.

Carapace as long as the anterior three caudal segments, somewhat coarsely and closely granular, with strong granular superciliary crests and strong crests on each side of the anterior groove; ocular tubercle cleft, the distance between the eyes a little greater than a diameter; lateral eyes distinct, the posterior a little nearer the median than the latter is near the anterior.

Tergites thickly and coarsely granular throughout, the keel conspicuous and granular; the last furnished with five granular keels.

Stergites smooth, the last furnished with four weakly granular keels.

Tail short, only about three times the length of the carapace, posteriorly attenuate, the second segment as wide as long and about half the length of the fifth; the keels developed as in the preceding species, except that the upper ones on the second to fourth segments have the terminal denticle enlarged and bifid; *vesicle* long, compressed, as wide as the fifth segment, as high as wide, almost smooth beneath.

Palpi long, the humerus about as long as the carapace; all the normal keels well developed and granular, the spaces between them also somewhat coarsely granular; brachium with ten pores on its lower surface and two very large and sharp teeth, as well as a few smaller ones on its anterior surface; hand not nearly twice as wide as the brachium, narrow, more than twice as long as wide, the hand-back nearly twice as long as the width of the hand and slightly longer than the carapace; the movable dactylus a little longer than the hand-back; the immovable digit nearly four times as long as it is wide at the base, the inner edge of the digits nearly straight.

Legs externally granular.

Pectines furnished with 8 teeth.

Length about 50 millim., of carapace 9·3, of tail 27·5; width of brachium 3·5, of manus 5; length of hand-back 9, of movable digit 9·8.

A single female example from Silhet.

This species appears to differ from *S. montanus* of Karsch in having the carapace and palpi coarsely instead of very finely granular, and in having the movable digit longer instead of shorter than the hand-back.

From *anthracinus*, Simon, it may be recognized by having ten pores on the lower surface of the brachium instead of nineteen, and from *S. Lindstroemii* and *lugubris* by having ten instead of fifteen of these pores.

Scorpiops Binghamii, sp. n. (Pl. XIV. fig. 13.)

Colour nearly black, the tergites obscurely spotted with ferruginous; the lower surface and the feet ochraceous or ferruginous, the vesicle ferrugineo-fuscous.

Carapace and *tergites* distinctly but not very coarsely granular, the superciliary crests pronounced; ocular tubercle cleft above, the eyes large and separated by a space that is about equal to a diameter; the postero-lateral eye the smallest, the space dividing it from the median eye greater than the space between the anterior and median eye and a little smaller than the diameter of the small eye. The median keel on the tergites rather weak, but the four granular keels on the last tergite strong.

Sternites smooth, impressed with large punctures; the last with four granular keels.

Tail constructed as in the preceding species, but rather stronger, being more than three times the length of the carapace, which is shorter than the first three segments by about one third of the third segment, and the second segment is wider than long, and the third as wide as long.

Palpi almost as in the preceding species, but with the keels weaker and not so strongly granular, while the intercarinal spaces also are less strongly granular; there are thirteen pores on the lower surface of the brachium; the length of the hand-back considerably exceeds that of the carapace and of the movable digit, these two being equal—it equals, in fact, the first three caudal segments; the digits are rather short, distinctly lobate and sinuate in their proximal half, the height of the immovable at the base being about one third of its length.

Legs externally granular.

Pectines large, with distinct fulcra and 9 teeth.

Total length 55 millim., of carapace 8, of tail 27; width of brachium 3, of hand 5; length of hand-back 9, of movable digit 7.

A single adult male from Central Tenasserim, collected by — Bingham, Esq.

This species, with its slender hands, strongly crested superior caudal keels, &c., belongs to the same category as *S. montanus*, Karsch, *anthracinus*, Simon, *Lindstroemii* and *lugubris*, Thorell, and *longimanus*, sp. n. It differs from *montanus* at least in having the carapace shorter than the anterior three caudal segments and in having the carapace considerably shorter than the hand-back. From *anthracinus* it may be recognized by having thirteen instead of nineteen pores on the brachium, from *Lindstroemii* and *lugubris* by having thirteen instead of fifteen pores, and from *longimanus* by having thirteen instead of ten pores, &c.

Anuroctonus, gen. nov. (Pl. XIV. figs. 14 and 15.)

Allied to *Uroctonus*, Thorell, but differing at least in having a single tooth instead of a series of teeth on the lower edge of the movable digit of the cheliceræ.

Type *Anuroctonus phæodactylus* (Wood).

Of this species I have seen a single specimen (female, with normal aculeus) from Virginia, belonging to the collection of Owens College, Manchester.

It is a singular thing that Dr. Karsch, who has seen this species, referred it to *Uroctonus*, and characterizes *Uroctonus* as having a series of teeth on the lower border of the digit of the chelicerae. Dr. Marx also referred it to *Uroctonus*. But I cannot see any series of teeth at all comparable to the series presented by *Uroctonus*. On the contrary, there is only one tooth, not so large it is true as the one in *Hadrurus*, but occupying the same position, and the edge in front of this may be finely roughened; but there is no structure presented that I should call a series of teeth.

Of course a solution to the difficulty is that I have examined a species which is not *phæodactylus*. I cannot, however, without further evidence bring myself to believe this, on account of the closeness of the application of Wood's description to my specimen.

HADRUROIDES, gen. nov. (Pl. XIV. figs. 16 and 17.)

Allied to *Caraboctonus*, Pocock, but recognizable by the dentition on the digits of the chelæ.

In *Caraboctonus Keyserlingii* the median series consists of a few (six) longitudinal slightly overlapping rows of denticles, the posterior denticle of each being enlarged, while on the inner side of the anterior extremities of each row there is a large tooth, all the large teeth together forming an inner series. This arrangement is well shown in fig. 21, pl. lxxxiii. vol. ii. of the Trans. Zool. Soc.*

In *Hadruroides* the dentition is on the same plan as in *Caraboctonus*, but the large teeth of the inner series are further back from the ends of the median rows, and close to the latter on the outer and inner side are a few (two or three) supernumerary denticles.

Type *Hadrurus charcasus* (Karsch).

On p. 92 of the August number of the 'Annals' for this year I referred *H. charcasus* of Karsch to *Caraboctonus*. But the dentition of the chelæ seems to me to be of sufficient importance for the establishment of a genus †. The species in the Museum identified as probably *maculatus* or *robustus*,

* In fact there can be no doubt that the "*Telegonus* from Coquimbo" mentioned and figured by Prof. Lankester in this paper is the specimen I have made into the type of *Caraboctonus Keyserlingii*. Further details are represented on pl. lxxxii. figs. 4, 12, and 16, and pl. lxxxiii. figs. 7 and 19.

† The differences between *Caraboctonus* and *Hadruroides* are strictly comparable to those that obtain between *Centrurus* and *Tityus*.

and also referred (*ibid.*) to *Caraboctonus*, I now transfer to this new genus. I may mention that, in addition to the clothing of the soles of the feet, both *Caraboctonus* and *Hadruroides* differ from *Hadrurus* in having the ocular tubercle in front of the middle of the carapace.

EXPLANATION OF THE PLATES.

Plate XIV.

Fig. 1. *Tityus Quelchii*, sp. n. Vesicle.
Fig. 2. *Opisthacanthus elatus* (Gerv.). Sternum and operculum of male.
Fig. 2 *a*. Ditto. Ditto of female.
Fig. 3. *Opisthocentrus africanus* (Sim.). Sternum and operculum of male.
Fig. 3 *a*. Ditto. Ditto of female.
Fig. 3 *b*. Ditto. Foot, side view.
Fig. 4. *Chiromachus ochropus* (C. K.). Foot, side view.
Fig. 5. *Iomachus læviceps* (Pocock). Foot, side view.
Fig. 6. *Hormurus de Changei* (Becker). Foot, side view.
Fig. 7. *Urodacus planimanus*, sp. n. Hand.
Fig. 8. *Urodacus Woodwardii*, sp. n. Vesicle from the side.
Fig. 8 *a*. Ditto. Vesicle from below.
Fig. 9. *Urodacus novæ-hollandiæ*, Pet. Vesicle from side.
Fig. 9 *a*. Ditto. Vesicle from below.
Fig. 10. *Scorpiops Petersii*, sp. n. Hand.
Fig. 11. *Scorpiops leptochirus*, sp. n. Hand.
Fig. 12. *Scorpiops longimanus*, sp. n. Hand.
Fig. 13. *Scorpiops Binghami*, sp. n. Hand.
Fig. 14. *Anuroctonus phæodactylus* (Wood). Dentition of digit of chela.
Fig. 14 *a*. Ditto. Dentition of movable digit of chelicera.
Fig. 14 *b*. Ditto. Foot.
Fig. 14 *c*. Ditto. Vesicle.
Fig. 15. *Uroctonus mordax*, Thor. Dentition of movable digit of chelicera.
Fig. 16. *Hadruroides charcasus* (Karsch). Dentition of digit of chela.
Fig. 17. *Caraboctonus Keyserlingii*, Pocock. Dentition of digit of chela (after Lankester).

Plate XV. B

Fig. 1. *Urodacus planimanus*, sp. n. Foot from the side, to show the lobes and the spine armature.
Fig. 1 *a*. Ditto. Foot from below, to show the single spur characteristic of the Scorpionidæ.
Fig. 2. *Hemiscorpius lepturus*, Peters. Foot from below, showing spur and spine armature.
Fig. 3. *Iurus Dufoureius* (Brullé). Foot from below, to show the two spurs and the hairy clothing.
Fig. 4. *Chærilus variegatus*, Sim. Foot from below.

BIBLIOGRAPHICAL NOTICE.

A Classed and Annotated Bibliography of the Palæozoic Crustacea, 1698–1892, *to which is added a Catalogue of North-American Species.* By Anthony W. Vogdes. 8vo. 412 pages. San Francisco, California Academy of Sciences, June 1893.

In the 'Annals and Magazine of Natural History' for April 1890 a short notice was given of a "Catalogue of the North-American non-Trilobitic Palæozoic Crustacea" prepared by the same Author (Captain A. W. Vogdes, of the U.S. Artillery), who has now supplied Palæontologists with the elaborate and careful Bibliography before us, to which the Trilobites of North America are added in a full and lucid catalogue, as well as an augmented list of the other palæozoic Crustacea of that region.

A preparatory edition appeared in the 'Bulletin of the United-States Geological Survey,' No. 63, 8vo. Washington, 177 pages.

The later and far more complete work has been brought out as No. iv. of the "Occasional Papers of the California Academy of Sciences," and is a highly creditable result of the Author's painstaking enthusiasm, and of the Academy's well-directed liberality.

Part I., the "Bibliography" itself, occupies pages 3–252, giving the Authors' names alphabetically, with the titles of the papers, place of their publication, &c., and a full list of the species therein treated of. This is very satisfactory, though misprints occur here, and there are some *errata* besides those mentioned at page 413. There is an appendix to the Bibliography at pp. 409–411. Useful notes are given in many cases as to the memoirs or some portions of their contents.

In Part II. we have a good "Catalogue of North-American species of Trilobites" (pages 259-360), preceded by "A Systematic Classification of the Genera" (pp. 253–258), with the names of Authors, formations, and types, reference to publications, and dates. The names of genera, with synonyms, sections, and subgenera, are carefully distinguished in the printing; and the references, geological stages, and localities appear to have been very carefully attended to. The genera are arranged alphabetically.

In Part III. a "Catalogue of North-American non-Trilobites" occupies pages 369–408; and a classification of the "Merostomata, Phyllocarida, Bivalved Entomostraca, Isopoda, Cirripedæ, Decapoda, Schizopoda, Amphipoda, Stromapoda," precedes it, at pp. 361–369. These are all of Palæozoic age, and their grouping is to some extent provisional. The non-Trilobitic Crustacea found fossil in North America are enumerated on the same plan, and with equal care and precision, as the Trilobites referred to above.

Altogether this bibliographic work on the Palæozoic Crustacea is to be welcomed by Geologists both at home and abroad. The scrupulous care of the Author has raised it far above the level of some catalogues of fossils; and his conscientious and modest nature leads him to recognize the probable requirement of cautious corrections and additions, which he has asked his readers and fellow-workers to supply him with as far as they can. In the meantime we thank him for this excellent Bibliography, and the California Academy for issuing it to the world.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 21, 1893.—Dr. H. Woodward, F.R.S., Vice-President, in the Chair.

The following communications were read :—

1. "On Two Dinosaurian Teeth from Aylesbury." By R. Lydekker, Esq., B.A., F.G.S.

Two teeth from the neighbourhood of Aylesbury, believed to be of Portlandian age, may be referred to the same species as is a tooth figured by De La Moussay from the Portlandian of Boulogne. The Aylesbury teeth are described in the paper, and the nature of the animal which possessed them is discussed.

2. "On a new Plesiosaur from the Waipara River, New Zealand." By Capt. F. W. Hutton, F.R.S., F.G.S.

This specimen was shortly described by Sir James Hector in 1873. The Author considers it more prudent to follow Mr. Lydekker in referring all the known New Zealand Cretaceous Sauropterygians with which he is acquainted to Leidy's genus *Cimoliosaurus*, and he therefore describes this form as a new species of that genus.

3. "Observations on the Affinities of the Genus *Astrocœnia*." By Robert F. Tomes, Esq., F.G.S.

Researches recently made by the Author relative to the structure of certain undoubted *Astrocœniæ* of the Gosau beds, having for their primary object the better understanding of the supposed species of the genus obtained from the Glamorganshire conglomerate, have been productive of results which will render a complete modification in the classificatory position of the genus imperative.

The Author gives a new definition of the genus, in which he does not at present include any species of an earlier date than the Cretaceous period, all the so-called Jurassic *Astrocœniæ* being referable to other and quite distinct genera.

4. "Description of a new Genus of *Madreporaria* from the Sutton Stone of South Wales." By Robert F. Tomes, Esq., F.G.S.

In the Quarterly Journal for 1885 is a detailed description of a coral from the Sutton Stone named *Astrocœnia gibbosa*. This specimen is not the type of the species, and a re-examination of it by the Author has proved that it is not an *Astrocœnia*. Two other specimens have also been examined, and as a result of examination of the three the Author is enabled to found a new genus *Styloseris*, of which a diagnosis is given, and the specific name *gibbosa* is retained for this, the only known species. The genus will take its place near *Clausastræa*, from which it differs by possessing a well developed columella and increasing by both fissiparity and gemmation.

5. "On Cheilostomatous Bryozoa from the Middle Lias." By Edwin A. Walford, Esq., F.G.S.

The Author describes some forms of Bryozoa from the *spinatus*-zone of the Middle Lias near Banbury, some of which had previously been classed with the Cyclostomata. The new material not only shows the opercular aperture but the opercula *in situ*, together with appendages and supra-oral ovicells characteristic of the Cheilostomata. In addition he has also found giant cells (cistern-cells) of form quite dissimilar from the ordinary zoœcia and probably reproductive. He cites M. Jules Haime as having described in his magnificent monograph somewhat similar cells from the Inferior Oolite; and in the Oxfordshire Great Oolite Bryozoa Mr. Walford has found cistern-cells like the Lias species on some colonies like *Diastoporæ*. He contends that it is merely the acquisition of very well-preserved material which is needed to show the necessity of removal of many such species to the Cheilostomata. The name *Cisternophora* is suggested for the genus, of which several forms are described.

MISCELLANEOUS.

On Hybrids or Mongrels with two Male Parents.

Mr. Herbert Spencer, in the 'Contemporary Review' for March, enters at some length into the evidence concerning the possible influence of one male parent on the offspring of another male by the same female. This question was discussed by Darwin, and the best-authenticated instances are well known; but, granting the validity of the evidence, the explanation given—that the sexual elements of the first male parent modified the somatic cells of the female—is surely not sufficiently proven to admit of the phenomenon being adduced as fatal to Weismann's hypothesis.

Sir John Lubbock (Journ. Linn. Soc., Zool. xx. p. 133) has published an instance among ants, in which it appears that the spermatozoa retained their life and energy in the body of a female for no less than thirteen years. Therefore it is possible to imagine that the male elements of the first parent really fertilized the ovum, giving rise to the supposed offspring of the second parent, although, for various reasons which need not be entered upon, this seems highly improbable.

But it does not seem so improbable that they may have *partly* fertilized it. Strasburger has shown that among plants the pollen of a species very diverse from that which he attempted to fertilize with it would frequently produce a certain amount of growth in the ovum, resulting in an aborted embryo, which would never have been noticed had not special attention been paid to the subject. Now it seems conceivable that a spermatozoon of an earlier male, which was for any reason unable to produce a perfect embryo, might enter an ovum without destroying it or causing it to develop, and that the ovum might afterwards be fertilized by a perfect spermatozoon of another male, and develop accordingly. The germ-plasm derived from the first and apparently ineffectual spermatozoon would account for the result as recorded, and the hybrid or mongrel animal would, in fact, have two fathers.

This is hypothetical, of course; but, while waiting for further proof, it may be permissible to set hypothesis against hypothesis.

T. D. A. Cockerell.

Las Cruces, New Mexico, U.S.A.,
Aug. 3, 1893.

On the Identity of the "Cotton Spinner" (Holothuria nigra) *of English Authors with* Holothuria Forskalii, *Chiaje, and on the Occurrence of* Cucumaria Koellikeri, *Semp., in the Atlantic Ocean.* By Dr. Emil von Marenzeller.

The following observations were evoked by the examination of certain Holothurians which were collected off Sines, on the coast of Portugal, and for which I am indebted to the kindness of Prof. Paulino d'Oliveira, of the University of Coimbra. The collection comprised specimens of *Holothuria Forskalii*, Chiaje, *Cucumaria Koellikeri*, Semp., and *Cuçumaria Montagui*, Flem.

Holothuria Forskalii (to which species Ludwig justly assigned *H. cataniensis*, Gr.) was first shown to exist in the Atlantic Ocean in the year 1882 by Greeff. The author referred to found the species in Setubal Bay, while in 1890 Hérouard reported it as occurring at Roscoff. This Holothurian, which is characterized by its external appearance, by the slight development of the calcareous bodies, and the possession of Cuvierian organs, had, however, already been observed long before on the British coast, especially in the West of Ireland, and had been designated "the Nigger or Cotton Spinner" (*Holothuria nigra*). Anyone may convince himself of the justice of this view by comparing the calcareous bodies of *H. Forskalii* with the figures of these structures in *H. nigra* given by Jeffrey Bell ('Catalogue of the British Echinoderms,' London, 1892). For my part I was also able to compare preparations of calcareous bodies furnished to me by the Rev. Canon A. M. Norman, and derived from a specimen of *H. nigra* from Polperro, Cornwall. That this state of affairs, which is interesting from the point of view of animal distribution, remained so long undiscovered, is probably to be ascribed to the insufficiency of the earlier descriptions of *H. nigra*, as well as to the fact that the animals themselves did not come into the hands of those investigators who were acquainted with *H. Forskalii*. Moreover, *Stichopus Selenkæ*, described by Th. Barrois in 1882 from Concarneau, is certainly nothing else than *H. Forskalii*. The difference shown in the representation of the calcareous bodies will receive correction. It appears that in the Atlantic Ocean *H. Forskalii* does not attain so large a size as in the Mediterranean.

Cucumaria Koellikeri, Semp., hitherto known only from Sicily and Naples, has likewise under another name figured for some time past as a member of the Holothurian fauna of the Atlantic. I regard *Cucumaria Lefevrii*, Th. Barrois (1882), from Concarneau, as the same species, though certainly the figures of the calcareous bodies do not justify this supposition. I have already explained in my memoir on the Holothurians of the 'Hirondelle,' at present in the press, that it is not advisable to follow Hérouard ("Recherches sur les Holothuries des côtes de France," Arch. Zool. Exp. [2] vol. vii. 1890) in regarding *Cucumaria Lefevrii*, with ten tentacles, as synonymous with Thompson's old species *C. Drumondii*, which is now assigned to the genus *Phyllophorus*. Since I have in the meantime learned to know the species, I can now also protest against Hérouard's attempt to regard *Thyone gemmata*, Pourt., of the American coasts, as of the same value. In the determination of *C. Koellikeri*, Semp., from Sines, I used an original specimen which belonged to Semper.

Cucumaria Montagui, Flem. (=le Fleurilardé, Dicquemarre, 1778;=*Colochirus Andersoni*, Lampert, 1885;=*Colochirus Lacazei*, Hérouard, 1890), was represented by three quite young specimens measuring from 4 to 8 millim. in length. Jeffrey Bell (*loc. cit.*) has not recognized this conspicuous species, which also occurs on the coasts of Great Britain. I have set forth its synonymy at length in my memoir alluded to above. The examination of these young specimens has decided me to give a new, and perhaps finally satisfactory solution of the question as to what Forbes ('A History of British Starfishes,' London, 1841) understood by his "*Psolinus brevis*." The choice of the generic name proves that Forbes wished to draw attention to the contrast between the dorsal and ventral surface, which distantly recalled *Psolus*. It is precisely this peculiarity that distinguishes *C. Montagui*, and this it was also that misled Lampert and Hérouard, so as to make them think of *Colochirus*, since in the species of this genus the feet are confined to the ventral surface. The sole difference between the contracted young specimens of *C. Montagui* from Sines and the figure of *Psolinus brevis* drawn from life, consists in the fact that in the former the feet are more numerous and are not arranged in a single row. It is well known that Lütken referred *Psolinus brevis* to *Cucumaria* (*Ocnus*) *minuta*, F.—*Sitzgs.-Ber. k. Akad. Wiss. Wien, math.-naturw. Classe*, Jahrg. 1893, no. xii. pp. 107–109.

On the Habits of Blennius sphynx, *Cuv. & Val., and of* Blennius Montagui, *Fleming.* By M. Frédéric Guitel*.

The construction of the great experimental fish-pond, recently added to the laboratory at Banyuls-sur-Mer, has enabled me to make certain observations which I had vainly endeavoured to carry out

* The observations here described were made at the zoological laboratory at Banyuls-sur-Mer (Pyrénées Orientales).

successfully hitherto. A large number of littoral animals, finding in this pool a safe shelter from the rough sea, have come to choose their abode in it; they are found there under conditions exceptionally favourable for uninterrupted observation. *Blennius sphynx* is a case in point. Many individuals belonging to this pretty species have made their way into the basin in order to construct their nests in it. Some have chosen the holes with which the schist forming the sides is pierced in all directions; others have established themselves in the tunnels bored by the *Teredos* in the timbers which have been utilized for the construction of the coffer-dams.

The male of *Blennius sphynx* selects as the locality of his nest a little cavity with a narrow opening, just large enough to allow his body to pass through. His pretty head, which is black striped with blue, and surmounted by two graceful yellow horns, alone projects from the hole, and the little creature remains constantly on the watch in this position; as soon as he espies a female searching for food among the surrounding algæ, he raises himself halfway out of the nest, while his spiny dorsal fin, which is greatly elevated and very vividly coloured, assumes a vertical position; he imparts to the anterior portion of his body a vertical swaying motion, undoubtedly with the object of attracting the female. If the latter does not respond to this invitation, the male leaves the nest and goes to meet her. His colours become extremely vivid, and his head suddenly darkens, which again causes the blue streaks with which it is adorned to stand out more sharply; the black, yellow, and blue bands on the sides of his body acquire a brilliancy of striking effect, and he darts suddenly upon the female, at the same time again erecting his magnificent dorsal fin.

These demonstrations do not always succeed in ensuring the success of the little male; but, if his appeals are listened to, the female enters the nest and soon commences to deposit her eggs, which adhere to the walls of the nest by means of delicate filaments of a glutinous nature and follicular origin, attached to the base of the shell around the micropyle. During the whole of the time occupied by the spawning the male is the victim of intense excitement. He cruises around his hole to keep watch on its approaches; when the female, who is completely hidden within the nest, allows her head to be seen and makes a show of wishing to escape, he flies at her and bites her in order to force her to reenter. From time to time he penetrates into the nest; he is seen to move rapidly and then to undergo a sort of violent shudder, accompanied by a slight forward movement, which corresponds to the emission of the semen destined for the fertilization of the ova which have been deposited.

The scenes which I have just described are repeated until, spawning being completed, the female abandons the nest to return to it no more. The male, who is polygamous, remains as the faithful guardian of the ova deposited by the different females which he receives in his domicile, and acquits himself of his task with surprising perseverance and tenacity.

I have captured males guarding their ova and transported them into a tank of the aquarium. When, after the lapse of fourteen and even eight and twenty hours, I have brought them back to within a short distance from their abode, they have always found it again. I have taken a male watching over his offspring and set him at liberty forthwith, at a distance of 12 metres from the floating plank in which he had established his nest; this plank was surrounded by a large number of others, pointing in all directions and immersed at different levels; nevertheless, after a certain time, he was back again at his post. Another male, placed in the same conditions, was transported to a distance of 28 metres from his nest, and returned to it an hour and a half afterwards. A third, in order to return to his ova, was obliged to cross the pool, which is 50 metres wide. These facts, and others besides which I shall shortly publish, indicate in *Blennius sphynx* a very great development of memory and an attachment to his ova which is quite remarkable.

If sand, gravel, shells, or objects of any kind be introduced into his dwelling or placed so as to block up his door, the male removes them to a distance by carrying them in his mouth.

He always enters his hole backwards, first introducing into it the extremity of his tail, upon which he proceeds to haul by bending it so as to gain a hold upon the walls of his dwelling. He savagely pursues the shrimps, which infallibly devour his ova if he is imprudent enough to leave them too long. He also furiously chases the fish which pass near his hole, especially the other males, and follows and bites them, if they do not flee to a sufficient distance.

To witness a battle it is not necessary to await the advent of another male. As a matter of fact, if we take a mirror and alternately bring it near to and withdraw it from the guardian of a nest, we easily succeed in convincing him that he is attacked by one of his fellows; he then issues from his retreat, and flies at his own image, striking his snout violently against the mirror, and does not cease until his imaginary adversary is withdrawn.

Blennius Montagui is very abundant at Banyuls-sur-Mer. It is easily captured with the hand on searching the clefts of rocks at no great depth, which are clothed with shore sea-weeds. My observations, made in April 1892, were conducted upon specimens living in captivity in a tank of the aquarium at the Arago laboratory.

The male, like that of *Blennius sphynx*, is alone burdened with the care of the ova. He establishes his nest beneath a stone which is hollowed out on the underside.

When a gravid female passes near his domicile, he darts towards her, agitates his whole body very rapidly in order to attract her attention, and even brushes her with the tip of his snout; if he is unsuccessful he returns to his nest: he constantly raises and lowers the whole anterior portion of his body, and sways at the same time to the right and left; then he returns towards the female, and excites her afresh. If the latter allows herself to be tempted, she enters the nest with him, turns over with her ventral side uppermost, and deposits her ova on the roof of the nest, in a layer which covers a large area of it.

During this time the male, remaining at her side, leans and rubs himself gently against her; then, all at once, he himself turns over towards the ceiling of the nest, his tail waves with a regular motion, and finally a tremor accompanied by a slight forward movement agitates his whole body. This is recognizable as the genital spasm.

On the conclusion of the spawning, the female abandons the nest while the male remains as the assiduous guardian of it. He keeps his pectoral fins and tail continually in motion to ensure the constant renewal of the water. He furiously pursues the other fish which pass too near him: if one of them, even much larger than himself, happens to penetrate into his nest, he bites and worries it until it takes to flight.

Blennius Montagui is extremely careful as to the cleanliness of his abode; he carries away to a distance all foreign bodies which enter it, driven by the currents. Nothing is so curious as to see him seize with his mouth large fragments of shells, and carry them to the furthest possible distance from his nest. It is impossible to succeed in tiring out his patience; he casts outside his dwelling all foreign bodies introduced by the observer.

The females spawn several times during the same season, and the same male fertilizes the ova of several different females. The male guards his progeny only so long as the incubation of the ova lasts; the embryos on hatching are left to themselves and live in the open water.—*Comptes Rendus*, t. cxvii. no. 5 (July 31, 1893), pp. 289–291.

A Synopsis of the European Newts.

By Dr. J. von Bedriaga, of Nice.

Since the publication of my detailed treatise upon the Urodele Amphibia of Europe will still take some time, I venture to bring forward at once a systematic arrangement of our species of *Molge*. In so doing it is my intention to lay stress chiefly upon permanent differences, and I shall endeavour to disregard secondary sexual characters.

Several years ago Leydig and later Boulenger alluded to constant specific characters in the case of certain Urodela. Nevertheless batrachologists do not yet seem to have succeeded in discovering in the case of all our species of newts characters which are at all times recognizable and common to both sexes, since in all analytical tables we are invariably confronted with the time-honoured enumeration of secondary sexual characters, as well as of sexual peculiarities which are subject to periodical changes. Moreover, owing to the fact that features belonging to the last-mentioned category occur more especially in the male sex, we acquire in the majority of cases no conception of the specific type, but rather obtain a complex of characters which merely serves for the definite determination of the male individuals. The characteristics upon which an empirical distinction of the females was based had, as is well known, in many cases to be sought in the coloration, size, and shape of the entire body and of various parts. It is scarcely necessary for me to point out that differences of this kind, although easy to see, are sometimes difficult to express in words.

It is true that in the males of *Molge* the specific characters, especially at the breeding-season, are considerably more prominent than in the females; moreover, they catch the least practised eye, and I readily admit that it is extremely difficult to escape from the beaten path of many systematists and to strike out a new way in order to preserve the conception of the species. The fact is that the males of *Molge* possess a pronounced tendency towards variation, and that this inclination expresses itself especially in the development of their nuptial characteristics; while the females exhibit isolated instances of variability, in general possess a limited capacity for seasonal variation, rather incline to the preservation intact of their primitive characters, and in consequence of this, moreover, check rather than facilitate the development of the specific type.

Cases of dimorphism in the one sex are known in our species of *Molge*. *Molge vulgaris*, L., and var. *orientalis* vel *meridionalis* are forms which are distinguished solely by the difference in the nuptial equipment of the males; and it almost appears that in the case of the males modifications of the nuptial dress occasion the dimorphism of that sex, and that this dimorphism may lead to the formation of two species. On the one hand a nuptial dress, a tendency of the males to vary, and a dimorphism of the male sex in the spring give rise to specific characters which are obvious, although sometimes temporary, while on the other a want of special nuptial characters and an absence of the impulse which leads to variation produce females which remain almost alike and of similar aspect. Owing to this circumstance the attempt to draw up a series of characters which shall be really serviceable, permanent, and common to both sexes is fraught with unusual difficulty.

The following table will perhaps induce those who are interested in the subject to take up for themselves the question which has been raised and to lend us their aid and advice. It is absolutely necessary that we should at last be able to satisfy ourselves as to the reasons why this *post nuptias* male must be called *Molge Boscai* rather than *M. Montandoni* and why that female is termed *M. palmata*.

Table for the Determination of the Species.

I. The strongly developed process of the frontal unites with the squamosal or its anterior process, and constitutes an ossified, or partly cartilaginous, partly bony, arch bridging over the orbit.

A. An unpaired septum cartilagineum nasi arises from the ethmoidal plate, and extends as far as the inferior opening of the cavum internasale.

Vomero-palatine rows of teeth extending beyond the choanæ anteriorly. *M. Waltli*, Michah.

Vomero-palatine rows of teeth not extending beyond the choanæ.... *M. aspera*, Dugès.

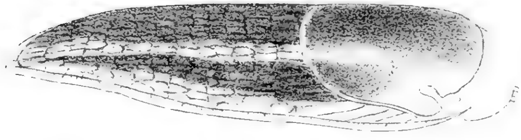
B. The parts which constitute the cavum internasale extend as far as the ethmoidal plate, and represent a completely or almost completely osseous septum nasale.
  a. Quadrate directed backwards. Anterior process of the squamosal almost or precisely as long as the frontal process .... *M. Rusconii*, Gené.
  b. Quadrate directed forwards or downwards. Anterior process of the squamosal shorter than the frontal process.
    1. Pterygoid reaching the upper jaw ("Oberkieferjochbogen"); internasal space about as wide as the basal breadth of the three longest toes .... *M. Boscai*, Lataste.
    Internasal space considerably narrower than the basal breadth of the three longest toes .... *M. Montandoni*, Blgr.
    2. Pterygoid not reaching the upper jaw .. *M. palmata*, Schneid.

II. The slightly developed or somewhat long frontal process is connected with the squamosal or its anterior process by means of a ligament.
  Gular fold wanting. Anterior region of the head much flattened. Internasal space as wide or somewhat wider than the interpalpebral space, equalling the distance from the eye to the nostril, and greater than the length of the second finger (measured on the outside) .... *M. montana*, Savi.
  Gular fold distinct. Anterior region of the head very convex. Internasal space narrower than the interpalpebral space, less than the distance from the eye to the nostril, and shorter than the second finger (measured on the outside).
  Belly unspotted .... *M. alpestris*, Laur.
  Belly spotted.
    a. The first finger reaches at the most to the anterior end of the first phalanx of the second .... *M. vulgaris*, L.
    b. The first finger extending beyond the anterior end of the first phalanx of the second.
      Belly yellow or orange-yellow, with dark spots .... *M. Blasiusi*, de l'Isle.
      Belly brownish or grey-brown, with more or less distinct dark spots .... *M. marmorata*, Latr.

III. No connexion between the scarcely indicated process of the frontal and the squamosal. *M. cristata*, Laur.

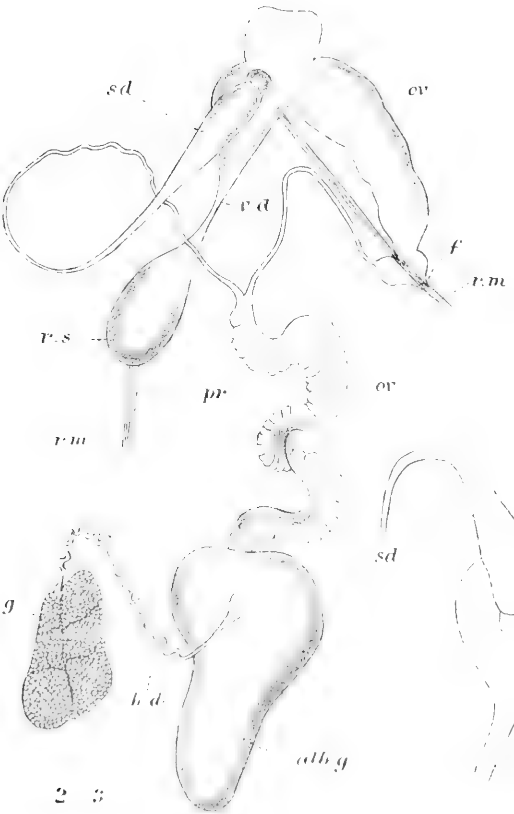
Nice, April 20, 1893.

—*Zoologischer Anzeiger*, xvi. Jahrg., no. 421, June 12, 1893, pp. 214–216.



1. ×1½.

3. ×9

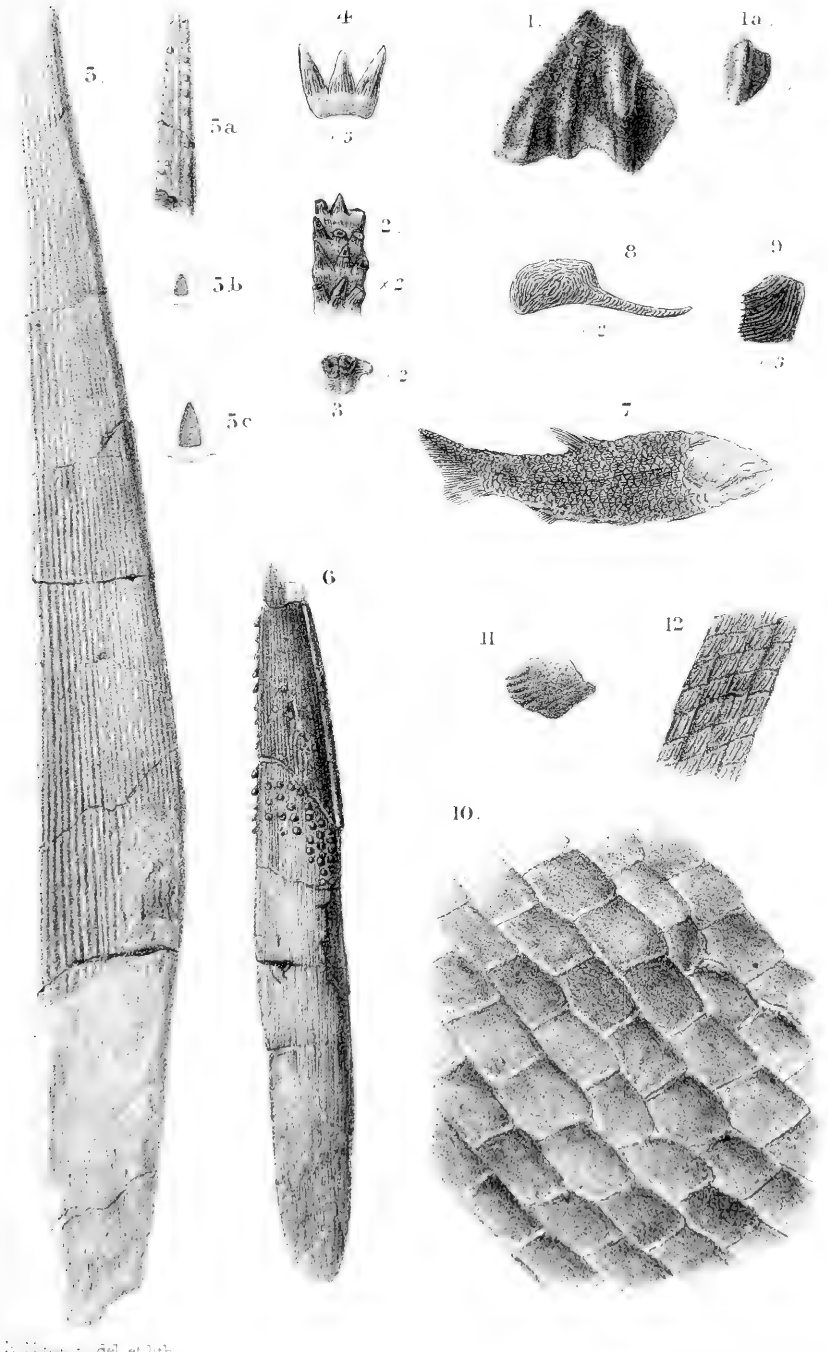


2 ×3

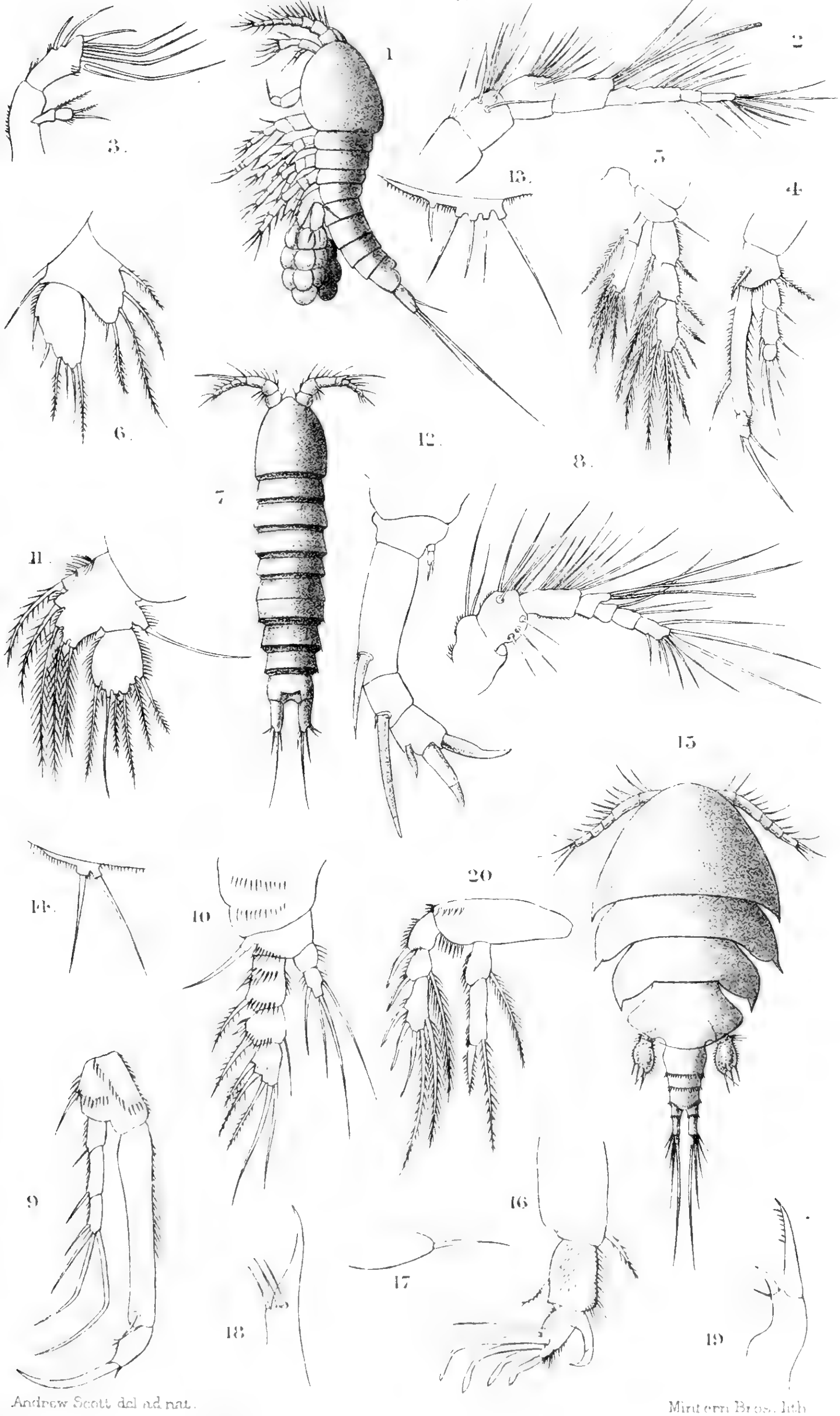
4. ×5

V.E.C. del. ad nat. Fig 1. J. M. Anderson del.

Mintern Bros. imp.

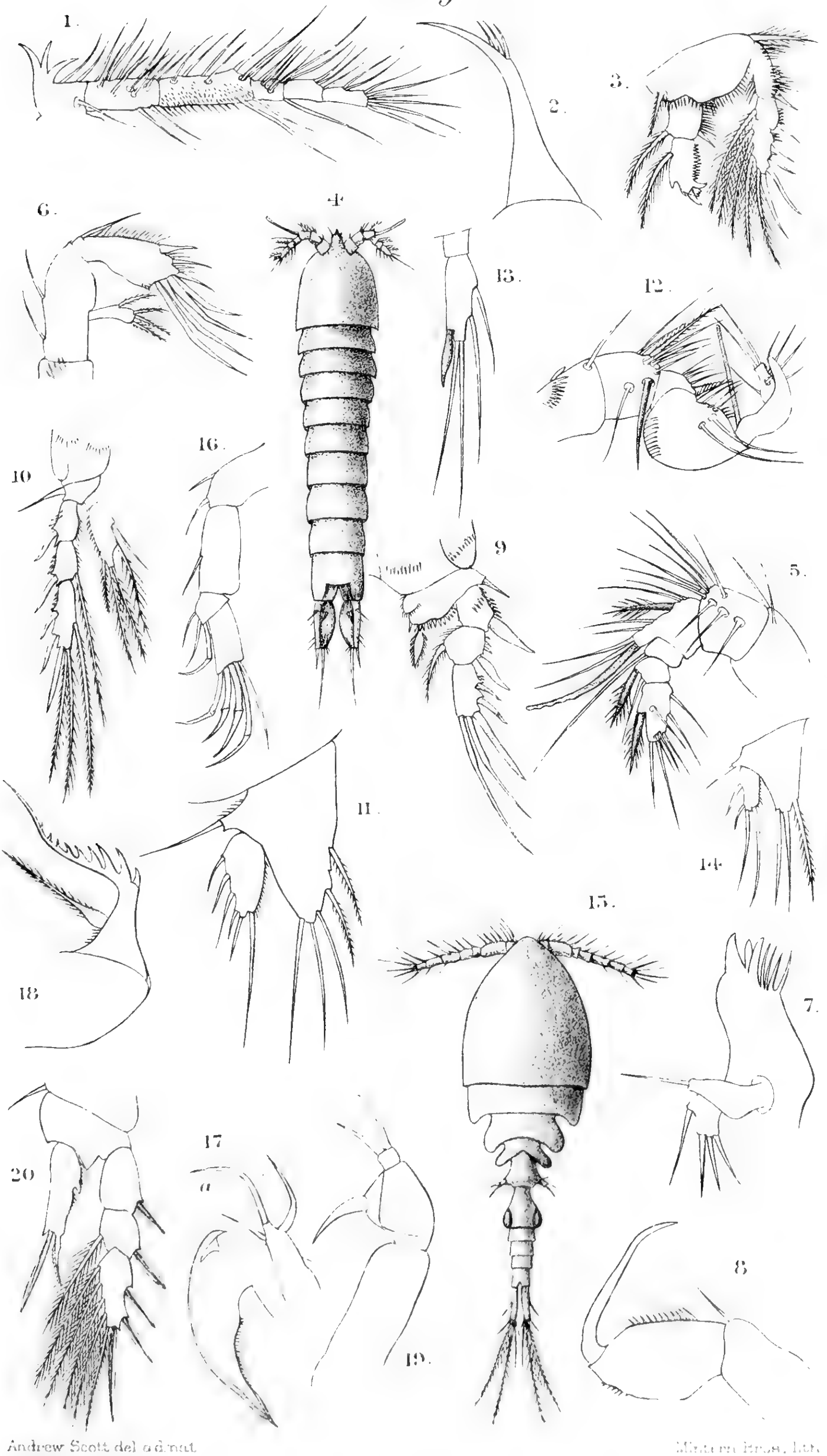


del et lith
Mintern Bros imp



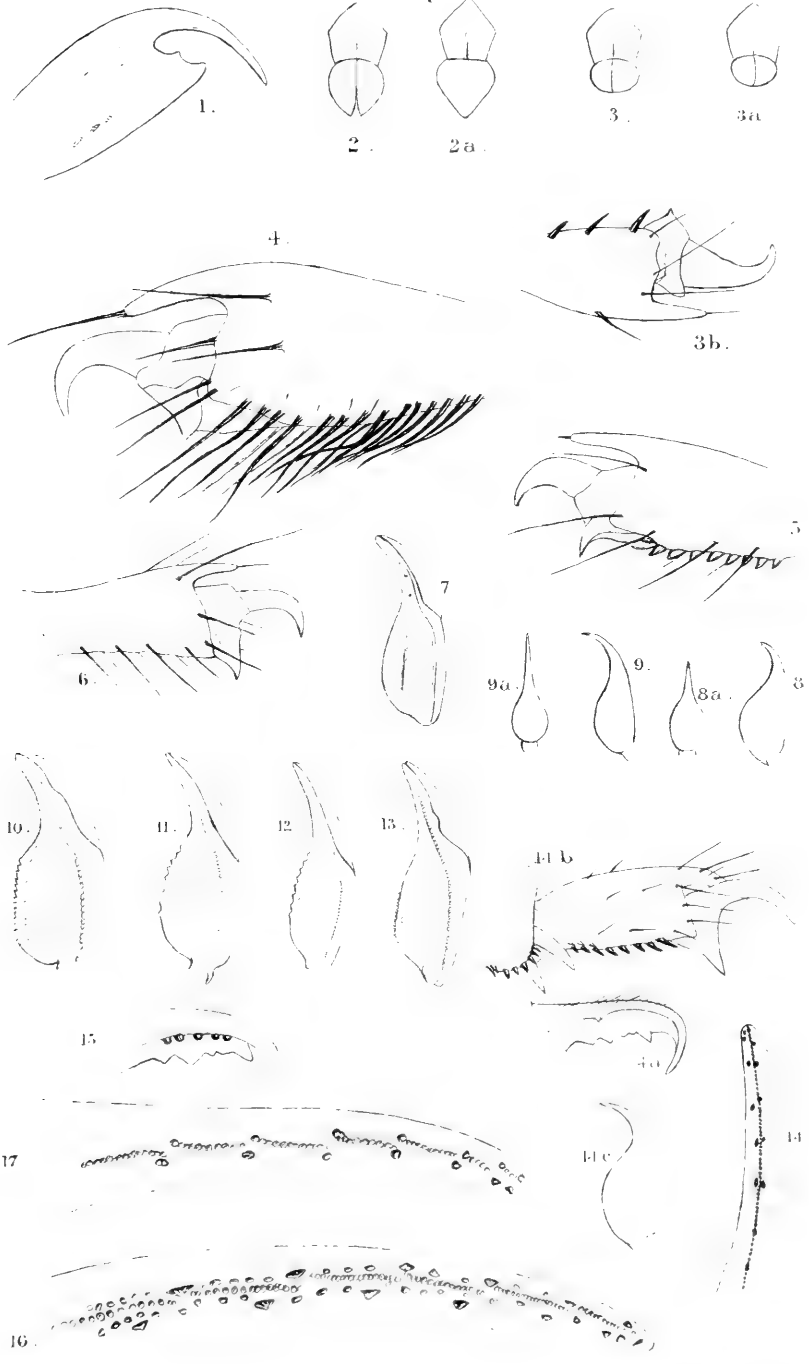
Andrew Scott del. ad nat.
Mintern Bros. lith.

1-6. DIOSACCUS PROPINQUUS, n. sp. 7-14. LAOPHONTE LITTORALE, n. sp.
15-20. REMIGULUS TRIDENS, n. sp.

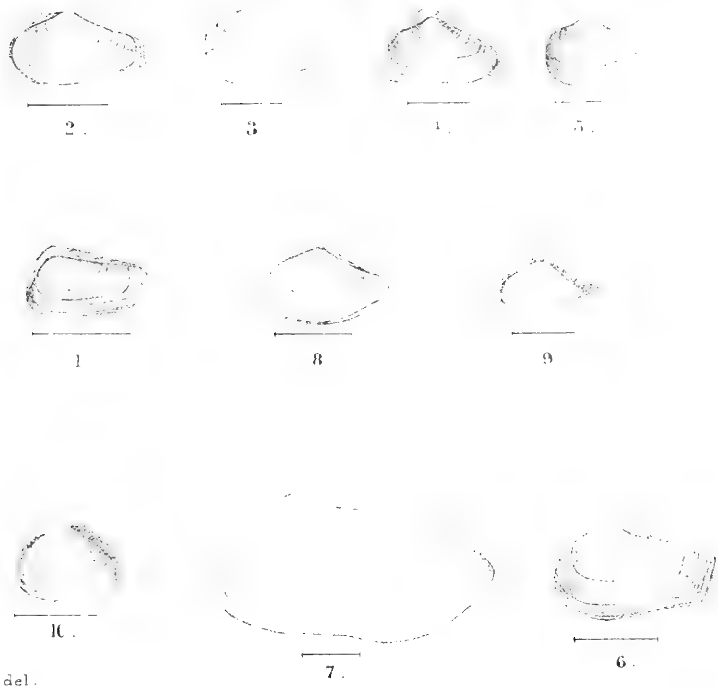


Andrew Scott del ad nat.

Mintern Bros. lith.

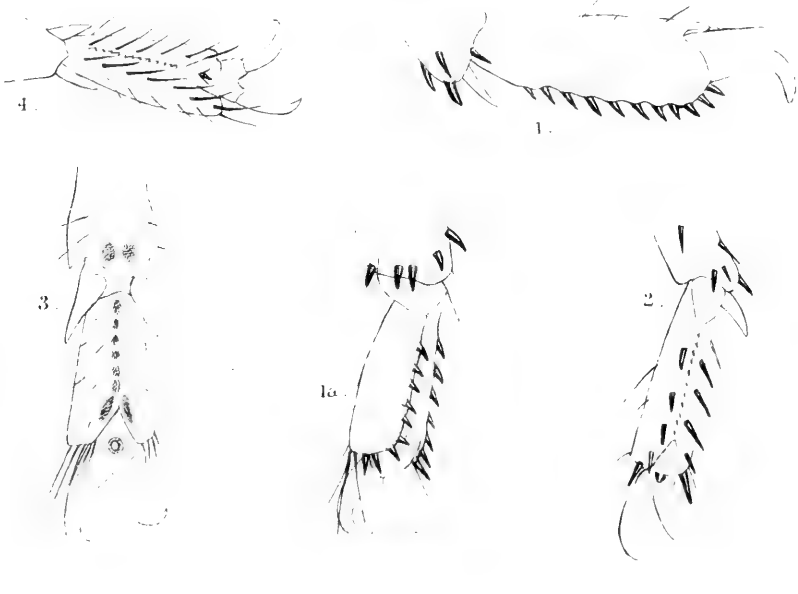

1.
2.
2a.
3.
3a
4.
3b.
5
6.
7
9a.
9.
8a.
8
10.
11.
12.
13.
14 b
15
14 a
17
14 c
14
16.

A



E A Smith del.

B.



R. I. Pocock del.

Mintern Bros. lith.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 71. NOVEMBER 1893.

LIII.—*A Month on the Trondhjem Fiord.* By the Rev. Canon Norman, M.A., D.C.L., F.R.S., &c.

[Plate XVI.]

I HAD already spent four summer holidays in dredging on the Norwegian coast. In 1878 I went first to Oster Fiord, which is a little north of Bergen, and along the lovely sides of which the admirably engineered railway from Bergen to Voss now passes through endless cuttings and tunnels; then I took up my quarters on Bukken, an islet in the Bergen Fiord, and subsequently had a week's work at Dröbak, on the Christiania Fiord. In 1879 I went to the Hardanger Fiord, staying at Lervig, on the island of Stordö. In 1882 I determined to visit Florö, a district made classic by the admirable work done there fifty years ago by Professor M. Sars, at that time Minister of Florö. While there I received an urgent request from Prof. E. Ray Lankester to come to Lervig and help him to find *Rhabdopleura*, which I had taken there in 1879. I therefore left Florö and joined him at Lervig. In 1890 I spent two months in East Finmark or Lapland, dredging first from Vadsö, on the Varanger Fiord, and subsequently working the Sydvaranger Fiords from Kirchenes, which is close on the Russian frontier. It had been my purpose this past summer to have gone southwards, but my doctor ordered me north. This being the case, I selected the Trondhjem Fiord as the place for my researches. I was led to this decision first on account of the richness of the locality in Actinozoa, as proved by the work of Herr Storm, and secondly and more particularly because Prof. G. O. Sars had found so many new and rare Amphipoda in its waters.

Trondhjem, or Drontheim, as it is commonly spelt in England, is in about lat. 63° 25′, or some 1° 50′ south of the Arctic Circle. The fiord is very tortuous, first, near its entrance, running nearly south, then west, and ultimately making its way N. by E. for a great distance in a direction nearly parallel with that of the coast. Taking into account the varied windings it probably is as long, or nearly so, as the two great Sogne and Hardanger Fiords, and the square miles of water which it embraces must, I think, be fully equal to that of either of the two fiords named.

I took with me as assistant Mr. Andrew Scott, son of Mr. Thomas Scott, of the Scotch Fishery Board. The working apparatus consisted of three dredges of different sizes, a small trawl, towing-net, hand-nets, 600 fathoms of rope and 200 fathoms of whale-line, a hand-winch (without which dredging in 200–300 fathoms is, of course, out of the question), sieves, &c., and cases of jars and bottles of various sizes. As my chief object was to obtain small species, the nets of the dredges were made either of cheese-cloth or old coffee-bags. These rapidly filled and brought up all the finest mud. A consequence of this was that while these nets admirably served my special purpose, they did not sweep over the ground in the way that nets with a large mesh which let the mud pass through would have done; and thus, while I was amply rewarded by the small forms obtained, I did not procure the same, or anything like the same, number of large Echinoderms &c. which might have been secured in the same time had another mode of collecting been employed.

A rather small boat with lugger sail was hired at Trondhjem, a considerably larger one, but similarly rigged, at Rödberg. Three or four men and ourselves were the boats' complement of hands.

I spent the first fortnight at Trondhjem and a fortnight and a few days at Rödberg.

Trondhjem was not found to be very rich. The best shallow-water ground seemed to be that between the land and the islet of Munkholmen. The English Channel Fleet, however, was lying at anchor in this part during most of the time I was there, and this somewhat interfered with working this ground. To the east of this the river Nid flows into the fiord with a very strong current and large volume of water, and while the former is not helpful to dredging, the latter seems to make the ground comparatively unproductive. Between Munkholmen and the western shore of the bay there is deep water, 100–150 fathoms; but at the head of this part of the bay is an extensive saw-mill, and hence, even at the greatest depths, a large amount of sawdust was found, which is not favourable to animal life. The best ground I met with from Trondhjem was out in the fiord beyond Munkholmen, and here in 150 fathoms was a rich fauna. The weather was more or less stormy while we were at Trondhjem, and we were only able to dredge one day so far from land.

Rödberg is about 15 miles from Trondhjem towards the mouth of the fiord, and the dredging-ground here is remarkable in many ways and peculiarly typical of what Norwegian fiords are. The fiord is at this point considerably contracted in breadth, and through this narrow channel the whole tidal waters must pass. This causes a very strong current; but the surface-current, curious to say, is always, both at ebb and flood tide, in the same direction, *outwards*, except that when a strong wind comes into the fiord this would seem sometimes to alter its course. I could get no explanation of the tidal currents from the inhabitants; but it is obvious that during flood tide if the upper water is flowing outwards there must be a very powerful under-current flowing inwards, and this was clearly evidenced when dredging, and made it most difficult to hit the ground which it was desired to reach. Of course the paying out of 500 or 600 fathoms of line takes a considerable time, and what with current one way and wind another, when the strain of dredging came upon the rope it was often discovered that we were very far from where we intended to be and were dragging the dredge in an opposite direction to that desired. Thus much will suffice to show that it is not an easy place to work.

But if not easily worked it is none the less very rich ground. From the causes I have mentioned it is extremely difficult to know the exact depth to which the dredge has been down, and the depths given in this report which follows must be received with some amount of reserve. Charts are of little use, as comparatively few soundings have been taken. It is easy enough on the British coast to have charts with very numerous soundings, since the depths are merely a few fathoms. It is quite a different question on the vast Norwegian coast, where soundings in the fiords range from 100 to 600 fathoms. Moreover it is not, of course, necessary for purposes of navigation to accurately survey depths which are known to exist and to be too great either for danger or for anchorage. The soundings given of the bottom of the fiord for a few miles round Rödberg all range from 250 to 280 fathoms, while the fishermen state that at certain spots 300 fathoms are exceeded. I have therefore when intimating the bed of the fiord given it as "250–300 fathoms."

The Bottom of the Fiords.

The bottom is a very fine greyish mud. With the exception of Echinodermata (more especially Asteroidea), Actinozoa of the families Virgulariadæ and Pennatulidæ, and the giant *Lima excavata* (which, however, more usually is found attached to the precipices), the animals which inhabit this mud are for the most part of small size. The Mollusca are almost all white or pale in colour or olivaceous green; as typical species in that depth the following are given:—

Scaphander punctostriatus.
Cylichna alba.
Diaphana globosa.
Bela Trevelyana.
*—— tenuistriata.
Spirotropis carinata.
Typhlomangelia nivalis.
Taranis cirrata.
*Metzgeria alba.
Trophon barvicensis.
—— clavatus.
S. Sipho ebur †.
Ukko Turtoni.
Lovenella metula.
Læocochlis Macandreæ.
Cerethiopsis costulata.
S. Torellia vestita.
Alvania Jeffreysii.
—— cimicoides.
—— subsoluta.
Aclis exigua.
*—— Walleri.
Eulima stenostoma.
—— intermedia.
Eulimella scillæ.
Cyclostrema, species.
Scissurella crispata.
Neomenia carinata.
Chætoderma nitidulum.
Dentalium striolatum.
Dentalium agile.
Pulsellum quinquangulare.
Cadulus subfusiformis.
*—— propinquus.
Lima excavata.
Pecten imbrifer.
*Dacrydium vitreum.
Nucula tenuis.
—— tumidula.
*Portlandia acuminata.
—— lucida.
—— tenuis.
—— frigida.
Malletia obtusa.
*Limopsis minuta.
Cardium minimum.
Cryptodon flexuosus.
—— croulinensis.
*—— eumyarius.
—— ferruginosus.
Kelliella miliaris.
Abra longicallus.
—— nitida.
*Lyonsiella abyssicola.
Poromya granulata.
Cuspidaria rostrata.
—— obesa.
*—— lamellosa.
—— abbreviata.
Saxicavella plicata.

* Species with an asterisk were not found by me in the Trondhjem Fiord, yet are typical of the bottom of other West-Norway fiords.

† Species to which S. is prefixed were not found by me at Rödberg, but very fine examples of them from that locality have been collected by Herr Storm and are in the Trondhjem Museum.

The Crustacea of the Norwegian fiords possess a peculiar interest when compared with British and Arctic species. As we go further and further north the Brachyura and Anomura gradually decrease in number, and species after species drops out. To make up for their absence there is a much larger development of Cumacea, Mysidea, and Amphipoda on the Norwegian coast, while in the true arctic seas the Amphipoda attain their maximum development—not, as far as yet known, perhaps in number of species, but in size and multitude of specimens. The following list will give evidence of this gradual suppression of Brachyura and Anomura :—

	Brachyura.	Anomura†.
Mediterranean *	79	23
Britain	49	15
Norway	24	9
Greenland, Spitsbergen, and Kara Sea	3	2

Of the three Arctic Brachyura the great *Chionœcetes phalangium* is a truly arctic form, circumpolar in its distribution. It often measures $2\frac{1}{2}$ feet in stretch of legs. It rarely occurs outside the Arctic Circle, but on the American coast has been found as far south as Casco Bay (*S. I. Smith*). On the coast of Europe it is unknown. *Hyas araneus* and *coarctatus* grow to an immense size in Greenland, but occur southwards to the south coast of England in greatly dwarfed dimensions. The two Anomura, *Lithodes arctica* and *Eupagurus pubescens*, also reach England. If we deduct these four species it is very remarkable that of the remaining twenty-nine species of Norwegian Brachyura and Anomura there is only one, and that of very small size, *Eupagurus chiroacanthus*, Lillj., which is not as yet known in the Mediterranean. Corresponding to the decrease in the number of higher Crustacea as we go northwards is the similar falling off in numbers as we descend to greater depths in the sea ‡. Macrura, on the other hand, are not unequally distributed, but seem to occur in no great disparity of numbers in arctic, temperate, and warmer waters and in the great depths of the ocean.

The most marked peculiarity of the Norwegian fiords with respect to the class Crustacea is the abundance of Mysidea and Cumacea. In the month on the Trondhjem Fiord I obtained more specimens of this tribe than I have found

* I have not counted a great many doubtful species recorded from the Mediterranean in Carus, 'Faunæ Medit. Prodromus.'

† I have not here included the family Galatheidæ in the Anomura. No species of that family is found in the Arctic regions.

‡ See Norman, "Presidential Address," Trans. Nat. Hist. Soc. and Tynes. Nat. Field Club, vol. viii. (1883), p. 108.

in our own seas during thirty to forty years. Having given a list of typical Mollusca of the bed of the fiords, I now add one of some typical animals of other classes.

CRUSTACEA.

Calocaris Macandreæ.
*Pontophilus norvegicus.
*Nika edulis.
Bythocaris simplicirostris.
*Pandalus propinquus.
Pasiphæa tarda.
Boreomysis tridens and other species.
Pseudomma, *Amblyops, Erythrops, Parerythrops, species.
Mysideis insignis.
Hemimysis abyssicola.
*Cyclaspis longicaudata.
Eudorella hispida.
Diastylis lucifer.
—— echinatus.
—— cornutus.
—— tumidus.
—— serratus.
Campylaspis horrida and other species.
Apseudes spinosus.
Paranthura tenuis.
Æga ventrosa.
Ischnosoma bispinosum.
Macrostylis spinifera.
Munnopsidæ, many genera and species.
Haplonyx cæculus.
Leptophoxus falcatus.
Harpinia pectinata.
—— truncata.
—— crenulata.
—— lævis.
*—— abyssi.
Ampelisca odontoplax.
—— pusilla.
Haploops setosa.
*Andania abyssi.
Astyra abyssi.
Gitana rostrata.
Œdiceropsis brevicornis.
Halimedon acutifrons.
Bathymedon longimanus.
Laphystiopsis planifrons.
Bruzelia typica.
*—— tuberculata.
Nicippe tumida.
Halice abyssi.
Pardalisca abyssi.
—— tenuipes.
Eusirus propinquus.
—— leptocarpus.
Laothoe Meinerti.
Leptamphopus longimanus.
Eriopisa elongata.
Cypridina norvegica.
Philomedes Lilljeborgii.
Conchœcia borealis.
Macrocypris minna.
—— angusta.
Euchæta norvegica.

GEPHYREA.

S. Sipunculus priapuloides.
Phascolosoma squamatum.
*Tylosoma Lütkeni.
Ochnesoma Steenstrupii.
*—— Sarsii.

ECHINODERMATA.

Rhizocrinus lofotensis.
Antedon dentatus.
Ophioglypha Sarsii.
—— gracilis.
—— carnea.
Amphiura borealis.
Amphilepis norvegica.
Ophiacantha, species.
Ophioscolex glacialis.
—— purpureus.
Asteronyx Loveni.
S. Pontaster tenuispinus.
S. Plutonaster Parelii.
S. Leptophycaster arcticus †.
Psilaster andromeda.
Pentagonaster granularis.

† This species has not, I think, been found to the south of the Trondhjem Fiord.

Lasiaster hispidus.
S. Lophaster furcifer.
Pteraster militaris.
S. —— pulvillus.
S. Retaster multipes.
S. Brisinga endecacnemos.
S. —— coronata.

Echinus acutus.
—— elegans.
* —— norvegicus.
Schizaster fragilis.
Holothuria tremula.
Echinocucumis hispida.
Myriotrochus brevis.

ACTINOZOA.

Many fine Pennatulids and Virgularians.

SPONGOZOA.

Craniella cranium.
Thenea muricata.
*Cydonium Normani.
*Synops Macandrei.
*Isops phlegræi.

*Trichostemma hemisphæricum.
Cladorhiza abyssicola.
*—— pennatula.
Stylocordyla longissima.
—— borealis.

The mud is of a wholly different character from that of the Atlantic. It contains a large amount of mineral matter, while the shells of *Globigerina* and *Orbulina* are rarely represented. The Foraminifera are chiefly characterized by a large development of arenaceous forms, including many very interesting species, and by the large proportion of shells which belong to the Bulimine allies.

The Precipices.

The chief interest in the dredging of the Norwegian fiords centres in the work on the precipices. These often descend almost or quite perpendicularly from close to the shore to the bottom of the abyss. At Rödberg the whole of the western shore seems thus to sweep down into the fiord; but as I did little dredging on that side of the fiord, I shall speak only of that part of the eastern shore which is close to Rödberg itself. Here, according to my observations, there are three chief precipices. The first of these lies to the south and does not descend immediately from low-water mark, but runs out obliquely in a south-westerly direction from a little outside the end of the pier, the precipice thus facing N.E. In my first day's dredging I got upon this precipice most satisfactorily and brought up a dredge full of rare things, including the fine Alcyonarians *Paragorgia arborea*, *Paramuricea placomus*, *Briareum grandiflorum*, and *Duva rosea*, the corals *Lophohelia prolifera* and *Amphihelia ramea*, and the hydroid coral *Stylaster gemmascens*; together with various sponges, including *Geodia Barretti*, *Phakellia ventilabrum*, and *Tragosia infundibuliformis*; on and among these was a rich fauna, embracing *Gorgonocephalus Lamarckii* and *Linckii*, *Ophio-*

glypha gracilis, *Ophioscolex glacialis*, *Echinus elegans* (very fine), *Spirotropis carinata*, *Trophon clathratus*, *Emarginula crassa*, *Hanleyia debilis*, *Pecten vitreus* and *aratus*, *Lima excavata*, &c. Although several attempts were made to again strike this exact spot, we never succeeded in doing so, and other parts of this precipice did not prove so rich.

The second precipice descends from a water-covered ridge which runs out in a west-by-south direction from the point of the little hill on the other side of the miniature bay which that hill forms to the north of Rödberg, the face of the precipice being thus E. by N. Here I met with some species which were not procured elsewhere, including the very rare and beautiful *Sarcophyton purpureum*.

The third precipice is at Rödberg itself, where from the northern ends of the rocks which form the little headland thus named a precipice of 250 fathoms descends perpendicularly to the bottom. This precipice was thus worked: the boat pulled out about two hundred yards, and when the dredge and sufficient rope had been let out returned to the shore; the dredge was then hauled up the face of this great 1500-feet submerged cliff. If it caught on a ledge or jutting point the rope was hauled very "taut," and then suddenly a few fathoms of line were slackened. In this way the dredge was frequently set free and hauled up again. When it finally caught, which was sure to be the case, the boat was again manned and the dredge was taken in from the sea. It was a wonderful sight to see the deep-sea Corals, Alcyonarians, Astrophytons, &c. in a dredge thus handled from the shore—containing a fauna of which we know nothing in our own shallow seas, and can only hope to meet with when we reach the great precipices which dive into the bed of the Atlantic far away to the west of Ireland.

The following list gives species which are characteristic of the precipices; many of them attach themselves to or crawl on the rock, but a considerable number feed upon or are almost invariably with or on the Alcyonarians or corals, into the latter of which some very interesting sponges also burrow.

MOLLUSCA.

Aldisa zetlandica.
Triopella incisa.
Trophon clathratus.
—— ——, var. Gunneri.
Spirotropis carinata.
Cerethiopsis costulata.
Calliostoma occidentale.
Emarginula crassa.
Puncturella noachina.
Hanleyia debilis.
S. —— abyssorum †.
Leptochiton alveolus.

† Magnificent specimens are in the Trondhjem Museum from Rödberg, but I did not meet with it.

Trachydermon exaratus.
Pecten vitreus.
—— ——, var. abyssorum.
—— aratus.
—— similis.
Lima excavata.
Modiola phaseolina.
Arca pectunculoides.
—— nodulosa.

CRUSTACEA.

Galathodes tridentatus.
Spirontocaris polaris.
—— securifrons.
Cryptocheles pygmæa.
Caridion Gordoni.
Parerythrops abyssicola.
Pseudomma roseum.
Mysideis insignis.
Stegocephalus inflatus.
—— similis.
Andania abyssi.
Stenothoe megacheir.
Paramphithoe pulchella.
Stenopleustes nodifer.
Epimeria cornigera.
—— tuberculata.

ECHINODERMATA.

Ophiacantha spectabilis.
—— abyssicola.
—— anomala.
Ophioscolex glacialis.
Ophiactis Ballii.
Ophiopholis aculeata, varieties.
Gorgonocephalus Lamarckii.
—— Linckii.
Echinus elegans.
—— acutus.
Psolus squamatus.

POLYZOA.

Caberea Ellisii.
Bicellaria Alderi.
Menipea Jeffreysii.
Flustra Barleei.
Tessarodoma gracile.
Hornera lichenoides.
—— violacea.
Idmonea atlantica.
Rhabdopleura Normani.
(And many incrusting species.)

CŒLENTERATA.

Duva rosea.
Sarcophyton purpureum.
Briareum grandiflorum.
Paragorgia arborea.
*Primnoa lepadifera.
Paramuricea placomus.
Lophohelia prolifera.
Amphihelia ramea.
Stylaster gemmascens.
S. Allopora norvegica.
Stegapoma plicatilis.
Halicornaria integra.
*Lytocarpia bicuspis.
*Plumularia elegantula.
*—— gracillima.
*Heteropyxis norvegica.

SPONGOZOA.

Geodia Barretti.
Tentorium tubiferum, *Œrsted*†, = Thecophora semisuberites, *O. Sch.*
*Quasillina brevis.
*Alectona Milleri.
Phakellia ventilabrum.
Trogosia infundibuliformis.
Esperella lingua.
*Desmacidon crux.
*Rhaphidotheca Marshall-Hallii.
(And many other Sponges.)

† I adopt this name, for I think there is no question that this is the sponge described as *Tethium tubiferum* by Œrsted, "Forteg. over Dyr samlede i Christianiafjord ved Dröbak" (Naturhist. Tiddsk. Anden Række, vol. i. 1845, p. 426 (or p. 29 separate copy), pl. v. figs. 3, 4, 6).

MOLLUSCA.

Admirable figures of all the northern Mollusca which do not occur on our own coasts will be found in G. O. Sars's 'Mollusca regionis Arcticæ Norvegicæ,' 1878.

CEPHALOPODA.

1. *Octopus Bairdii*, G. O. Sars (? = *O. arcticus*, Prosch).
A small specimen taken in Trondhjem Bay.

GASTROPODA.

2. *Limacina retroversa*, Fleming (= *Spirialis retroversa*, G. O. Sars).
Two small specimens among dredged material at Rödberg.

3. *Actæon tornatilis*, Linn.
Rödberg, one dead specimen.

4. *Tornatina nitidula*, Lovén (= *Utriculus nitidulus*, G. O. Sars).
40–70 fath., Rödberg.

5. *Cylichna alba*, Brown.
Trondhjem and Rödberg, in 40–300 fath.

6. *Scaphander lignarius*, Linn.
Trondhjem.

7. *Scaphander puncto-striatus*, Migh.
Rödberg, 250–300 fath.

8. *Acera bullata*, Müller.
Rödberg, 5–10 fath.

9. *Philine scabra*, Müll.
One living, Rödberg.

10. *Philine Loveni*, Malm.
One living specimen, 70–100 fath., Rödberg.

11. *Aldisa zetlandica*, A. & H.
One specimen, 200–250 fath., Rödberg.

12. *Caldina repanda*, A. & H., = *Doris obvelata*, G. O. Sars.
Laminarian zone, Trondhjem.

13. *Triopella incisa*, M. Sars.
A specimen taken at Rödberg in 250–300 fath., easily recognized by Sars's admirable figures.

14. *Alderia modesta*, Lovén, Alder and Hancock, Mon. Nudib. Moll. pl. xli.; Forbes and Hanley, pl. CCC. fig. 1.

Mr. Scott found a specimen of *Alderia* in a shallow pool into which the sea only broke at spring tides. This pool was in the little indentation of the coast just north of Rödberg.

It does not occur in Sars's list of Norwegian Mollusca, and has not, I believe, been previously met with in Norway. Alder and Hancock write: "The species extends to Norway, where it was discovered by Professor Lovén;" but this seems to be a mistake, for Lovén found it at Bohuslän, which is in Sweden. The distribution of the brackish-water fauna has a peculiar interest.

15. *Clathurella linearis*, Mont.

Shallow water, Trondhjem and Rödberg.

16. *Clathurella Leufroyi*, Mich.

One young, Trondhjem.

17. *Bela Trevelyana*, Turton.

Trondhjem and Rödberg, 70–100 fath.

18. *Bela rugulata*, Möll.

Rödberg, 10–20 fath.

Var. *bergensis*, Friele.

Rödberg, 70–100 fath.

19. *Bela decussata*, Couth., = *viridula*, Möll. (scarcely of G. O. Sars, which is *B. Kobelti*, Verk.).

A single specimen of var. *conoidea*, G. O. Sars, at Rödberg, in 250–300 fath.

20. *Bela cancellata*, Migh. (= *elegans*, Möll.), var. *declivis*, Lovén.

Rödberg, 70–200 fath.

21. *Spirotropis carinata*, Phil.

Rödberg, 250–300 fath.

22. *Typhlomangelia nivalis*, Lovén.

Two half-grown specimens, Trondhjem and Rödberg 150–300 fath.

23. *Thesbia nana*, Lovén.

Rödberg, 70–150 fath., three living specimens.

24. *Taranis cirrata*, Brugnone, = *Trophon Mörchi*, Malm.

Trondhjem, 150 fath.; Rödberg, 250–300 fath.

25. *Admete viridula*, Fabr.
Rödberg, 10–70 fath.

Genus Ukko, Friele (new name for *Jumala*, Friele).

Herr Friele gave the name *Jumala* to this genus after that of an ancient Finnish god, unaware that *Jumala* was their word still in use for the one true God. My friend Herr Sparre Schneider, of Tromsö, having informed me that this was the case, and as under these circumstances the word could not with propriety be retained, I called Herr Friele's attention to the fact. At his request I substitute for it *Ukko*, the name once used among the Fins for the heathen god of wind and weather.

26. *Ukko Turtoni*, Bean.

A living specimen of a very interesting variety of this species was dredged at Rödberg in about 150 fath. In outline it is shorter and less drawn out in the spire than usual, the volutions are 7½ and more tumid. The nucleus is smaller and less cylindrical than in the type, the suture less oblique, the whorls more rapidly increasing in breadth, the spiral striæ more regularly arranged at distinct intervals, the substance of the shell is thinner, the interior is of a purplish hue.

There are three modifications of this shell known to me:—

A. *a.* The typical Dogger-Bank form, with its greatly drawn-out spire, well figured by Forbes and Hanley, also by Jeffreys, and very nearly the same by G. O. Sars (pl. xiv. fig. 3 *b*, and pl. xxv. fig. 9). The following are measurements of a specimen from the Dogger Bank *:—Length of mouth from commencement of lip to end of canal 54 millim.; spire from commencement of lip to end 72 millim.; greatest width of total shell at the mouth 40 millim. Volutions nine.

b. Var. *brevispira* (Pl. XVI. fig. 1; see also Kobelt, Icon. der schalent. europ. Meeresconch. pl. xiii. fig. 1). Form from East Finmark. Mouth proportionately longer and wider and the spire shorter, but in general character very like *a.* Length of mouth 49 millim., spire 45, breadth at mouth 41. Volutions 7½. Here the length of the mouth is greater than that of the spire and the width at the mouth greater than in the much larger Dogger-Bank specimen. The four or five first volutions are very narrow, as in the type.

c. Var. *tumida* (Pl. XVI. fig. 2). The Rödberg specimen already described. The mouth in my specimen has unfortunately been much damaged, but its length is 45 millim.,

* This specimen is rather more elongated than usual.

length of remaining portion of spire 44 millim., breadth at mouth 36 millim. Here the proportions are not very different from those of the East-Finmark form, but the aspect is altogether different on account of the greater tumidity of the whorls and other characters. Sars's pl. xiv. fig. 3 *a* comes near to my specimen in characters of sculpture and tumidity of whorls, but it is more elongated in the spire. It may be regarded, however, as an illustration of the variety.

B. *Ukko Ossiani*, Friele,=*Jumala Ossiani*, Friele (Den Norske Nordhavs-Exped., Mollusca, I., 1882, p. 7, pl. i. figs. 1–6, pl. iv. figs. 1–3*).

The figure given supplies the following measurements:— Length of mouth 38 millim., of remaining portion of spire 40 millim., breadth at mouth 32 millim. This form comes suspiciously near to *U. Turtoni*, from which, among other points, it differs in the more regular formation of the earlier nuclear whorls, in which respect it agrees with *U. schantaricus*.

C. *Ukko schantaricus* (Middendorff). (Pl. XVI. fig. 3.)

1849. *Tritonium* (*Fusus*) *schantaricum*, Middendorff, Beit. zu einer Malacoz. Rossica (Mém. Sci. Nat. Acad. Imp. vol. vi.), pt. 2, p. 146.
1851. *Tritonium schantaricum*, Middendorff, Siberische Reise, vol. ii. p. 230, pl. x. figs. 7–9.

Some years ago I purchased a shell from the collection of the late Baron Prévost, which was said to come from Japan, which is beyond the range of my collections and studies; but this particular shell was purchased on account of its evident relation to arctic forms. The shell was in a paper tray, on which was the following account of it:—"*Fusus Sabinii*, Gray, coquille recueillie dans le nord du Japan par M. A. Adams pendant le voyage du Samarang." It clearly had nothing to do with *T. Sabini*. Jeffreys was just then writing something on Japanese shells, and I sent Prévost's *Fusus* to him for his opinion. He returned it with a label "*Fusus Turtoni*, not *T. Sabini*." It might well be so, but I could not doubt that so marked a form had received a name; and so, while writing this paper, I sent it up to Mr. Edgar A. Smith to ask whether he could throw any light upon it. He replied that the shell was not in the British Museum, but that it was "*Tritonium schantaricum* of Middendorff, from Schantar Island, in the Okhotsk Sea." On referring to Middendorff's

* Figure reproduced in Kobelt, Iconog. der schalentragenden europ. Meeresconch. pl. xii. fig. 2.

works it is evidently, I find, that species; the only difference is that in my specimen, as compared with Middendorff's fig. 9, the raised spiral portions of the shell are wider and the grooved lines narrower. As to the exact locality of my specimen, nothing can be satisfactorily determined.

The species is not mentioned in the voyage of the 'Samarang;' Schanter Island is certainly *to* the north of Japan, but whether Adams was ever there or not is uncertain; as surgeon of one of H.M. ships he may have gone there.

The shell must unquestionably be referred to the genus *Ukko*, and possibly may be, as Jeffreys considered, an extreme form of *U. Turtoni*; but its characters are so marked, and I lay chief stress on the spiral grooving of the inside of the lip, that it may well bear a specific name.

Whorls 9; total length 77 millim.; greatest breadth 33 millim.; length of mouth and canal 35 millim.; length from commencement of lip to end of spire 46 millim. Comparing these measurements with Middendorff's figure it will be found that the spire in my example is longer in proportion to the mouth than in the type. The whole appearance of form, amount of convexity of whorl, and obliquity of suture, together with surface sculpture, are like those of typical *U. Turtoni* in miniature. The differences are that the nucleus is not so cylindrical, each succeeding whorl being wider than the preceding; the epidermis is thinner and closely adherent to the shell; the shell is proportionately more solid, the spiral grooves are more deeply impressed, while the most important character is that the mouth within the shell is lirated with spiral grooves and ridges corresponding to the external sculpture—"apertura intus ad strias externas regulariter et parallele sulcata" (*Middendorff*). The operculum is imperfect, but enough remains to show that it is like that of the type of the genus.

27. *Neptunea antiqua*, Linn.

One dead example.

28. *Sipho gracilis*, Da Costa, var. *glaber*, Verkruzen. (Pl. XVI. figs. 4, 4 *a*.)

A dwarf and remarkable form of this variety was found. Volutions 6½. Length 37 millim., breadth 19 millim.; length of mouth and canal 21 millim. Whorls only slightly convex, suture not deeply impressed and only a little oblique, no spiral sculpture to be seen even in the neighbourhood of the columella; epidermis of a pale greenish-ash hue.

This is the smallest form of this very variable species that I have, and of peculiar interest as being absolutely identical in size, form, and colour with a variety of the allied *S. propinquus*, Alder, found in the Kattegat, and for which I am indebted to the Copenhagen Museum. The different character of the nucleus alone distinguishes them; and, although the use of a lens reveals spiral striæ in the latter which are absent in the former, such striæ are usual in *S. gracilis* and are even to be distinguished on a young specimen of the present form.

The Kattegat variety of *S. propinquus* is intermediate in size and form between typical *S. propinquus* and *S. Jeffreysianus*, Fisher, which latter I regard as a large variety of the former. It is figured (Pl. XVI. figs. 5, 5 *a*) for comparison with the dwarf form of *S. gracilis*, var. *glaber*.

29. *Buccinum undatum*, Linn.

Specimens procured not representing any special variety.

30. *Nassa reticulata*, Linn.

All the examples of this species which I have dredged on the west coast of Norway, in the Hardanger, Bergen, and Trondhjem Fiords, and at Florö, have a peculiar aspect and form a well-marked variety, which I would propose to call var. *norvegica*. The form is shorter and proportionately broader than usual, so that the outline is more ovate; the ribs are about twenty-five on the body-whorl, very close together, and, as the spiral grooves are deeply channelled, the sculpture is of a more regular reticulate character than usual; the colour is greenish ashy. Of the twenty-five figures of *N. reticulata* given by Kobelt on plate xxiv. of his Icon. der schalentragenden europ. Meeresconchyl. 1887, fig. 24 comes nearest to this form.

31. *Nassa incrassata*, Ström.

Laminarian zone.

32. *Trophon truncatus*, Ström.

One dead specimen, 40 fath., Rödberg.

33. *Trophon clathratus*, Linn.

In 70–300 fath., Rödberg.

Var. *Gunneri*, Lovén.

Two half-grown examples with the last.

34. *Trophon clavatus*, G. O. Sars.

Rödberg, 250–300 fathoms. Two living examples of this very rare shell were procured. They very closely accord with the two specimens figured by Sars in character and even in size, the one having a length of 15½ millim., the other 11 millim.; of these total lengths, in the first the mouth and its very long canal occupy 7½ millim., in the latter 6 millim.; on the larger five varices are visible on the body-whorl when viewed from the front, on the smaller six. The varices are projected considerably on the upper part of the volutions in triangular processes outwards, but *scarcely* at all upwards. It appears to me quite distinct from *M. clathratus*, and is also wholly different from *M. vaginatus*, Christ. and Jan, of the Mediterranean.

35. *Trophon barvicensis*, Johnston.
Specimens small, in 150–300 fath.

36. *Trivia europæa*, Mont.
10 fath.

37. *Aporrhais pes-pelecani*, Linn.
Trondhjem, 10–30 fath.

38. *Bittium reticulatum*, Da Costa.
Laminarian zone.

39. *Lovenella metula*, Lovén.
Rödberg and Trondhjem, 150–300 fath.

40. *Læocochlis Macandreæ*, H. Ad.
Rödberg, 250–300 fath.

41. *Cerethiopsis costulata*, Möll.
Rödberg and Trondhjem, 150–300 fath.

42. *Trichotropis borealis*, Brod. & Sow.
Trondhjem and Rödberg, 5–30 fath.

43–45. *Littorina littorea*, Linn., *L. rudis*, Maton, and *L. obtusata*, Linn.

The last typical and not showing any approach to *L. palliata*. I have not seen the latter from south of Tromsö. Specimens taken at the Lofoten Islands in 1890 were the former; nor has G. O. Sars met with *L. palliata* at those islands.

46. *Lacuna divaricata*, Fabr.
Large at Rödberg, Laminarian zone.

47. *Skenea planorbis*, Fabr.
Rödberg, among weeds.

48. *Rissoa inconspicua*, Alder, var. *albella*, Lovén.
Laminarian zone, Rödberg.

49. *Rissoa parva*, Da Costa, var. *interrupta*, Adams.
Laminarian zone, Trondhjem.

50. *Alvania Jeffreysii*, Waller.
Trondhjem and Rödberg, 150–300 fath.

51. *Alvania cimicoides*, Forbes.
Trondhjem and Rödberg, 150–300 fathoms.

52. *Alvania subsoluta*, Aradas, = *Alvania abyssicola*, G. O. Sars, typus (Forbes and Hanley, varietas).

250–300 fath., off Rödberg. As it appears to me that Jeffreys has introduced great confusion respecting the synonymy of this shell, it will be well to attempt to clear the matter up. This confusion commenced in his paper on Mediterranean Mollusca in the 'Annals' of 1870, and was made worse by his latest views, as expressed in his "Mollusca of the 'Lightning' and 'Porcupine' Expeditions" (Proc. Zool. Soc. 1884, p. 115).

I will give the synonymy of the species as I now take it to be, a list of the specimens in my collection on which my conclusions are based, and some notes on the reasons of those conclusions.

1. *Alvania Testæ* (Aradas and Maggiore).

1844. *Rissoa Testæ*, Ara. & Magg. Cat. rag. Catania, pl. ix. fig. 4.
1870. *Rissoa abyssicola*, var. *conformis*, Jeffreys, "Mediterranean Mollusca," Ann. & Mag. Nat. Hist. ser. 4, vol. v.
1880. *Rissoa Testæ*, Monterosato, Bull. Soc. Malac. Ital. vol. vi. p. 68.
1884. *Rissoa Fischeri*, Jeffreys, Proc. Zool. Soc. p. 113, pl. ix. fig. 1.
1884. *Rissoa Testæ* (partim), id. ibid. p. 115, pl. ix. fig. 4.
1884. *Actonia Testæ*, Monterosato, Nomencl. gen. e spec. di alcune Conchiglie Medit. p. 61.

Hab. Mediterranean (not North European).

I am indebted to the Marchese di Monterosato for ten specimens labelled "*Alvania Testæ = conformis*, Palermo." These, from their more numerous ribs and the peculiar shouldering (above and below) of the volutions, agree more closely with Jeffreys's figures of *R. Fischeri* than with those he gives of *R. Testæ.* The lip is considerably thickened, and sculptured externally with many fine longitudinal striæ. I think that there can be little doubt that these two forms are one species. It is possible also that *R. subsoluta* is not *specifically* distinct from them.

2. *Alvania subsoluta* (Aradas).

1847. *Rissoa subsoluta*, Aradas, Mem. di Malac. Sic. vol. iii. p. 21.
1853. *Rissoa abyssicola*, Forbes & Hanley, Hist. Brit. Moll. vol. iii. p. 86, pl. lxxvii. figs. 1, 2, and pl. JJ. fig. 3 (varietatis *abyssicola* figura bona).
1867. *Rissoa abyssicola*, Jeffreys, Brit. Conch. vol. iii. p. 19, pl. lxvi. fig. 9 (figura mala).
1878. *Alvania abyssicola*, G. O. Sars, Moll. reg. arc. Norv. p. 177, pl. x. fig. 7, *a–c* (formæ typicæ optimæ figuræ).
1870. *Rissoa abyssicola*, var. *obtusa*, Jeffreys, "Mediterranean Mollusca," Ann. & Mag. Nat. Hist. ser. 4, vol. vi. p. 12 (separate copy).
1875. *Rissoa elegantissima* and *subsoluta*, Monterosato, Nuova Revista delle Conch Medit. p. 17.
1884. *Rissoa subsoluta* and *R. Testæ*, var. *abyssicola*, Jeffreys, Proc. Zool. Soc. p. 115, pl. ix. fig. 3.
? 1884. *Rissoa deliciosa*, id. ibid. p. 121, pl. ix. fig. 7.
1884. *Actonia subsoluta*, Monterosato, Nomen. gen. e spec. di alcune Conch. Medit. p. 61.

Specimens in my collection are as follows:—

a. "*Alvinia elegantissima*, Palermo" *, from Marchese di Monterosato.—Three specimens.

b. "*Actonia subsoluta*=*deliciosa*, Palermo," from Monterosato.—Four specimens.

c. "*Rissoa subsoluta*, Aradas, Palermo, very deep," from Monterosato.—Two specimens.

d. Off Batalden, near Florö, Norway, 200 fath.—Two specimens, A. M. N.

e. Oster Fiord, near Bergen, 375 fath.—Five specimens, A. M. N.

f. Off Lervig, Hardanger Fiord, 200 fath.—Five specimens, A. M. N.

g. Rödberg, Trondhjem Fiord, 250–300 fath.—Twelve specimens, A. M. N.

h. Loch Fyne.—Five specimens, Mr. MacAndrew.

i. The Kattegat.—Five specimens from the Copenhagen Museum.

a and *b* (received at different dates) are identical and rather

* Monterosato subsequently united his *A. elegantissima* with *A. subsoluta*.

narrower in form than the next. *c*: these specimens are absolutely identical with those of *d*, and are the form figured by Jeffreys, 1884, fig. 3, except that the spiral riblets are on all parts of the whorls; *c* and *d* have not the labial rib so well developed, as is admirably figured by Sars (fig. 5 *c*), with whose figures *e*, *f*, and *g* exactly correspond. *h* are some of the original specimens of the form dredged by Forbes and MacAndrew and figured in the 'British Mollusca;' they differ from Norwegian and Mediterranean specimens, as Forbes and Hanley's figure shows, in the more conical outline, much less swollen and almost flat volutions, and less expanded mouth. The Norwegian form I therefore consider should be called *Alvania subsoluta*, Ar., and the Loch-Fyne form *Alvania subsoluta*, Ar., var. *abyssicola*, Forbes.

The Kattegat examples are interesting, intermediate between the British and Norwegian forms, though perhaps nearer to the former.

The particular specimen of *A. subsoluta* figured by Jeffreys (1884, fig. 3) is represented as having spiral riblets only on the lower half of the whorls. One of my Trondhjem-Fiord examples has no spiral riblets except on the last whorl, and another has the upper whorls without riblets, while on the penultimate whorl they are, as in Jeffreys's figure, confined to the lower half.

53. *Onoba striata*, Adams.

A few specimens of the typical form.

54. *Velutina lævigata*, Penn.

Trondhjem and Rödberg.

55. *Lamellaria latens*, Müller.

Rödberg, 40–70 fath., one specimen.

56. *Lunatia grœnlandica*, Beck.

Two or three small specimens, 150 fath., Rödberg.

57. *Lunatia Montagui*, Forbes.

Shallow water, Trondhjem and Rödberg.

58. *Scalaria grœnlandica*, Perry.

Only one specimen, Rödberg, about 20 fath.

59. *Aclis exigua*, G. O. Sars.

One living specimen, 250–300 fath., Rödberg.

60. *Eulima intermedia*, Cantr.

Rödberg and Trondhjem, down to 300 fath.

61. *Eulima bilineata*, Alder.
A few specimens.

62. *Eulima stenostoma*, Jeffr.
Trondhjem and Rödberg, 150–300 fath.

63. *Parthenia spiralis*, Mont.
A few living specimens.

64. *Turbonilla rufa*, Phil., var. *rufocincta*, Thomp.
A single living specimen, Trondhjem.

65. *Odostomia unidentata*, Mont.
Rödberg, in the Laminarian zone.

66. *Auriculina insculpta*, Mont.
Rödberg, 250–300 fath.

67. *Eulimella ventricosa*, Forbes.
One living specimen, Rödberg.

68. *Eulimella scillæ*, Scac.
Trondhjem and Rödberg, 40–300 fath.

69. *Cyclostrema Petterseni*, Friele, = *C. trochoides*, Jeffreys.
Rödberg, 250–300 fath.

70. *Cyclostrema lævigatum*, Jeffreys.
Rödberg, 70–100 fath., two specimens.

71. *Cyclostrema basistriatum*, Jeffreys.
Rödberg, 250–300 fath.

72. *Calliostoma millegranum*, Phil.
3–20 fath., Rödberg.

73. *Calliostoma occidentale*, Migh.
Rödberg, 150 fath.

74. *Gibbula cineraria*, Linn.
Rödberg, Laminarian zone.

75. *Margarita helicina*, Fabr.
Trondhjem and Rödberg, 0–10 fath.

76. *Margarita grœnlandica*, Chemn.
At Rödberg, with the last.

77. *Scissurella crispata*, d'Orb.
Large specimens, Rödberg, 250–300 fath. *Scissurella*

attains a much larger size in the Norwegian fiords than in the British seas.

78. *Emarginula crassa*, Sow., and var. *depressa*, G. O. Sars.
Five specimens at Rödberg on the precipices, 100–250 fath.

79. *Puncturella noachina*, Linn.
Trondhjem and Rödberg, 5–200 fath.

80. *Pilidium fulvum*, Müll.
Trondhjem and Rödberg, 5–40 fath.

81. *Acmæa virginea*, Müll.
Specimens small, Rödberg, 0–40 fath.

82. *Lepeta cæca*, Müll.
3–40 fath., Rödberg and Trondhjem.

83. *Patina pellucida*, Linn.
Rödberg, on Laminariæ.

84. *Patella vulgata*, Linn.

85. *Hanleyia debilis*, Gray, = *Chiton Hanleyi*, Bean.
100–250 fath., Rödberg and Trondhjem.

86. *Leptochiton alveolus*, M. Sars.
150–250 fath., Rödberg.

87. *Leptochiton cinereus*, Linn., = *C. asellus*, Chemn.
5–10 fath.

88. *Trachydermon ruber*, Linn.
Shallow water.

Var. *candidus*, Norman.

A very pretty variety occurred at Rödberg, of which I found three specimens, all exactly alike. Valves white, except a longitudinal central dorsal line of rose-colour on the fifth valve, and the girdle also rose-coloured.

89. *Trachydermon albus*, Linn.
Shallow water, Rödberg.

90. *Trachydermon exaratus*, G. O. Sars.
200–250 fath., Rödberg.

91. *Tonicella marmorea*, Fabr.
Shallow water, Trondhjem and Rödberg.

92. *Neomenia carinata*, Tulljberg, = *Solenopus nitidulus*, M. Sars (MS.).
250–300 fath., Rödberg.

93. *Chætoderma nitidulum*, Lovén, = *Chrystallophrisson nitens*, Möbius.
250–300 fath., Rödberg.

SCAPHOPODA.

94. *Dentalium entalis*, Linn.
40–70 fath.

95. *Dentalium striolatum*, Stimpson, = *D. abyssorum*, M. Sars.
150–300 fath.

96. *Dentalium agile*, M. Sars.
Rödberg, 250–300 fath.

97. *Pulsellum affine*, M. Sars.
Abundant in one dredging, 250–300 fath., Rödberg.

98. *Pulsellum quinquangulare*, Forbes, = *Siphonoentalis tetragona*, G. O. Sars.
150 fath., Trondhjem; 250–300 fath., Rödberg.

99. *Cadulus subfusiformis*, M. Sars.
Rödberg, 250–300 fath.

PELECYPODA.

100. *Anomia ephippium*, Linn.
Var. *aculeata*, Linn.

101. *Anomia striata*, Brocchi.
Rödberg, in about 150 fath.

102. *Pecten islandicus*, Müller.
Trondhjem, a small specimen.

103. *Pecten aratus*, Gmelin.
150–250 fath., Trondhjem and Rödberg.

104. *Pecten pes-lutræ*, Linn., var. *septemradiatus*, Müll.
Two or three small specimens, Rödberg and Trondhjem.

105. *Pecten vitreus*, Chemn.
150 fath., off Trondhjem; and 150–300 fath., Rödberg.

106. *Pecten striatus,* Müller.
Specimens large.

107. *Pecten tigrinus,* Müller.
Trondhjem and Rödberg.

108. *Pecten similis,* Laskey.
Trondhjem and Rödberg, down to 250 fath.

109. *Pecten imbrifer,* Lovén, =? *Pecten Hoskynsi,* Forbes.
Only one living specimen, 250–300 fath., Rödberg.

110. *Lima excavata,* Fabr.
This magnificent shell is far from rare in the fiord, and was taken both off Trondhjem and Rödberg in 150–300 fath., for the most part with the large corals and Alcyonarians on the precipices.

111. *Mytilus edulis,* Linn.

112. *Modiola modiolus,* Linn.
Trondhjem.

113. *Modiola phaseolina,* Phil.
Trondhjem and Rödberg.

114. *Modiolaria marmorata,* Forbes.
In *Ciona intestinalis* at Trondhjem.

115. *Modiolaria nigra,* Gray.
Rödberg, shallow water.

116. *Crenella decussata,* Mont.
250–300 fath., Rödberg.

117. *Arca pectunculoides,* Scacchi.
100–250 fath., Rödberg.

118. *Arca nodulosa,* Müller.
A single valve only, Trondhjem, in about 70 fath.

119. *Nucula nucleus,* Linn.
Only one, Trondhjem.

120. *Nucula nitida,* Sow.
Frequent down to 300 fath.

121. *Nucula tumidula,* Malm.
100–300 fath., Trondhjem and Rödberg.

122. *Leda minuta*, Müller.
Frequent.

123. *Leda pernula*, Müller.
Only one specimen, Rödberg.

124. *Malletia obtusa*, M. Sars.
A fine series of living specimens of this rare shell taken at Rödberg, 250–300 fath.; also off Trondhjem in 150 fath.

125. *Portlandia lucida*, Lovén.
Trondhjem, 150 fath.; Rödberg, 70–300 fath.

126. *Portlandia tenuis*, Phil.
Trondhjem, one specimen only, 150 fath.

127. *Portlandia frigida*, Torell.
Rödberg, 250–300 fath., specimens large. This species attains larger dimensions on the west coast than in East Finmark.

128. *Astarte sulcata*, Da Costa.
Shallow water.

129. *Astarte compressa*, Linn.,=*A. elliptica*, Brown.
The Scandinavian naturalists seem agreed that this is Linné's species, and not the next, which is usually called by this name by British conchologists.

130. *Astarte Montagui*, Dillwyn,=*A. compressa*, Montagu.
Shallow water, Trondhjem and Rödberg.

131. *Kelliella miliaris*, Phil.
Abundant in 150–300 fath. in the Trondhjem Fiord, as I have also found it to be at the bottom of the Bergen and Hardanger Fiords, as well as at Florö.

132. *Montacuta substriata*, Mont.
On *Spatangus purpureus*, Trondhjem.

133. *Montacuta ovalis*, G. O. Sars,=*Tellemya ovalis*, G. O. Sars.
A single perfect but dead shell in 250–300 fath., Rödberg. It has only previously been recorded from Lofoten, where it was taken by the describer, unless it be a synonym of *Decipula ovata*, Jeffreys, as stated by him to be the case (*vide* Proc. Zool. Soc. 1881, p. 696). If that be so, and Sars's shell has such a hinge as is described by Jeffreys, my

determination is wrong, since the hinge in my shell closely corresponds with that of *Montacuta ferruginosa* and with Sars's description. Unfortunately the specimen I had of *Decipula ovata* from the Oster Fiord, identified by Jeffreys, has been broken and lost (Norman, Journ. of Conch. vol. ii. 1879, p. 42).

134. *Montacuta bidentata*, Mont.
Rödberg, 0–10 fath.

135. *Cryptodon ferruginosus*, Forbes.
70–100 fathoms.

136. *Cryptodón croulinensis*, Jeffr.
100–300 fath., Trondhjem and Rödberg.

137. *Cryptodon flexuosus*, Mont.
Down to 300 fath.

138. *Cryptodon Sarsii*, Phil.
With the last.

139. *Lucina borealis*, Linn.
Trondhjem, specimens small.

140. *Cardium echinatum*, Linn.
Trondhjem.

141. *Cardium edule*, Linn.
Trondhjem, tide-marks.

142. *Cardium fasciatum*, Mont.
Trondhjem and Rödberg.

143. *Cardium minimum*, Phil.
Trondhjem and Rödberg, 70–300 fath.

144. *Cyprina islandica*, Linn.
Trondhjem.

145. *Venus gallina*, Linn.
A single valve, Trondhjem.

146. *Venus ovata*, Pennant.
Trondhjem and Rödberg.

147. *Dosinia lincta*, Pult.
Rödberg, shallow water.

148. *Psammobia ferroensis*, Chemn.
A single specimen, Trondhjem.

149. *Macoma calcarea*, Chemn.
Rödberg, 0–5 fath.

150. *Macoma balthica*, Linn.
Trondhjem.

151. *Abra longicallus*, Scacchi.
Trondhjem, 150 fath.; Rödberg, 250-300 fath., rare.

152. *Abra nitida*, Müll.
Abundant, Trondhjem and Rödberg, 40–300 fath.

153. *Abra alba*, Wood.
Trondhjem, a single specimen.

154. *Poromya granulata*, Nyst.
Two specimens, 150 fath., off Trondhjem.

155. *Cuspidaria rostrata*, Speng.
Trondhjem and Rödberg, 70–300 fath.

156. *Cuspidaria obesa*, Lovén.
Rödberg, 150–300 fath.

157. *Cuspidaria costellata*, Desh.
Rödberg, 40–150 fath.

158. *Cuspidaria abbreviata*, Forbes.
Rödberg, 70–100 fath.

159. *Corbula gibba*, Olivi.
Only a small specimen or two seen.

160. *Saxicavella plicata*, Mont.
Trondhjem and Rödberg, 150–300 fath.

161. *Mya arenaria*, Linn.
Trondhjem, dead valves.

162. *Mya truncata*, Linn.
Trondhjem, on shore and dredged.

163. *Saxicava rugosa*, Linn.
Rödberg, down to 250 fath.

Var. *arctica*, Linn.
Unusually large examples of this variety at Rödberg on the precipices down to 200–250 fath.

164. *Solen pellucidus*, Penn.
Two or three small specimens.

165. *Xylophaga dorsalis*, Turton.

Wood dredged at Trondhjem which had been bored by this species.

[To be continued.]

EXPLANATION OF PLATE XVI.

Fig. 1. *Ukko Turtoni*, var. *brevis*, Norman, nat. size.
Fig. 2. *Ukko Turtoni*, var. *tumida*, Norman, nat. size; the lip much broken below.
Fig. 3. *Ukko schantaricus*, Middendorff, nat. size; specimen from the North Pacific.
Fig. 4. *Sipho gracilis*, var. *glaber*, Verkruzen, dwarf form, nat. size.
Fig. 4 *a*. Apical whorls of the last, to show the rudely coiled nucleus.
Fig. 5. *Sipho propinquus*, Alder, var. from the Kattegat, nat. size, to show its close approximation in form to fig. 4.
Fig. 5 *a*. Apical whorls of the last, to show the regularly coiled nucleus.

LIV.—*On a new Genus of Heteromerous Coleoptera belonging to the Family* Lagriidæ, *from Tasmania.* By G. C. Champion, F.Z.S.

SIRRHAS, gen. nov.

Mentum small, strongly transverse, trapezoidal, almost smooth, flat, the maxillæ exposed at the base; mandibles bifid at the tip; labrum strongly transverse, prominent, separated from the epistoma by a coriaceous space; head rather large, moderately broad, exserted, very little narrowed behind, the epistoma very broad, short, depressed, and confounded with the front, the antennary orbits short and feebly raised, not projecting over the points of insertion of the antennæ; the eyes large, moderately prominent, widely separated, somewhat distant from the base of the head; apical joint of the maxillary palpi stout, triangular, the outer side rounded and a little longer than the inner or apical sides; antennæ very elongate, slender (the first joint excepted), joints 1 to 8 sparsely punctured, shining, 9 to 11 densely punctured, opaque, 2 to 8 cylindrical, each abruptly thickened at its distal end, 2 short, 3 exceedingly long, nearly four times as long as 2, 4 about half the length of 3, 4 to 11 subequal in length, 9 to 11 a little stouter than 8 and more gradually thickened, 11 subacuminate at the tip; prothorax transversely cordate, much wider than the head, expanded and sharply margined at the sides, the base and apex subtruncate, the apex with a fine reflexed marginal carina, the lateral margins reflexed; scutellum strongly transverse, rather large; elytra broad and depressed, about one third wider than and more than four times as long as the prothorax, broadly truncate at the base, subparallel for two thirds of their length, confusedly punctured, the humeri rounded; anterior coxæ somewhat conical, strongly exserted, subcontiguous, the prosternum not raised between them, the cavities closed behind; mesosternum largely developed anteriorly, feebly transversely depressed before the middle coxæ, the latter slightly exserted, narrowly separated, with widely open cavities and large trochantin; metasternum elongate, deeply longitudinally grooved in the middle behind; intercoxal process subtriangular; epipleuræ extending narrowly to the apex; legs rather elongate, very slender, sparsely clothed with rather long hairs, the femora slightly swollen beyond the middle, the tibial spurs short; the tarsi shorter than the tibiæ, densely clothed with fine silky hairs beneath, simple, the basal joint of the hind pair rather longer than the third and fourth joints united; body elongate, depressed, fully winged.

This genus is proposed for a single species from Tasmania. It belongs to the group Trachélosténides of the Lagriidæ, following the system of Lacordaire. The only known genus of the Trachélosténides, *Trachelostenus*, Sol., is from Chili.

Sirrhas limbatus, sp. n.

Elongate, rather broad, subparallel, depressed; pitchy brown, the margins of the prothorax narrowly and indeterminately ferruginous, the elytra broadly bordered with obscure testaceous; antennæ testaceous, the basal joints stained with piceous; legs pitchy brown, the base of the femora, the outer half of the tibiæ, and the tarsi entirely testaceous; the upper surface with scattered, short, fine, semierect hairs. Head thickly, irregularly punctured; prothorax about one fourth broader than long, much wider at the apex than at the base, widest a little behind the middle, the sides thence to the base obliquely and abruptly converging, the anterior angles strongly rounded, the hind angles very obtuse, the disk a little flattened at the base in the middle, the surface densely, moderately finely punctured, more sparsely so towards the sides anteriorly, the punctures on the middle of the disk showing a tendency to become longitudinally confluent; elytra densely, very irregularly, moderately finely punctured, with irregular double rows of very shallow areolæ, which are separated by feebly raised longitudinal lines, the areolæ here and there confluent, and becoming deeper beyond the middle; beneath sparsely pubescent, somewhat densely, moderately coarsely punctured, the metasternum more finely punctured in the middle.

Length 12, breadth 4½ millim.

Hab. N.E. Tasmania, Gould's Country.

I have seen three specimens of this species: two recently brought from Tasmania by Mr. J. J. Walker, late of H.M.S. 'Penguin,' to whom they were given by Mr. A. Simson, of Launceston, from one of which the above description is taken (the other having been deposited by Mr. Walker in the British Museum), and a third in Mr. F. Bates's collection. Mr. Bates's specimen is lighter in colour, it being reddish brown, with the broad marginal stripe of the elytra stramineous.

Sept. 23, 1893.

LV.—*On the Nutrition of the* Salpa *Embryo.* By W. K. Brooks*.

As the mammalian placenta nourishes and aerates the blood of the fœtus by the diffusion of gases and food in solution through the walls of the blood-vessels, it has been generally taken for granted that the placenta of *Salpa* performs its function in the same way; and it has been described as divided into a fœtal chamber and a maternal chamber, although its cavity is in reality part of the body-cavity of the chain-Salpa, and the blood which circulates in it that of the chain-Salpa. The *Salpa* embryo is bathed by the water which is constantly flowing past it, and it is therefore in very much closer relation to the external world than a mammalian embryo shut up in the interior of a large thick-walled body. There does not seem to be any need in *Salpa* for a respiratory placenta, and its thick spongy walls seem to indicate that it is not respiratory. We find in its structure nothing like the interlacing villi of the mammalian chorion, and the sections show that the embryo is nourished in a way quite unlike anything which has been described in the Mammalia.

The subject is a very interesting one. The rapid growth of the *Salpa* embryo is one of its most conspicuous characteristics, and the nutrition which this rapid growth demands

* From the 'Johns Hopkins University Circulars,' vol. xii. no. 106, pp. 97, 98.

is secured by two very peculiar organs, the follicle and the placenta.

While the egg at the time of fertilization is very minute, the embryo at the time of birth is enormous as compared with the size of the chain-Salpa which carries it, and it certainly increases many thousandfold during development. The growth is only partially due to cell-multiplication, and it is in part a result of the growth of the individual cells, for, instead of growing smaller with repeated division, they actually increase in size in all parts of the body.

This growth of the cells is one of the most notable peculiarities of the *Salpa* embryo, and in many parts of its body cells as large as the original ovum are found. The growth sets in very early, and it goes on uninterruptedly throughout the whole fœtal life, so that the embryo becomes gigantic as compared with the body of the chain-Salpa which contains it. Quoy and Gaimard describe an embryo 2 inches long at birth in a Salpa (*S. Forskalii*) a foot long, and Leuckart says that the embryo of *S. democratica* at birth is two fifths as long as the chain-Salpa which carries it. The fully grown embryo of *S. hexagona* is almost as long in comparison with the chain form of the same species.

It is not unusual for the embryos of viviparous animals to gain slightly in size and weight before birth; but, as Leuckart points out, the mammals are the only animals which exhibit anything comparable to the rapid growth of the *Salpa* embryo from a minute egg, and the history of the *Salpa* embryo at once calls to mind that of the placental mammals; nor is this resemblance entirely superficial, for in both the mammal and in *Salpa* we find an especial fœtal organ, the placenta, for the purpose of affording to the growing embryo an abundant supply of nutriment.

The resemblance between the fœtal life of *Salpa* and that of a mammal is most remarkable, and it is all the more noteworthy since we may be absolutely confident that the placenta of *Salpa* is an independent acquisition, entirely without genetic relation to that of mammals.

No modern writer except Todarro has ventured to regard the two structures as homologous, and their phylogenetic independence is so obvious that it is not necessary to discuss it, although a greater physiological and anatomical resemblance than the facts warrant has usually been assumed.

We should hardly expect fundamental similarity in structures of diverse origin. On the contrary, we might reasonably look for profound differences between the placenta of *Salpa* and that of the mammals.

The various writers on *Salpa*, while recognizing this fact and while pointing out the great differences in the way in which the placenta is formed in the two cases, have nevertheless assumed, either explicitly or by implication, a much greater resemblance to the mammalian placenta in structure and in function than actually exists. The later writers say very little about the function of the placenta of *Salpa*, but they assume a fundamental similarity to its function in mammals.

So far as it is in both cases an organ for supplying the embryo with nutritive matter derived from the blood of the supporting organism, the resemblance is real; but it goes no further than this, and the way in which the nourishment is conveyed to the embryo is totally unlike, a fact which has never been described or even noted.

In the mammalian placenta the blood of the embryo, as it circulates through the villi of the chorion, is brought into such close contact with the blood of the mother, that diffusion takes place through the separating walls, and thus the blood of the fœtus is oxidized, relieved of its waste products, and supplied by diffusion with nutritive matter in solution.

Notwithstanding the very intimate union between the blood-vessels of the fœtus and those of the mother, there is no direct communication between them, and nothing except gases and liquids can pass from the body of the parent to the body of the child without the violent rupture or perforation of the walls of the vessels, unless perhaps some very minute Bacteria are an exception.

It has been generally assumed that this must be true of *Salpa* also. Thus, Barrois says incidentally and very briefly (p. 495) that the function of the placenta of *Salpa* is to bring about by osmosis an interchange of fluids between the blood of the parent and that of the embryo, as in the placenta of a mammal.

The subject has received very little attention; but as no one has ever commented upon the view set forth at considerable length by Leuckart (pp. 61 and 62), this may be regarded as the accepted view. He says:—"The histological differentiation of the organs and tissues of the embryo is accelerated to a high degree by the circulation in the body of the young *Salpa*, which is completely separated from the circulation of the mother. At no time does the blood of the mother pass through the wall of the placenta into the body of the embryo. The transfusion between the mother and the fœtus is, as in the mammals, purely endosmotic, through the substance of the placenta, and it is most essentially facilitated by the movement of the blood, both in the embryo and in the chain-Salpa.

"The upper wall of the placenta, which is the peculiar seat of the process of diffusion, projects into the body of the embryo and is surrounded by the median ventral blood-sinus. As the blood-corpuscles of the embryo are much smaller than those of the chain-Salpa, it is easy to see that no mingling takes place."

It is probably true that no transfusion of blood-corpuscles takes place, and it is difficult to show from the study of sections of hardened specimens that no serum from the blood of the chain-Salpa is diffused through the wall of the placenta, although its great thickness seems to be a very unfavourable condition for this purpose; and I shall show further on that the mechanism of nutrition is very different from that of mammals, that this is effected by the actual migration of great placenta-cells into the body-cavity of the embryo. The placenta is an organ for the nourishment of the placenta-cells by the blood of the chain-Salpa, and the subsequent degeneration of these cells, after they have migrated into the body of the embryo, supplies the material for the growth of the embryo. This is in all probability the only function of the placenta, for there does not seem to be any need for an especial apparatus for oxidation or for the removal of waste products. The *Salpa* embryo stands in much more direct relation to the external world than the mammalian embryo. It projects into the cloaca of the chain-Salpa, and is freely exposed to the constant current of fresh sea-water which flows around it, and its thin surface seems to be much more favourable than the thick wall of the placenta for the diffusion of gases. During the later stages of fœtal life its own mouth is open, its muscles contract, and there is no reason why it should not breathe for itself exactly like an adult. I therefore regard the placenta as a nutritive organ pure and simple, and it serves its purpose not by the diffusion of a fluid, but by the transportation of solid food into the body of the embryo. From this point of view it is clear that those investigators who have described it as divided into a fœtal chamber and a maternal chamber have been misled by an erroneous notion of its function.

The detachment of the placenta-cells has been observed and noted by both Salensky and Barrois, but it has been regarded as a destructive change and as a sign that the organ has served its purpose and has become superfluous.

It has been assumed that it reaches its perfect form and serves its purpose, and that it then degenerates and breaks down, and no importance has been attached to the process of degeneration, as it has not been regarded as significant.

No note has been made of the very early stage at which degeneration begins, nor of the fact that it is initiated as soon as the embryo begins to grow and long before it has reached half or a quarter of the size which it is to have at birth.

This is hard to explain so long as the disintegration of the placenta is regarded as its destruction, but it becomes quite intelligible as soon as we learn that the detachment of the placenta-cells, instead of marking the end of its functional life, is actually a manifestation of its useful activity.

These strings of cells multiply at their lower ends by direct division of their nuclei, and as the new cells which are thus formed push up towards the top they grow very large, while their nuclei become filled with diffused chromatin granules. In *Salpa hexagona* these cells ultimately reach the top of the placenta, where they gradually become elongated and irregular, and then break through into the body-cavity of the embryo as the migratory follicle-cells.

While the details are slightly different in *Salpa pinnata*, placenta-cells migrate bodily into the embryo in the same way.

The rapid growth of the embryo seems to be most important to *Salpa*, and while we know almost nothing of its birth-rate, the quickness with which the surface of the ocean becomes covered with *Salpæ* of all ages in a long calm shows that the animals are most prolific, and the complicated structure of the organs for nourishing the embryo shows that every provision is made for rapid growth.

The placenta is not the only nutritive organ, for the follicle also makes most important contributions to the supply of material which is available for the construction and rapid completion of the body of the embryo; and while I have spoken of the segmentation and the formation of the blastodermic germ-layers as retarded, the retardation is probably not actual but only relative, and the process of development is, on the whole, accelerated by the presence of the follicle and by its share in the growth of the embryo.

The ultimate fate of all the follicle-cells is the same, and they may be found in the sections, detaching themselves and degenerating, first, in the somatic layer of the embryo; secondly, in the somatic follicular lining of the perithoracic structures; thirdly, in the cavity of the pharynx; fourthly, in the visceral mass outside the digestive cavity; and, last, in that part of the placenta which is derived from the somatic layer of the follicle.

While it is not possible to trace the history of every cell from first to last, we have as ample evidence as we could hope from sections that the function of the follicle of *Salpa* is exclusively nutritive, that it is transitory and embryonic, and that the tissues of the embryo are not built up out of follicle-cells, but from blastomeres, after the analogy of all the rest of the animal kingdom.

LVI.—*Descriptions of new Coleoptera from New Zealand.* By Captain Thos. Broun.

[Continued from p. 302.]

Group **Cryptorhynchidæ.**

Acalles integer, sp. n.

Convex, piceous, variegate; squamosity hair-like, mostly yellowish red; at the base of the thorax, near each side and near each shoulder, there are pale streaks, and there is a similar but less distinct and much interrupted one between the hind thighs; near the top of the posterior declivity there is a large dark band which does not reach the middle; there are also numerous erect, not coarse, variegate setæ on the legs as well as on the body; antennæ and tarsi reddish.

Rostrum shorter than the thorax, with a median carina, more or less squamose and punctate. *Antennæ* implanted behind the middle; scape short, incrassate towards the apex; funiculus elongate, second joint as long as the first but much more slender, 3 to 7 decrease in length; club elongate-ovate. *Thorax* longer than broad, widest behind the middle, more (but very gradually) narrowed towards the front than it is near the base, its punctuation close and rugose; the apex is rounded, the base truncate. *Scutellum* absent. *Elytra* very slightly broader than the thorax at the base, widest and much rounded between the middle and hind legs, from thence they are gradually but a good deal narrowed; the hind declivity is not at all abrupt; they are rather deeply and regularly striate, the punctuation (owing to the clothing) is indefinite. *Legs* robust, elongate; femora long and thick, not dentate; front tibiæ incurved, the others flexuous; tarsi slender, third joint a good deal expanded and bilobed.

Underside with depressed, tawny, hair-like scales. *Meta-*

sternum short. *Abdomen* flat or only slightly but broadly impressed longitudinally; first segment rounded between the coxæ, second only half the length of the first in the middle, third and fourth not much abbreviated, fifth as long as the preceding two and more closely punctured. *Femora* grooved near the extremity.

A very pretty little species, which, in general appearance, much resembles *Agacalles formosus.* No. 874 is its nearest ally.

Length (rostr. excl.) $1\frac{1}{4}$, breadth $\frac{5}{8}$ line.

Hunua Range, Maketu. Two examples.

It is a ground weevil.

Acalles formosus, sp. n.

Convex, broad, subovate, beautifully variegated; antennæ and tarsi red.

Rostrum nearly as long as the thorax, moderately broad, subparallel, covered with comparatively coarse, depressed, fulvous and yellow scales. *Antennæ* medially inserted; scape very short, much thickened apically; funiculus elongate, second joint rather longer but much more slender than the first, third and fourth subquadrate, seventh a little broader than the sixth; club large, ovate, its basal joint large, the others small. *Thorax* about as long as broad, its anterior half moderately contracted, the base subtruncate, it is closely punctured; the surface shining black, covered with elongate but not hair-like scales, mostly reddish; greyish ones form a short basal streak near each side, sometimes a few grey squamæ are scattered on the disk. *Scutellum* invisible. *Elytra* broader than the thorax at the base, subcordate, curvedly narrowed and deflexed posteriorly; their striæ seem to be formed by deep elongate punctures, the sutural region is somewhat depressed near the base, so that the adjoining interstices appear raised; they are apparently reddish, the scales are like those of the thorax, but some black ones form large spots at each side, and sometimes there is a dark space in front of the declivity; there are also some grey scales, these, however, are much more slender than the others; the setæ are not numerous, they are erect or curled, and are most evident near the sides. *Legs* long and thick, covered with elongate fulvescent scales; the tibiæ with coarse outstanding setæ, the front pair a little incurved, the others nearly straight. *Tarsi* narrow, the third joint, however, is broadly lobate, fourth rather short, their soles with very short setæ.

Underside piceous, squamæ reddish. *Pectoral canal* deep, extending to hind margin of front coxæ, the whole middle portion of the mesosternum forms a sort of raised curved lamina; this is not abruptly elevated towards the front. *Metasternum* short. *Abdomen* large, first segment flat, densely squamose, nearly truncate between the coxæ; second on a lower level, hardly longer than the third or fourth. *Coxæ* about equidistant longitudinally and transversely. *Femora* grooved near the apex.

In No. 2572 the eyes are rather large and nearly round; in *A. formosus* they are small and more widely separated above.

Allied to *A. incultus*, the sternal structure similar.

Var. A.—Rufous, the rufescent scales replaced by yellowish ones, the black marks nearly absent, rostrum nearly nude.

Var. B.—The slender white scales of the elytra are wanting, as are also the pale thoracic streaks.

Length (rostr. excl.) 1, breadth $\frac{5}{8}$ line.

Mount Pirongia. Three, December 1892.

This is another ground weevil.

Acalles ruficollis, sp. n.

Convex, subovate, not narrow, rather nitid, with many erect, slender, fuscous setæ; the sides of the thorax covered with flat tawny scales; the elytral interstices sparsely clothed with curled, rather short and thick, yellowish setæ; thorax dark red, the sides and apex of the hind body piceous, the dorsal portion reddish or castaneous; rostrum pitchy red; antennæ fulvescent, club dark; legs infuscate red.

Rostrum shorter than the thorax, with four ill-defined longitudinal grooves, its punctuation becoming very coarse behind. *Antennæ* medially inserted; scape slender and moderately short, thickened near the extremity; funiculus elongate, second joint as long as the first but much more slender, third and fourth rather longer than broad; club ovate, opaque, indistinctly annulate. *Thorax* as long as broad, much narrower in front than behind, not abruptly so however, slightly constricted near the apex, base truncate; its surface closely and distinctly punctured, the interstices on the middle form transverse rugæ. *Elytra* much broader than the thorax, closely adapted thereto, the base, however, scarcely exceeds that of the thorax, they are obovate or cordiform; their striæ are moderately broad and deep, but their punctuation is not always well marked, the interstices are convex. *Legs* stout, with elongate erect setæ, the anterior evidently longer than the others; tarsi finely setose, third joint strongly expanded and lobate, fourth slender.

Underside piceous, shining, with a few rather slender yellowish setæ. *Pectoral canal* deep, extending to the front margin of the middle coxæ, the mesosternum curved there but not much raised; it is ciliate behind. *Metasternum* very short, almost linear between the hind and middle coxæ, the middle depressed, each side with a patch of pallid sponge-like squamæ extending inwardly as a sort of streak. *Abdomen* large, densely and minutely sculptured, the first segment in the middle nearly twice the length of the second, depressed along the middle, with some coarse punctures, the frontal suture not well defined; third and fourth very short, below the level of the basal ones; fifth red, rather large, finely punctured. *Tibiæ* produced and acuminate at the inner extremity.

In appearance this somewhat resembles *A. comptus*, which, however, is less convex and much narrower; the tibiæ have slender but distinct spurs, and the tarsal and sternal structure differs, so that the two are not really congeneric. It may be identified by the bare, red, transversely sculptured disk of the thorax.

Length (rostr. excl.) $\frac{7}{8}$, breadth $\frac{1}{2}$ line.

Mount Pirongia. About half a dozen individuals were found on the ground in December 1892.

Acalles porcatus, sp. n.

Piceous, slightly shining, nearly bald, having only a few erect, rather slender, yellowish setæ; rostrum red; antennæ testaceous, club black.

Rostrum finely sculptured. *Scape* short and rather thick, medially inserted. *Funiculus* longer than the scape, second joint short, much more slender than the thick basal one; club large, ovate. *Thorax* about as broad as it is long, a good deal narrowed anteriorly, broadly constricted there, coarsely punctate. *Scutellum* invisible. *Elytra* short and broad, much rounded; the striæ broad and deep, with coarse punctures, sometimes appearing irregular or interrupted; interstices narrow and convex, not always equally elevated.

Underside like that of *A. farinosus*, except that the middle of the metasternum is more broadly depressed.

In form like the preceding species, but with still more scanty clothing, and the sculpture much coarser and irregular. The second ventral segment is nearly vertical behind and on a higher plane than the following two, which are extremely short. The femora are grooved below.

Length (rostr. excl.) $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia. Four examples, December 1892.

Var. *A. xenorhinus.*

Thorax pale castaneous or fuscous. The rostrum is peculiar, as along each side there seems to be a sort of carina, which becomes thicker near the eye; this, if it were not for the fine dense sculpture, looks as if the scape were placed there. As it may prove to be distinct, I have given it a name.

Length (rostr. excl.) $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia.

Acalles puncticollis, sp. n.

Convex, compact, ovate, sparingly clothed with quite erect, rather long and slender, yellowish setæ; there are some on the elytra only half as long, and on the sides of the thorax the setæ are short and curled; the rostrum, most of the elytral disk, and the thorax dark red; the antennæ and tarsi and, in one example, the apex of the thorax more or less testaceous.

Rostrum shorter than the thorax, slightly and gradually narrowed behind, grooved near each side, with a row of elongate punctures along each side of the middle. *Scape* short, rather slender, glabrous, implanted at the middle. *Funiculus* elongate, second joint slender, quite the length of the first; club oblong-oval. *Thorax* about as long as broad, not suddenly narrowed towards the front, broadly and abruptly constricted there, base truncate; its punctuation close, deep, not very coarse, and transversely rugose. *Scutellum* absent. *Elytra* rounded towards the base, which equals that of the thorax, broader behind, the posterior declivity rounded or inflexed and not much narrowed; striæ broad, their punctures not deep; interstices rather narrow and convex. *Legs* moderate; tibiæ a little flexuous, the anterior with small hooks; tarsi short, third joint broadly expanded.

A very small species, which may be known by the densely sculptured thorax and broadly oval form. One example is almost entirely piceous.

Length (rostr. excl.) $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia. Three, December 1892.

Acalles farinosus, sp. n.

Ovate, convex, piceous or pitchy red; antennæ reddish, club dark; sparsely clothed with short, rather coarse, semierect, yellowish, scale-like setæ.

Rostrum about as long as the thorax, smooth along the middle. *Scape* short, incrassate apically, medially inserted. *Funiculus* with the first joint a good deal expanded towards the extremity, second about as long but very slender; club large, oblong-oval. *Thorax* about as long as broad, considerably but not abruptly narrowed anteriorly, broadly but not deeply constricted near the apex, base truncate; rather coarsely, closely, and rugosely punctured, the punctures in front rather large, but not as close as those on the disk. *Scutellum* absent. *Elytra* rather short and rounded, hardly wider than the thorax at the base, with broad deep striæ, which, however, are distinctly punctured near the sides only; interstices narrow and convex. *Tarsi* short, third joint broadly expanded.

Underside piceous, with coarse, shallow, rather distant punctures and short slender setæ. The *pectoral canal* extends to the front of the middle coxæ. *Metasternum* very short, so that the hind coxæ are not as far from the middle pair as the anterior are. Second segment of the *abdomen* half the length of the first, the intervening suture curvate, fifth red, minutely sculptured.

Distinguished from *A. puncticollis* by the coarser thoracic sculpture, the broader and deeper elytral furrows, and the short coarse setæ. The insect is usually covered with easily-rubbed-off pale scale-like matter.

Length (rostr. excl.) $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Mount Pirongia. Several, December 1892.

ZEACALLES, gen. nov.

Body compact, ovate, very convex, covered with very small squamæ and erect setæ. *Rostrum* about the length of the thorax, pinched in close to the eyes, slightly and gradually narrowed towards the middle. *Scrobes* lateral, deep, expanded behind, reaching the eyes. *Antennæ* implanted at or just behind the middle. *Scape* short and stout, attaining the eyes. *Funiculus* 7-articulate, second joint as long as the first but much more slender. *Club* large, ovate, with small apical joints. *Head* large, broad and globose below. *Eyes* just free, coarsely faceted, ovate, directed downwards, but not acuminate below. *Thorax* conical. *Scutellum* absent. *Elytra* very convex, obovate, abruptly deflexed behind, of the same width as the thorax at the subtruncate base, and closely fitted thereto. *Legs* robust. *Femora* thick, grooved underneath. *Tibiæ* flexuous, uncinate. *Tarsi* short and broad, their soles setose, third joint broadly expanded and lobate. *Pectoral canal* deep, extending as far as the middle of the intermediate coxæ, with raised borders. *Metasternum* short. *Abdomen* large, the suture between the hind coxæ apparently truncate but indistinct; second segment on a lower plane than the first, only about one fourth its length, third and fourth short.

From *Acalles* this differs in the unacuminate eyes, the greatly abbreviated second ventral segment, as well as in the general form. The genus is nearer to *Acallopais*, but the femora and abdomen are totally different. The species form a homogeneous group distinguishable by the strongly and regularly arched upper surface, the fine clothing, &c. They are terrestrial in habit.

Zeacalles flavescens, sp. n.

Body fusco-rufous, densely covered with small, not round, variegate scales, mostly fulvescent; there is a pale streak along the middle of the thorax, another (along each side) is prolonged backwards beyond the shoulders and is curved inwards towards the elytral suture; the short curled setæ are usually pitchy; the rostrum and legs are pale chestnut-red, the antennæ and tarsi fulvous.

Rostrum moderately broad, with yellow scales behind. *Antennæ* feebly pubescent. *Thorax* subtruncate at base, widest there, gradually narrowed anteriorly, without frontal constriction or superficial inequalities, its punctuation concealed by the squamosity. *Elytra* more convex than the thorax, regularly arched above, the posterior portion abruptly curved, obovate, slightly wider before the middle than they are elsewhere; their striæ neither deep nor broad, finely punctured; the second interstice widened behind, and near the top of the declivity slightly elevated. *Legs* with short setæ.

Underside piceous, with some coarse shallow punctures and depressed yellow scales; the fifth ventral segment red, nude, finely and closely punctured.

Var.—Squamosity not so brightly coloured, pale yellowish or greyish. This is smaller than No. 2568, and the sutural striæ are not so deep and broad.

Nos. 2568 and 2569 may be placed in this genus; in the former, however, the second abdominal segment is not so short.

Length (rostr. excl.) $\frac{7}{8}$, breadth $\frac{1}{2}$ line.

Mount Pirongia. December 1892.

Zeacalles varius, sp. n.

Ovate, convex, piceous; antennæ and tarsi reddish, rostrum pitchy red; the clothing variegate, the erect setæ fuscous; on the thorax the scales are reddish, but pallid along the middle and sides, and with some black near each side of the middle; on the elytra pale reddish and grey patches of erect grey setæ form two spots near the sides, and two nearer the suture and top of the declivity; there are also some blackish spots, one of which is on the suture near the base.

Rostrum smooth along the middle, squamose near the base. *Antennæ* inserted behind the middle; scape short, gradually incrassate; second joint of the funiculus nearly the length of the first; club large, ovate. *Thorax* truncate at the base, gradually narrowed towards the front, closely punctate. *Elytra* convex, oval, apparently with series of fine punctures; these, however, are not distinct. *Tibiæ* nearly straight.

This is a well-marked species.

Length (rostr. excl.) $\frac{7}{8}$, breadth $\frac{1}{2}$ line.

Mount Pirongia. Two only, December 1892.

METACALLES, gen. nov.

Body convex, subovate, sparsely clothed with hair-like scales and long outstanding slender setæ. *Rostrum* just about the length of the thorax, gradually and slightly narrowed behind, abruptly notched at the sides near the eyes. *Scrobes* lateral, reaching to the front of the eyes. *Scape* rather short, thickened apically, reaching to the eye. *Funiculus* elongate; first joint stout but slender at the base, second evidently shorter than the first, much more slender, seventh larger than sixth; club large, ovate. *Head* globose below, nearly hidden above; the eyes, however, are not covered, they are depressed. *Thorax* truncate at base, the basal half with rounded sides, the anterior not abruptly contracted. *Scutellum* absent. *Elytra* sharply defined at the base and not exceeding that of the thorax in width, their sides rounded, much narrowed and vertical behind, cordiform. *Legs* moderately long; femora long and thick, grooved near the apex; tibiæ flexuous, their hooks proceed from the outer angles and are bent inwards; *tarsi* narrow, their soles finely setose, the basal two joints nearly nude, their third joint deeply grooved above, not distinctly bilobed, and but little expanded.

The *pectoral canal* extends to beyond the hind margin of the middle coxæ, its sides and the hind border are sharply elevated. *Metasternum* very short. *Abdomen* large, rounded between the hind coxæ, second segment half the length of the first, the suture deep at the sides, apparently straight, but almost obliterated, in the middle. The sides of the thorax in front are gradually shortened downwards; the angles formed by their junction with the pectoral canal can hardly be called *ocular lobes*.

The type of this genus can be recognized by the long rostral canal, which extends into the metasternum. The numerous species referred to *Acalles* are difficult to identify by description alone, so I think advantage may be taken of any well-marked character to lessen the difficulty. Nos. 1274, 1290, 1291, and 1292 should, I think, be located in this genus. I have not been able to study the sternal structure of these four species in a satisfactory manner; but they are so much alike in general appearance and in habit that they form one natural group. In No. 1292, however, the third tarsal joint is more lobate.

Metacalles aspersus, sp. n.

Piceous, clothed with pale ferruginous and grey, elongate, depressed scales, and erect, slender, fuscous setæ; rostrum and antennæ red, club pitchy, tarsi fuscous.

Rostrum finely sculptured, smooth along the middle. *Antennæ* inserted behind the middle of the rostrum, shining; club opaque, with dense pubescence. *Thorax* as long as broad, its frontal half a little depressed and broadly but not deeply constricted; its surface with large shallow punctures and narrow interstices, the sculpture indistinct in front. *Elytra* cordate, widest before the middle, the shoulders much rounded; they are punctate-striate, their clothing is shorter and less depressed than that of the thorax; on the third interstice on each elytron there is a small setose elevation near the base and another on the summit of the declivity; on the fifth there are two ill-defined elevations. *Legs* infuscate, with long upright setæ and also with short, erect, and decumbent grey hairs; tarsi narrow, basal joint rather elongate, yet shorter than the fourth.

Underside piceous, a little shining, with a few fine grey setæ. The two basal segments with some coarse shallow punctures, the fifth red, more finely and closely punctured, third and fourth very short, with straight deep sutures.

Var.—Antennæ testaceous, tarsi reddish. This is mounted on its back, and the description of the underside has been recorded above.

Length (rostr. excl.) $\frac{3}{4}$, breadth quite $\frac{3}{8}$ line.

Mount Pirongia. Two, found on the ground, December 1892.

Metacalles rugicollis, sp. n.

Piceous, antennæ and tarsi red, club pitchy; sparsely clothed with long, erect, fuscous setæ; some yellow scales are placed near the base of the rostrum and on the thorax; on each elytron near the middle of the side there are some pale slender scales, and there are a few fine ash-coloured setæ behind.

Rostrum pitchy red, smooth along the middle, nearly as long as the thorax. *Antennæ* implanted behind the middle; scape short, rather stout; funiculus elongate, second joint more slender than, but nearly as long as, the first; club opaque, large, ovate. *Thorax* rather longer than broad, widest just behind the middle, the frontal constriction shallow, the apex reddish; the surface with large closely placed punctures, these are transversely confluent for the most part, with narrow intervals, so that the disk seems rugose. *Elytra* cordate, much rounded at the sides; their striæ are rather broad and deep, but are only indistinctly punctured. *Tarsi* narrow, their third joint scooped out above, but not distinctly lobate.

When compared with *M. aspersus* it will be seen that the thorax is longer and less contracted anteriorly; it is differently sculptured and is without variegate squamosity. In quite unrubbed specimens I think there will be two small black crests on the third and fifth elytral interstices.

Length (rostr. excl.) $\frac{3}{4}$, breadth quite $\frac{3}{8}$ line.

Mount Pirongia. One, Dec. 1892, on the ground.

Ectopsis simplex, sp. n.

Cylindric, nearly flat above, opaque, black; tarsi and antennæ dark red; covered with very small, depressed, chiefly ferruginous scales; the posterior declivity is clothed with sordid grey squamæ, there is a speck of similar colour near the middle of each elytron, and an elongate mark in front of the scutellum.

Rostrum longer than the thorax, the frontal half nude and finely punctate. *Scape* nearly glabrous, rather slender, a little flexuous and incrassate apically. *Funiculus* sparsely pubescent, second joint distinctly longer than the first. *Club* elongate, one third shorter than the funiculus. *Thorax* one fifth broader than long, abruptly contracted in front; it is flat above and finely and distantly punctured. *Elytra* slightly broader than the base of the thorax, their apical portion rather suddenly truncate; they bear series of distant, shallow, foveiform impressions, the intervals are only slightly uneven. *Legs* nearly concolorous, there being a pale band near the middle of the femora only; these latter are angulate below, the anterior are dentate. *Tarsi* underneath with a bare channel along the middle, elsewhere with dense vestiture.

Very much like the typical species, No. 1272, but only about half the size and without superficial inequalities. The tarsi are narrower, their third joint evidently so. The sculpture of the elytra differs, the apical declivity has no nodiform elevations. The squamosity would be concolorous if it were not for the pale parts described above; in *E. ferrugalis* it is more or less variegate. The large cavities seen on the sides of No. 1272 are here absent, but there are many small flattened granules.

Length (rostr. excl.) $3\frac{1}{4}$, breadth $1\frac{3}{8}$ lines.

Mount Pirongia. One, on the ground, December 1892.

Group **Cossonidæ.**

Camptoscapus, gen. nov.

Body fusiform, subdepressed, nearly glabrous. *Rostrum* almost quite parallel-sided, only very slightly narrowed towards the eyes. *Antennæ* inserted at or close to the middle of the rostrum, rather long and stout. *Scape* not at all short, incrassate but not abruptly clavate towards the extremity; this thickened portion is bent backwards, the basal is slightly curved in the opposite direction. *Funiculus* 5-articulate, second joint almost the length of the first, rather longer than the third; joints 3 to 5 transverse. *Club* ovate, moderate, finely annulate. *Eyes* round, large, a little convex, widely separated above, distant from thorax. *Scutellum* distinct, flat. *Thorax* narrowed and constricted anteriorly, its base truncate. *Elytra* slightly curved from the suture to the shoulders, parallel or a little narrowed posteriorly, apical margins not explanate. *Legs* long and stout; femora slender at the base, clavate beyond; tibiæ slightly dilated towards the extremity, their hooks moderately developed. *Tarsi* narrow, third joint scarcely at all enlarged, not lobate; claws small.

In *Pentarthrum*, as defined by the author, the body is cylindric, the eyes prominent, and the scape is straight. In the Japanese genus *Tychiodes* the scape is short and flexuous, a character apparently of rare occurrence in the subfamily Pentarthrides.

Considering the difficulty in identifying the numerous species of this group, I think advantage may be taken of the structure of the scape, together with other details, to locate the species described below in a distinct genus, to be placed between the two genera cited above.

Camptoscapus sanguineus, sp. n.

Subdepressed, with some minute, hardly perceptible, greyish hairs; moderately shining, dark red, the head and suffused spaces on the elytra piceous.

Rostrum about one half the length of the thorax, moderately broad, subparallel, finely punctured in front, more closely and coarsely behind. *Head* punctate, not twice the width of the rostrum; behind the eyes the punctuation suddenly ceases, so that the short broad neck is smooth and shining. *Eyes* large, almost lateral, not prominent. *Scape* rather elongate, flexuous, gradually and only slightly incrassated. *Funiculus* sparsely pubescent, second joint about as long as it is broad, third and fourth equal. *Club* paler, pubescent, ovate, indistinctly jointed. *Thorax* evidently longer than broad, widest behind the middle, rounded there, gradually curvedly narrowed anteriorly, constricted near the front; the apical portion slightly raised and smooth, the disk flat, moderately finely punctured, much more closely near the sides. *Scutellum* small. *Elytra* almost as broad as the thorax, only very slightly and gradually narrowed posteriorly; their striæ regular, rather deep, closely punctured; interstices plane, with fine serial punctures. *Legs* pubescent; tibiæ but little dilated, not triangular, the front pair with yellow pubescence along the inner face and near the extremity; claws very small.

Pentarthrum planiusculum and *P. conicolle* must be placed in this genus. All three species are represented by single specimens. *P. conicolle* is a female, the others are males.

♂. Length $1\frac{1}{4}$, breadth quite $\frac{1}{4}$ line.

Mount Pirongia (Waikato). December 1892.

All my measurements of Cossonidæ include the rostrum.

Obs. Novitas nigrans, a minute and interesting Cossonid which was described from a female that I found about twenty years ago, was figured on plate 138 of 'Aid to the Identification of Insects.' In November 1892 I was fortunate enough to find a male, whose characters may be recorded here.

Rostrum as long as thorax, slightly and gradually narrowed towards the apex, opaque, densely and finely sculptured, pitchy red, twice as wide as that of the female. *Antennæ* inserted before the middle of the rostrum. *Scape* long, curvate. *Funiculus* five-jointed; second joint slender, as long as first; joints 3 to 5 rather longer than broad, oviform. *Club* oblong-oval. *Breast* finely and closely sculptured. *Metasternum* short. *Abdomen* elongate, the two basal segments rather flat, smooth, without intervening suture in the middle. *Elytra* with obsolete sculpture behind the middle, but with distinct striæ and punctures in front.

♀. Antennæ implanted at or immediately behind the middle of the very slender, quite parallel, glossy red rostrum.

Length $\frac{7}{8}$, breadth $\frac{1}{4}$ line.

Hunua Range, Clevedon. On the ground amongst leaves.

Macroscytalus frontalis, sp. n.

Depressed, moderately broad; pubescence scanty and hardly perceptible; elytra rufo-castaneous, with ill-defined pitchy marks behind, the rest of the body and the legs red, club nearly black.

Rostrum shorter than the thorax, gradually narrowed towards the base, its apical portion not as broad as the back of the head; it is shining red and more finely punctured than the head. *Eyes* round, rather flat. *Head* piceous, gradually narrowed anteriorly, the broad smooth back part abruptly marked off just behind the eyes. *Antennæ* inserted just before the middle of the rostrum; scape elongate, gradually incrassate; funiculus not longer than the scape; second joint distinctly longer than the third; club opaque, densely pubescent, as long as the funiculus. *Thorax* but little longer than broad, widest behind the middle, rounded there, gradually but considerably narrowed towards the front, so that the apex is scarcely more than half the width of the base; the frontal constriction is very slight; it is moderately finely, distinctly, and not very closely punctured; there is an indistinct smooth central line, and the apical margin is smooth. *Scutellum* triangular, distinct. *Elytra* as broad as the widest part of the thorax, base truncate, parallel-sided, apices simple; they are slightly transversely impressed before the middle, with distinctly punctured striæ, interstices with fine serial punctures. *Legs* moderately long; femora medially dilated below; tibiæ slightly flexuous, the outer apex prolonged, the inner acutely prominent, the anterior with moderately slender hooks; tarsi narrow, their third joint excavate above but narrow, so that the minute true fourth joint is obsolete, terminal joint slender, claws small.

This may be known by the large, opaque, densely clothed, black club and the indistinct frontal constriction of the thorax. *M. russulus* most nearly resembles it.

♀. Length $1\frac{1}{8}$, breadth quite $\frac{1}{4}$ line.

Hunua Range, Maketu. One example.

STILBOCARA, gen. nov.

Body ovate-cylindric, subdepressed, nearly glabrous. *Rostrum* parallel or only very slightly and gradually narrowed towards the base, rather shorter than the thorax, only moderately stout. *Antennæ* medially inserted. *Scape* short and stout, thickened towards the extremity. *Funiculus* longer, 7-articulate, basal joint rather larger than those next to it, seventh distinctly larger than sixth. *Club* large, oblong-oval, nearly the length of the funiculus. *Eyes* rotundate, large, prominent, distant from thorax. *Head* large and globose below, above (immediately behind the eyes) abruptly broader, convex, and polished. *Thorax* longer than broad, much narrowed and constricted anteriorly. *Scutellum* distinct, flat. *Elytra* subparallel, base nearly quite truncate, apices not explanate. *Legs* moderately elongate. *Femora* slender near the base, clavate near the extremity. *Tibiæ* laterally compressed, outer extremity of the two hind pairs curvedly prolonged as far as the second tarsal joint; the anterior with moderately developed hooks. *Tarsi* narrow, their basal joint elongate, third slightly lobate, so that the minute fourth joint is visible, terminal elongate and slender. *Claws* moderate.

Metasternum elongate, with an extremely slender linear impression behind. *Abdomen* broadly curved between the hind coxæ, first segment larger than the second, its apical suture fine.

The short scape, elongate club, and the large, globose, polished head, taken together, seem to differentiate this from those genera of the subfamily Cossonides in which the scape is abbreviated. The South-African *Brachyscapus* has a short triangular rostrum and rather approximate eyes. *Stenomimus*, from Brazil, is a minute narrow insect. *Micromimus*, a West-Indian genus, has very large, transverse, sunken eyes. In the New-Zealand list it may be placed near *Phlœophagosoma*, from which, however, it may be separated by a glance at the head and rostrum.

Stilbocara nitida, sp. n.

Shining, sparsely clothed with erect but minute greyish hairs; red, elytra chestnut-red, suffused with piceous behind; tarsi pale red.

Rostrum cylindric, not at all broad, finely and distantly punctured. *Head* behind the eyes twice the breadth of the rostrum, convex and glossy. *Thorax* widest behind the middle, rounded there, gradually but considerably narrowed towards the front, much constricted near the apex; the disk very little convex, with distinct, moderately fine, distant punctures, the sides more closely sculptured, the apical portion almost quite smooth. *Elytra* slightly and gradually narrowed posteriorly, the shoulders not wider than the broadest part of the thorax; dorsum nearly flat, regularly striate, the striæ with distinct but not very closely placed punctures; interstices with fine serial punctures. *Scape* shining and glabrous, considerably shorter than the funiculus. *Club* densely and obviously pilose. *Tibiæ* at the inner angle with a spiniform seta. *Coxæ* widely separated, the anterior much further apart than in *Phlœophagosoma*.

Sexual differences slight; in the female the rostrum is rather longer and more slender than in the male.

No. 942, temporarily placed in *Phlœophagosoma*, must be transferred to this genus. It may be distinguished from *S. nitida* by its more coarsely and closely sculptured thorax, the punctures just behind the constriction are quite close; the elytral grooves are rather deeper and broader, with more punctures in them.

Length $1\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Hunua Range, Clevedon.

Group **Cerambycidæ**.

Didymocantha pallida, sp. n.

Slender, elongate, shining, pale testaceous; antennæ and legs pale yellow; with very few erect pallid hairs.

Head, in line with the eyes, as wide as the thorax; the punctures on the vertex rather small and distant, those behind the eyes smaller but closer. *Eyes* large, coarsely faceted, their greatest bulk in front below the antennæ. *Thorax* of equal length and breadth, widest at the middle, each side with a prominent tubercle there and a smaller one near the front; on the disk in line with the frontal tubercles there are two small, indistinctly raised, smooth spots; along the middle, but not extending to the apex, there is a broad smooth space, this near the base becomes a linear impression; the punctures are fine, distant, and reddish, near the sides they are closer. *Scutellum* extremely short and broad, with a notch in the middle of the apex, so that it seems to consist of two parts. *Elytra* parallel-sided, apices strongly rounded individually, with an elongate sutural gap, the shoulders slightly raised and a little wider than the thorax in line with and including the lateral tubercles; on each elytron there are three ivory-like streaks—one is close to the suture, none attain the apex, the central one is the shortest; the punctures are reddish, rather fine, regular, and not at all close as far as the middle, behind this they become large but shallow and more distant, and they lose the red colour.

Antennæ pubescent, the hairs neither very long nor coarse; first joint closely punctured, the third joint reaches the base of the thorax, it is slightly longer than the fourth, but shorter than the fifth; the eighth attains the extremity of the body.

Underside pallid, the head punctate, transversely grooved behind; prosternum punctate, with some rugæ across the middle; metasternum with a median groove, it is finely punctured and transversely wrinkled; terminal segment of abdomen transversely quadrate, truncate behind, with long pubescence.

D. ægrota, Bates, is the only similar form; in it the thorax is more narrowed anteriorly, the hinder tubercles are placed behind the middle, the insect is darker and more closely and coarsely sculptured, the antennæ are thicker, and the head is narrower.

♀. Length $5\frac{1}{2}$, breadth $1\frac{1}{8}$ lines.

Ligar's Bush, Papakura. One individual only.

Group **Lamiidæ.**

Hybolasius optatus, sp. n.

Oblong, robust, rufo-piceous; legs and antennæ pale infuscate red, the two basal joints of the tarsi darker than the others; rather closely covered with greyish-yellow decumbent hairs, on the elytra they are thinner or absent on some parts so as to cause a spotted appearance.

Head finely sculptured, slightly impressed near the hind margin of the eyes. *Thorax* broader than long but not short, with very fine indistinct granular sculpture, which, however, is better defined and closer on the basal depression; lateral tubercles large but not acute, placed behind the middle; on the disk before the middle there is a pair of very slight elevations; there is no frontal constriction, there being only a superficial transverse depression. *Scutellum* densely pilose.

Elytra gradually narrowed backwards, with broadly rounded apices; basal tubercles rather small and not at all acute; in line with each of these, near the hind thigh, there is a slight obtuse elevation, which is prolonged nearly to the apex, the space near the suture appears depressed; their punctuation is moderate, rather irregular, and not close, the larger punctiform impressions are most distinct near the sides and behind, and cause to a great extent the maculate appearance. *Antennæ* unspotted, with greyish pubescence; the very slender outstanding hairs almost disappear after the eighth joint, the third joint reaches the middle thigh, the fourth is longer than the fifth but shorter than the third, its fulvous pubescence is most conspicuous near the middle; the seventh joint reaches the extremity of the body. *Femora* rather densely clothed except near the base, which is reddish; tibiæ simple, with elongate grey hairs.

There are no species like this. *H. lanipes* is broader and more robust, with more acutely prominent lateral tubercles, a much shorter and broader thorax, and silky white pubescence. In *H. optatus* the third joint of the front tarsi is rather narrow and the second is bisinuate at the apex.

Length 4, breadth $1\frac{1}{8}$ lines.

Woodhill, Kaipara Railway. One, November 1892.

Somatidia proxima, sp. n.

Convex, elongate, medially narrowed, shining, piceo-fuscous, unevenly clothed with yellow pubescence.

Thorax very convex, rotundate, moderately coarsely and closely punctured. *Scutellum* small and narrow. *Elytra* elongate-oval, at the base not wider than the thorax, so that the shoulders are quite obsolete; the basal region is nearly bald, with very few fine punctures; similar punctures are distributed almost to the apex; the yellow pubescence is almost confined to the sides and a broad transverse median space, the long upright hairs are also yellowish. *Legs* robust, femora piceous or rufo-castaneous, tibiæ and tarsi testaceous, the knees fuscous.

Antennæ obscure red, their fine yellowish pubescence does not form spots, the longer hairs are pale or infuscate; third joint very long, it reaches the base of the thorax and is twice the length of the fourth or fifth; the eleventh does not attain the extremity of the body.

♀. Thorax rather longer, widest at the middle, much less globular. Elytra broader. Antennæ slightly shorter, their basal joint not so thick. There is an elongate bare space on the last ventral segment.

S. ptinoides, Bates, is of the same form, but it has a minute denticle on each side of the thorax. The only other near ally is *S. spinicollis*; it is distinguishable by the acute projecting thoracic spines.

Length $1\frac{3}{4}$–2, breadth $\frac{5}{8}$–$\frac{3}{4}$ lines.

Ohaupo, Waikato. One male and two females found near Mr. Kusab's saw-mill, January 1893.

Group **Eumolpidæ.**

Eucolaspis vittiger, sp. n.

Convex, broadly oval, testaceous; the suture and a broad vitta near the side of each elytron dark fuscous, on the thorax there are two oblique vittæ of a paler brown.

Head rather finely punctate. *Thorax* strongly transverse, moderately narrowed anteriorly, the sides finely margined and but little curved; a large median space in front of the base has very few punctures, the sides sometimes are quite impunctate; the punctuation elsewhere is not coarse, nor is it close; sometimes the punctures are quite distant from one another. *Scutellum* longer than broad, smooth. *Elytra* gradually narrowed posteriorly; the sutural striæ are distinct behind, but hardly extend forwards beyond the middle; the punctures are moderately coarse, near the base they are irregularly distributed, behind they generally become quite serial, so that the apical portion is substriate; along the suture the punctures are smaller and closer. *Tibiæ* nearly straight, gradually thickened towards the extremity; the hind face of the posterior has finely carinate edges, so that the space between these appears flattened or grooved.

Length 2–$2\frac{1}{4}$, breadth $1\frac{1}{8}$ lines.

Hunua Range.

This is one of many insects that injure our fruit-trees, and most likely is little more than a variety of *E. ochracea*.

Eucolaspis picticornis, sp. n.

Robust, suboblong, convex, shining, violaceous; labrum and knees pale castaneous; tibiæ and tarsi fuscous; antennæ nearly black, the tips of joints 1 to 10 testaceous.

Head distinctly but irregularly punctured. *Antennæ* elongate, rather slender, second joint longer than broad, 6 to 10 slightly expanded towards the extremity. *Thorax* transverse, widest near the base, gradually narrowed anteriorly, the sides rather broadly margined, very slightly rounded behind; its surface rather coarsely and irregularly punctured, the punctures less numerous near the base and sides. *Scutellum* nearly smooth. *Elytra* oblong, the shoulders somewhat swollen and smooth; the dorsum rather coarsely but not very regularly punctured; the sculpture becomes serial and forms striæ behind, the sutural striæ become obsolete towards the base. *Legs* with greyish pubescence.

The sculpture is coarser than usual and the lateral margins of the thorax are broader. In Nos. 1094 and 1098 the head is quite smooth or only very minutely punctured.

♂. Antennæ thicker, second joint not longer than broad. Front angles of thorax acutely rectangular, less depressed. Legs and tarsi more robust.

Length $2\frac{1}{4}$, breadth $1\frac{1}{4}$ lines.

Waitakerei Range and Pokeno Valley.

Aphilon laticollis, sp. n.

Convex, hemispherical, glabrous, shining, bronze-black; legs and antennæ rufo-testaceous.

Head a little uneven. *Thorax* strongly transverse, its sides finely margined and curved, much more narrowed in front than behind, the apex widely incurved, anterior angles somewhat rounded; its surface finely, distinctly, but not closely punctured, the sides nearly smooth. *Scutellum* triangular. *Elytra* punctate, the larger punctures do not form regular series, the smaller ones are interposed longitudinally. *Legs* stout, the tibiæ curved and a little dilated below the middle. *Antennæ* longer than the head and thorax; first joint thick and dilated inwardly, second thicker but much shorter than the third; third, fourth, and fifth elongate and nearly equal, 6 to 8 longer than broad, seventh rather longer than the contiguous ones, ninth and tenth nearly similar to the eighth, eleventh rather longer than the tenth.

In No. 1106 the sides of the thorax are nearly straight. In No. 1105 the thorax and elytra are more coarsely punctured. The female of No. 1556 has the thorax much longer in the middle and the front angles do not extend outside the eyes. In *A. laticollis* the thorax is broader and the terminal joint of the palpi is obtuse at the extremity.

♀. Length $1\frac{3}{4}$, breadth $1\frac{1}{4}$ lines.

Thames. Mr. Albert Kœbele gave me a specimen.

Obs. In this genus the *scutellum*, though sometimes invisible, is usually triangular. The *tarsi* vary according to sex. Dr. Sharp described the female (No. 1104); in the male the basal joint of the tarsi is large, as in No. 1556.

LVII.—*Further Notes on Fossil Fishes from the Karoo Formation of South Africa.* By A. Smith Woodward, F.L.S.

[Plate XVII.]

A list of all the known fossil fishes from the Karoo formation of South Africa was given in these pages four years ago *, and since that time only one additional species seems to have been recorded †. It is gratifying now to be able to extend the list by adding no less than four new forms; and the following brief descriptions are published in the hope that they may lead to the discovery of more satisfactory specimens than any of those at present available. For this new evidence the writer is indebted to David Draper, Esq., of Newcastle, Natal, and to Professor H. G. Seeley, F.R.S., the former having brought to Europe for determination the species numbered 1 and 4, the latter having discovered those numbered 2 and 3 during his visit to Cape Colony a few years ago.

1. *Dictyopyge* (?) *Draperi*, sp. n. (Pl. XVII. fig. 1.)

Type.—The type and only known specimen of this species is shown of the natural size in the accompanying Pl. XVII. fig. 1. Apart from some fracturing, it is complete and scarcely distorted as far as the caudal pedicle; but the caudal fin, the most important feature in the fish, is unfortunately wanting. It is preserved in the National Museum, Bloemfontein, Orange Free State.

Description.—The proportions of the fish indicated in the figure are probably almost natural, the length of the head with opercular apparatus being about equal to the maximum depth of the trunk and contained perhaps five times in the total length. The head is much fractured, but impressions of the cranial bones seem to exhibit traces of a rugose ornament, and the hinder portion of the mandible is distinctly marked with longitudinal striations. The orbit must have been very large, and the maxilla is shaped as in Palæoniscidæ, with a deep posterior plate and a downward inflexion of the postero-inferior angle. There are some remains of conical teeth of

* A. Smith Woodward, "On *Atherstonia*," Ann. & Mag. Nat. Hist. [6] vol. iv. (1889), p. 242.

† *Acrolepis* (?) *digitata*, Smith Woodward, Cat. Foss. Fishes Brit. Mus. pt. ii. (1891), p. 508, pl. xv. fig. 4.

moderate size. The opercular bones are smooth and the sub-operculum seems to have been at least as deep as broad and little inferior in size to the operculum. All the fins are small, and conspicuous fulcra are preserved on the pectoral and dorsal. The pectoral fin-rays, not less than sixteen in number, do not appear to have been articulated except perhaps at the distal extremity; the pelvic fins, though imperfect, are evidently relatively small and short-based and arise midway between the pectoral arch and the anal fin. The rays of the dorsal and anal fins exhibit distant articulations, and in each fin there are a few short basal rays in front of the long anterior rays on which the fulcra are arranged. The dorsal fin is at least as deep as long, comprising about twenty-five rays besides the basals, and is almost completely in advance of the anal fin, which has a much greater extent and comprises not less than forty, perhaps forty-five, rays in addition to the basals. The whole of the trunk is covered with scales, and there is a series of large post-claviculars attached to the hinder border of the pectoral arch; there are also one or two enlarged ridge-scales at the origin of the dorsal and anal fins. The scales of the flank are about as deep as broad, but become much narrowed ventrally and reduced in size on the caudal pedicle. One of the postclaviculars is marked with oblique ridges and all the principal scales exhibit numerous fine oblique pectinations at their hinder margin, a character gradually becoming obsolete on the caudal region; apart from the pectinations, all the scales are smooth. The lateral line is conspicuous.

Generic Determination.—The absence of the tail renders it impossible to determine with certainty the family position of the specimen just described; but it may be placed either in the comprehensive family of Palæoniscidæ or in the Catopteridæ. Before the discovery of the species of *Dictyopyge* in the Hawkesbury Beds of Australia * it would have been concluded that such a head as is possessed by the South-African fossil could only belong to a Palæoniscid and undoubtedly implied a strongly heterocercal tail. The Hawkesbury fishes, however, have most distinctly the same type of head, combined with a remarkably atrophied heterocercal tail, such as occurs in *Dictyopyge* and *Catopterus*. No decision as to the genus can therefore be arrived at until the caudal extremity is discovered. If the fish is a Palæoniscid

* Smith Woodward, "The Fossil Fishes of the Hawkesbury Series at Gosford," Mem. Geol. Surv. N. S. Wales, no. 4 (1890), pp. 16–22, with figs.

it cannot be distinguished from the genus *Rhadinichthys*; if it belongs to the family Catopteridæ it may be assigned to *Dictyopyge*. As a provisional determination the latter course is here preferred; for the Australian fishes already mentioned occur in association with *Cleithrolepis*, and so also does the new specimen discovered by Mr. Draper.

Specific Determination.—Whether, however, this fish belongs to *Rhadinichthys* or to *Dictyopyge*, the combined characters of the scales and fins are sufficient to distinguish it from all known forms, and it may therefore receive the specific name of *Draperi*.

Formation and Loc.—Stormberg Beds (Upper Karoo); Rouxville, Orange Free State.

2. *Atherstonia minor*, sp. n. (Pl. XVII. figs. 2, 2*a*.)

Type.—This species is founded on the middle portion of a small fish shown of the natural size in Pl. XVII. fig. 2, while the greater part of the trunk of a still smaller fish adds some further particulars concerning the dorsal fin and squamation. Both specimens were discovered by Professor H. G. Seeley, F.R.S.

Description.—The fish thus indicated was evidently elongate-fusiform in shape, with relatively large and extended pelvic and anal fins. The depth of the trunk at the origin of the anal fin is about equal to the space between the latter and the origin of the pelvic fins. The fin-rays are numerous and slender, and those of the median fins are shown to be distantly jointed; fulcra are not preserved. The dorsal fin arises very slightly in advance of the anal, but its relative proportions cannot be determined. The scales of the middle of the flank are scarcely deeper than broad, and only those of the caudal region are strengthened by an inner rib; all the abdominal flank-scales, however, are united by a prominent peg-and-socket articulation. The scales are narrowed dorsally and ventrally, and there is evidence of a continuous series of greatly enlarged dorsal ridge-scales, besides a large median scale at the origin of the anal fin. Each flank-scale is marked by from four to six oblique longitudinal ridges, mostly continuous, but not parallel and not always straight, being slightly curved; while the dorsal ridge-scales are similarly ornamented by longitudinal lines. None of the scales are serrated.

Generic Determination.—The characters of the imperfect fossils thus described suffice to place them in the Palæoniscid genus *Atherstonia*, already obtained from the Beaufort Beds of Colesberg, Cape Colony; the enlarged series of dorsal ridge-scales combined with the arrangement of the fins and the nature of the scale-ornament being especially diagnostic.

Specific Determination.—It is, indeed, difficult to distinguish the new fossils, except in size, from the typical *Atherstonia scutata*. The species discovered by Professor Seeley, however, seems to have had a somewhat more robust trunk, with the dorsal fin slightly more remote than in the fish already known; it may therefore be recorded as *Atherstonia minor*.

Form. and Loc.—Beaufort Beds (Lower Karoo) in association with Theriodont Reptiles; Klip Fontein, on the farm of the Brothers Erasmus, S.W. of Fraserburg, Nieuwveldt Range, Cape Colony.

3. *Atherstonia Seeleyi*, sp. n.
(Pl. XVII. figs. 3, 3 *a*.)

Type.—The only known fragment of this species is shown of the natural size in Pl. XVII. fig. 3, with impressions of four scales enlarged in fig. 3 *a*. It was discovered by Professor H. G. Seeley, F.R.S.

Description.—The fish must have had a comparatively deep trunk, but it is impossible to obtain any of the proportions from the single known specimen. Of the fins, only one of the pelvic pair and the anal are preserved, both comprising numerous distantly articulated rays, of which some apparently show traces of a longitudinal striation. The pelvic fin has a much extended base-line, and is considerably smaller than the anal fin. All the scales preserved, except at the ventral border, are much deeper than broad, and those immediately at the base of the anal fin, though relatively very small, are equilateral. There seems to have been one enlarged ridge-scale at the origin of the anal fin. The scales of the flank are united by a large peg-and-socket articulation, but there are no indications of an internal median rib, and all are elaborately ornamented with conspicuous oblique ridges. A natural impression of the external surface of four adjoining scales is shown of four times the natural size in fig. 3 *a*, and it will be observed that the irregular oblique ridges exhibit a tendency towards convergence at the postero-inferior angle.

Generic Determination.—It is evident that the ichthyolite thus described belongs either to the Palæoniscidæ or to the Platysomidæ; and on account of the great development of the pelvic fins we prefer to assign it to the first family. The few generic characters enumerated are the same as those of

Atherstonia, with one exception, namely, the considerable deepening of the flank-scales; and, in the absence of further evidence, it may be doubted whether such a character is truly of generic value. The fish is therefore referred provisionally to *Atherstonia*.

Specific Determination.—Whatever be the generic position of the fish, the proportions and ornamentation of the scales at once distinguish it specifically from all known Palæoniscids and Platysomids; and it may be appropriately named in honour of the discoverer.

Form. and Loc.—Beaufort Beds (Lower Karoo); Klip Fontein, on the farm of the Brothers Erasmus, S.W. of Fraserburg, Nieuwveldt Range, Cape Colony.

4. *Undetermined Palæoniscid Fish.*
(Pl. XVII. fig. 4.)

There is evidence of another Palæoniscid fish from the Karoo formation in an imperfect specimen, of which the caudal region is shown of the natural size in Pl. XVII. fig. 4. It cannot, however, as yet be generically or specifically determined. The trunk is elongate-fusiform and completely covered with rhombic scales; the upper caudal lobe is attenuated. The pelvic fins are relatively small and the dorsal fin is remote, almost as large as the anal and directly opposed to the latter. The dorsal and anal fins are triangular, about as deep as broad, and each is fringed with a conspicuous series of small fulcra. The caudal fin is forked, apparently almost symmetrical, and all the rays of the median fins exhibit well-spaced articulations. The scales are too imperfectly preserved to exhibit anything beyond their relative proportions; and the course of the lateral line cannot be distinguished. None of the flank-scales appear to be deeper than broad, and no enlargement of the ridge-scales can be observed except on the upper caudal lobe and perhaps at the origin of the anal fin.

The specimen is preserved in coarse sandstone, exhibiting a stain of mineral matter almost parallel with its margin, and its interest centres specially in the fact that it was discovered in a stratum not hitherto known to yield fish-remains. It is preserved in the Museum at Pietermaritzburg.

Form. and Loc.—Sandstone referred by Mr. Draper to the Molteno Beds (part of the Lower Stormberg series of the Karoo formation), 150 feet above the main coal-seam; Sutherland's Quarry, Biggarsberg, Natal.

EXPLANATION OF PLATE XVII.

Fig. 1. *Dictyopyge* (?) *Draperi*, sp. n.; fish wanting caudal fin.—Stormberg Beds, Rouxville, Orange Free State.
Fig. 2. *Atherstonia minor*, sp. n.; middle portion of trunk.—Beaufort Beds, Klip Fontein, S.W. of Fraserburg, Nieuwveldt Range, Cape Colony.
Fig. 2 *a*. Ditto; scales, four times nat. size.
Fig. 3. *Atherstonia Seeleyi*, sp. n.; portion of trunk with pelvic and anal fins.—Ibid.
Fig. 3 *a*. Ditto; natural impression of scales, four times nat. size.
Fig. 4. Undetermined Palæoniscid fish; caudal region.—Molteno Beds, Biggarsberg, Natal.

[Unless otherwise stated the figures are of the natural size.]

LVIII.—*On some British Upper-Jurassic Fish-remains, of the Genera* Caturus, Gyrodus, *and* Notidanus. By A. Smith Woodward, F.L.S.

[Plate XVIII.]

There are still numerous British fossil fish-remains, named or briefly noticed by Agassiz, awaiting some definite description; and the first two of the following notes relate to Upper-Jurassic species unsatisfactorily treated in the 'Poissons Fossiles.' The third note refers to a very rare form of Selachian tooth from the Oxford Clay; and each of the species described is as yet known from such imperfect materials, that the brief review of the subject below may call attention to the deficiency and lead to the discovery of other specimens.

1. *Caturus angustus*, Agassiz. (Pl. XVIII. fig. 1.)

1844. *Caturus angustus*, L. Agassiz, Poiss. Foss. vol. ii. pt. ii. p. 118.

Among the numerous species of Upper-Jurassic fishes noticed by Agassiz under names with inadequate description is a form of *Caturus* from the Portland Oolite of Garsington Hill, near Oxford. It is named *Caturus angustus*, and dismissed with the brief diagnosis:—"Espèce très-allongée, remarquable par le développement excessif des fulcres du lobe supérieur de la caudale. Du portlandien de Garsington près d'Oxford." No information is afforded as to the owner of the original specimen or the museum in which it was preserved; and it is thus perhaps a matter of speculation to identify the actual fossil on which the notice is based. So far as the present writer is aware, however, only a single specimen of *Caturus* from Garsington exists; and as this exhibits the two special features noted by Agassiz, while wanting the head on which he would assuredly have remarked had it been present, it may be regarded with tolerable certainty as the type specimen on which *C. angustus* was intended to be founded. The fossil in question is in the museum of the Victoria Institute, Worcester, and bears an old label as follows, the specific name being apparently in the late Sir Philip Egerton's handwriting:—"*Caturus angustus.* Oolite, Garzington Hill, Oxon. From Revd. W. Parker." The present writer is indebted to the courtesy of the Museum Committee and of the Curator, Mr. Samuel Smith, for the opportunity of studying the specimen and of publishing the following description.

The head, with the anterior portion of the abdominal region, is wanting, but the remainder of the fish is well-preserved, as shown in Pl. XVIII. fig. 1, which is one half the natural size. The trunk is remarkably elongated, hence the specific name; and the caudal fin is especially large. The notochord, as usual, must have been persistent, and there are no indications of ossifications in its sheath. The ribs and neural spines in the abdominal region are comparatively slender; the neural and hæmal arches in the caudal region are stout, the pedicles being much expanded and the spines becoming rapidly shortened in the narrow portion behind the origin of the anal fin, where they are deeply imbricating. The pectoral fins are, of course, wanting; but all the others display a conspicuous fringe of fulcra on their anterior border. The fin-rays, though unjointed for some extent proximally, exhibit numerous articulations and bifurcations in their distal half or two thirds; and the distance between the successive articulations is usually much greater than the width of the ray or branch on which they occur. The pelvic fins arise opposite the origin of the dorsal fin, and are about equal in size to the anal; the anterior ray bearing the fulcra is especially robust. There are indications of a series of aborted fin-supports in advance of the dorsal, and this fin is about as long as deep, comprising not less than eighteen or twenty rays; there are two short rays in advance of the longest, of which the length appears to be nearly equal to the depth of the trunk at its insertion. The anal fin arises midway between the pelvic pair and the caudal, is deeper than long, and about two thirds as large as the dorsal fin; the number of rays cannot be satisfactorily counted, but there must have been at least twelve. The large caudal fin arises from a much constricted pedicle, and its great lobes are as slender as is usual in *Caturus*; the short mesial rays are more closely articulated and expanded than those of the lobes. The squamation is almost completely destroyed; but there are distinct impressions of the small rhombic exposed faces of the scales along both the dorsal and ventral borders, and behind the anal fin there is evidence of the deeply overlapping character of these scales. A mass of whitish coprolitic matter in the abdominal region seems to mark the position of the intestinal tract.

Though thus imperfectly known, the Portlandian fish from Garsington is evidently specifically distinct from any *Caturus* hitherto described. The proportions of the trunk and fins above noted suffice to distinguish it even from the elongated species described by Agassiz and Wagner from the Bavarian Lithographic Stone. The name of *Caturus angustus*, proposed by Agassiz, may therefore be retained.

Type. Fish, wanting head; Worcester Museum.

Form. and Loc. Portlandian; Garsington, Oxford.

2. *Gyrodus punctatus*, Agassiz.
(Pl. XVIII. figs. 2–4.)

1844. *Gyrodus punctatus*, L. Agassiz, Poiss. Foss. vol. ii. pt. ii. p. 231, pl. lxix. *a*. fig. 24.

Portions of the dentition of the Pycnodont genus *Gyrodus* are scarcely capable of specific determination; but it is probable that when specimens from one formation and locality exhibit only small differences from each other they are specifically identical. For this reason we refer to *Gyrodus punctatus* (a species founded on a vomerine dentition from the Corallian of Malton) some examples both of the upper and lower dentition of *Gyrodus* now in the Malton Museum. When describing the original fossil, which is in the York Museum, Agassiz remarked that it might perhaps be referable to the same fish as the Kimmeridgian lower jaws named by him *G. Cuvieri*; but if the Malton fossils now to be described are correctly determined, it seems likely that Agassiz's original nomenclature will eventually prove to be justifiable.

The new fossils comprise a portion of the vomerine dentition (fig. 2), the right and left splenials in association (that of left side shown in fig. 3), a large right splenial dentition (fig. 4), and some isolated teeth; and the writer is indebted to Mr. Samuel Chadwick, F.G.S., the well-known indefatigable explorer of the Yorkshire oolites, for the privilege of studying the collection. Two of the specimens (figs. 2, 4) were discovered by Mr. S. King in the Lower Calcareous Grit of Browse Pit, Malton, in 1850; the fine pair of splenials and the detached teeth were obtained from the same formation by Mr. Chadwick himself more recently.

The vomerine dentition (fig. 2) is a comparatively small specimen and evidently much abraded. It shows none of the punctation noted by Agassiz in the type, and there are only feeble indications of the apical indent on the teeth. The median teeth are very prominent, scarcely broader than long, nearly quadrate with rounded angles, and equalling in breadth the two lateral series. The inner lateral series is the smallest, low and forming a deep groove between the others, and the shape of the teeth is very irregular, there being a tendency to antero-posterior elongation. The outer teeth are about as broad as long and rise to a blunt apex.

The normal splenial dentition (fig. 3) exhibits an arrangement of teeth almost identical with that of *G. Cuvieri*, though apparently differing in the less prominence of the principal series and in the greater smoothness of all the teeth. The specimen, however, is abraded, and much of the feebleness of the ornament may be accidental. The teeth of the principal series are the most nearly smooth, only four of those in front exhibiting traces of the apical ring; the teeth of the inner and third series are about equal in size, nearly always as broad as long; those of the outer series are larger and much broader than long.

A large example of the right splenial dentition (fig. 4), with teeth wide apart, apparently owes its abnormal characters to crushing, the bone having disappeared. The teeth show much evidence of wear during the life of the animal; and those of the innermost series are relatively fewer and larger than in the original of fig. 3. Most of the inner teeth are also obliquely elongated.

If a detached tooth from Setterington pertains to the principal splenial series of *G. punctatus*, as seems probable, the species must have attained a still greater size than is indicated by the last specimen.

Form. and Loc. Corallian (Lower Calcareous Grit); Malton, Yorkshire.

3. *Notidanus Muensteri*, Agassiz.
(Pl. XVIII. fig. 5.)

1843. *Notidanus Muensteri*, L. Agassiz, Poiss. Foss. vol. iii. p. 222, pl. xxvii. figs. 2, 3.

Only three teeth of the primitive shark *Notidanus* have hitherto been recorded from the Upper Jurassic of England, one from the Oxford Clay of Yorkshire * and two others from the same formation near Oxford †. It is thus interesting to note that a fourth specimen has been discovered more recently by Mr. Thomas Jesson, F.G.S., in the Oxford Clay of St. Ives. This is a well-preserved tooth, shown of the natural size in fig. 5, and considerably differing from each of the others.

The new fossil has a shallow and somewhat crimped root; and the crown consists of a very large principal cone, followed by three secondary cones decreasing in size, with a minute posterior denticle. The enamel is quite smooth, and the gracefully sinuous anterior margin of the principal cone exhibits only the feeblest crimping, no denticulation.

The specific determination of the isolated teeth of Selachian fishes is, of course, nearly always a matter of speculation; but it is convenient to have names for purposes of quotation. As the new tooth, therefore, does not appear to differ in any essential respect from some of the specimens found in the Oxfordian, Corallian, and Lower Kimmeridgian of the Continent, commonly referred to *Notidanus Muensteri*, it seems advisable to provisionally record this specimen under the same name.

Form. and Loc. Oxfordian; St. Ives, Huntingdonshire.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Caturus angustus*, Agassiz; fish wanting head, lateral aspect, one half nat. size.—Portlandian; Garsington Hill, Oxford. [Worcester Museum.]

Fig. 2. *Gyrodus punctatus*, Agassiz; portion of vomerine dentition.—Corallian (Lower Calcareous Grit); Browse Pit, Malton, Yorkshire. [Malton Museum.]

Fig. 3. Ditto; left splenial dentition.—Corallian (Lower Calcareous Grit); Malton. [Malton Museum.]

Fig. 4. Ditto; large right splenial dentition, apparently crushed.—Corallian (Lower Calcareous Grit); Browse Pit, Malton. [Malton Museum.]

Fig. 5. *Notidanus Muensteri*, Agassiz; tooth, outer aspect.—Oxfordian; St. Ives. [British Museum, no. P. 6734.]

[Figs. 2–5 are of the natural size.]

---

* *Notidanus serratus*, Fraas, Smith Woodward, Geol. Mag. [3] vol. iii. (1886), p. 212, pl. vi. fig. 7.

† *Notidanus Daviesi*, Smith Woodward, *ibid.* p. 212, pl. vi. figs. 8, 9.

LIX.—*Two new* Coccidæ *from New Mexico.* By T. D. A. Cockerell.

Orthezia Annæ, sp. n.

Adult female.—Length $2\frac{1}{3}$ millim., with ovisac 8 millim. Body above covered with white secretion, which forms lateral and subdorsal longitudinal keels; dorsum marked by a furrow. Ovisac with eight longitudinal ridges above, none below.

Legs and antennæ dark brown, antennæ varying to pale brown, legs to brown with black tarsi.

Tibia about as long as femur, tarsus about half as long as tibia. Claw large, only slightly curved.

Antennæ with the third joint slightly longer than the second, but somewhat constricted in the middle, so as to appear in some specimens like two joints. First joint about as long as second. Lower lip elongated, as usual in the genus.

Derm with numerous small spines, similar to those of *O. insignis*, but not placed quite so closely together.

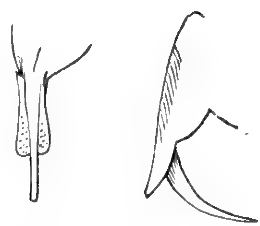
Larva.—Legs sepia-brown, tarsus decidedly longer than tibia; claw long and slender, nearly straight.

Antennæ 6-jointed; 6 as long as 3+4+5, which are about equal and shortest; 3 slightly longer than 4 or 5, 2 longer than 1. Formula 6213 (45).

Adult male.—Length of wing $1\frac{3}{4}$ millim. Body, legs, and antennæ black, dorsum of thorax pitch-black. Wings pale grey or greyish white, with the costa black. Eyes strongly facetted.

Legs bristly, tarsus less than $\frac{1}{3}$ length of tibia.

There is a brush of white caudal filaments, not covered by secretion, over ten in number; they are longer than the wings. The wings seen against a dark surface appear white and are slightly iridescent.



a *b*

Orthezia Annæ, ♂.—End of abdomen from different individuals: *a*, seen from beneath; *b*, from the side.

The genitalia are more elongated than in *O. insignis* as figured by Douglas.

Hab. Las Cruces, New Mexico, on a Chenopodiaceous plant (*Atriplex canescens?*), July 28, 1893.

I found this species while collecting larvæ of *Lycæna exilis*, which abound on the same food-plant. I find, however, that Prof. Townsend actually discovered the insect, specimens obtained by him being in the collection of the New Mexico Experiment Station.

I name this species after my wife, who died Sept. 14, 1893.

The United-States species of *Orthezia* are at present imperfectly known. Walker described *O. americana*, and, although his description was quite imperfect, it is generally admitted that he had before him a species found in the North-eastern States on various herbaceous plants. Prof. Comstock (1881) figured and redescribed Walker's species, which until lately remained the only known representative of its genus in the country.

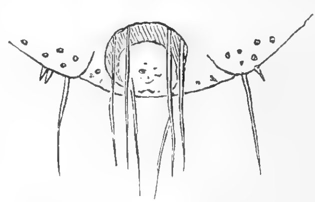
In 1888 Mr. Ashmead described *O. Edwardsii* from California, but he knew only the male, and the female still awaits discovery. In 1891 Mr. Douglas published his *O. occidentalis*, based on specimens found by the present writer in ants' nests in Colorado. Of this the adult male is undescribed.

O. Annæ, which is easily distinguished by structure and habitat from the above, is thus the fourth *Orthezia* detected in the United States. A fifth species, *O. insignis*, Douglas, has lately been found by Mr. R. H. Pettit in hothouses in New York State; but this is properly a member of the West-Indian and Mexican faunas. The most northern locality yet known for it out of hothouses is Guanajuato, Mexico, whence I have received specimens from Dr. A. Dugès.

Bergrothia Townsendi, sp. n.

A small oval species, covered by a white sac, 3 millim. long.

Antennæ of seven joints (in one specimen there seemed to be eight); 7 longest, longer than 5+6, which are shortest; 2 and 3 about equal, 4 a little shorter. Formula 7 (123) 465. Joints with whorls of a few short hairs; last joint with three such whorls and four longer hairs at the tip.



Bergrothia Townsendi, ♀.—End of abdomen.

Tibia $\frac{3}{4}$ length of femur; tarsus a little over (on hind leg not over) half length of tibia. Digitules of claw with large knobs; tarsal knobbed hairs ordinary. Trochanter with a long hair. End of tibia with a stiff bristle on inner side. Claw rather short, curved.

Anal ring with six very distinct hairs. Posterior tubercles inconspicuous, each emitting a hair similar to that on the anal ring.

Sides of body with many round gland-spots, and margin with pairs of short spines at intervals, at least on the posterior part of the body.

Lower lip elongated as in *Orthezia*, with about ten hairs. Rostral filaments short.

After boiling in caustic soda the insects appear pale reddish brown or almost colourless; they do not appreciably stain the liquid.

The above description refers to the adult female; larvæ were found with them in June 1893, but the male is as yet unknown.

Hab. In the main street of Las Cruces, on leaves of *Fouquiera*.

When I first examined this insect I supposed it might be identical with the *Signoretia* sp. recorded by Prof. Townsend as found on *Larrea*; but I now doubt whether this is the case. It is certainly not a species of *Signoretia*, Targ.-Tozz., although as found living it has much superficial resemblance to *S. atriplicis* as figured by Maskell. It does, however, appear to be a *Signoretia*, Kraatz, which is the same as *Westwoodia*, Sign., and *Bergrothia*, Kraatz—the first two names being preoccupied. Maskell would not separate *Bergrothia* from *Dactylopius*, and certainly it is difficult to draw any satisfactory line between these genera, owing to the number of aberrant *Dactylopius* spp. described by him and others of late years. The present species, though placed in *Bergrothia*, does not agree in all respects with the accepted definition of that genus, but it is much further removed from typical *Dactylopius*.

This is the first of its genus to be described from North America; but an unnamed species has been mentioned as occurring on blue-grass in Indiana &c. ('Insect Life,' ii. p. 327).

The following is a list of the Coccidæ at present known from New Mexico:—

1. N. g., n. sp., *Riley, MS.*
2. Dactylopius sp. (? 3 spp.).
3. Coccus, sp. n., *Ckll., MS.*
4. Lecaniodiaspis yuccæ, *Riley, MS.*
5. Pseudococcus helianthi, *Ckll.*
6. Bergrothia Townsendi, *Ckll.*
7. Orthezia Annæ, *Ckll.*
8. Prosopophora rufescens, *Ckll.*
9. Ceroplastes irregularis, *Ckll.*
10. —— artemisiæ, *Riley, MS.*
11. Lecanium robiniarum, *Dougl.*

12. Lecanium sp. (? 2 spp.).
13. Pulvinaria Macluræ, *Kenn., MS., Fitch.*
14. Signoretia sp., *Towns.*
15. Mytilaspis albus, v. concolor, *Ckll.*
16. Aspidiotus uvæ, v. coloratus, *Ckll.*
17. —— perniciosus, *Comst.*
18. —— rapax, *Comst.*
19. —— convexus, *Comst.*
20. —— Nerii, *Bouché.*

Nos. 2, 10, 12 (pars), 14, 18, and 19 I have not yet examined. A *Lecanium* found on pear at Las Cruces *seems* to be *L. Caryæ*, Fitch, but it may be only a variety of *robiniarum*, which occurs close by.

Agricultural Experiment Station,
Las Cruces, New Mexico, U.S.A.,
September 1893.

BIBLIOGRAPHICAL NOTICE.

Travel and Adventure in South-east Africa: being the Narrative of the last eleven years spent by the Author on the Zambesi and its Tributaries; with an Account of the Colonization of Mashunaland, and the progress of the Gold Industry of that Country. By Frederick Courteney Selous, C.M.Z.S. With numerous Illustrations and Map. London: Rowland Ward and Co.

Nothing could be more opportune than the appearance of this important work at the time when our countrymen are fighting in the interests of civilization against the savage Matabili—the prize being the fertile Mashunaland, of which Mr. Selous speaks as a country where Europeans can not only exist but even thrive, and in the exploration of which he has played a prominent part. The recipient of the Gold Medal of the Royal Geographical Society, the Author naturally prefers to be known as the scientific pioneer rather than the mighty hunter; and as his book has already been fully reviewed under both these aspects, we will direct our remarks chiefly to those portions of it which relate to natural history.

It must be within the recollection of most of our readers that in 1881 Mr. Selous published his experiences of nine years in 'A Hunter's Wanderings in Africa,' a work which, in addition to exciting episodes of sport, contained reprints of two valuable papers on rhinoceroses and antelopes read before the Zoological Society, and stamped the author as an observer of no ordinary character. During his residence in London in the above year he frequently visited the Natural-History Museum, where Dr. Günther and Mr. Oldfield Thomas called his attention to the sorry condition of many of the specimens of South-African Mammals, as well as to the fact that a number of interesting species were not represented at all; so Mr. Selous took note of what he ought to obtain should he ever revisit the interior. It was not then his intention to do so, for, after many years of roving, he felt inclined to take a farm and settle down; but *Diis aliter visum*, and he soon started on another expedition, to be followed by many more during the next ten years. Some of the results of his truly scientific collecting may be seen in the superb examples of antelopes of various species which now adorn the galleries at South Kensington, while other valuable animals are in the museum at Cape Town and elsewhere; though as yet the principal object of his search—the adult of the square-mouthed *Rhinoceros simus*, "the largest of modern terrestrial mammals after the elephant"—is still wanting in our collection. We think—for we cannot be sure from the map supplied—that it was not far from the present site of Salisbury that Mr. Selous shot the two last of this species he saw or ever expects to see, and he preserved the head of the male for the Cape Town Museum, counting upon procuring a finer specimen for our National Collection later on in the season. But in 1886 two Boer hunters got into the little tract of country where the few white rhinoceroses were left, and killed ten of them, five more being killed by the Matabili; and although, in August 1892, Mr. R. T. Coryndon shot a female and preserved its skin and skeleton, and captured the calf (which afterwards died), yet, through some unfortunate mischance, the fact remains that this once plentiful species is at present represented in collections by an antique calf in our Museum and a single specimen at Leyden.

Mr. Selous was surprised to find the fresh "spoor" of the hippopotamus at an elevation of upwards of 4000 feet above sea-level, but, he adds, "this animal wanders a great deal in search of food when undisturbed, especially during the rainy season." At a pool which offered a favourable opportunity for observation he noted by the watch the duration of submersion, and found that after being fired at a hippo' could stay down four minutes and twenty seconds, though from two to two and a half minutes was the usual time; and, as illustrating the supposed great age of Africa, he mentions "the hippopotamus paths worn deep into the solid rock along the Lower Umfuli River, formed in the hard stone, with the central ridge plainly shown as in a hippopotamus path made but yesterday in muddy ground, proving that the mammals existing in it at the present day have roamed the land for countless ages." With regard to the distribution of the wiry-haired klipspringer antelope, he considers it worthy of remark that in Mashunaland this small active species is to be found along the courses of all the larger rivers, amongst boulders and masses of rock; whereas in Cape Colony the species is confined to the highest portions of the most rugged hills and mountains, where the snow often lies deep. On one occasion

Mr. Selous's dogs pulled down a large hyæna—a circumstance very unusual with such a powerful beast, and accounted for by the fact that the ends of both lower jaw-bones were gone, as if cut off by a bullet; yet the animal was fat and its coat in excellent condition, though how it obtained a living was a mystery. On the River Sabi Mr. Selous shot five specimens of the rare Lichtenstein's hartebeest, of which a fine pair grace our National Collection; and he subsequently learned how dangerous an antagonist a wounded sable antelope at bay can prove, four of his best dogs being killed outright by the long curved horns, while four more were badly wounded, one of which died afterwards.

Of the author's numerous adventures with lions we will not speak, except to mention his defence of the attitude adopted by Landseer for his lions in Trafalgar Square, "with the fore paws straight out, like a dog," which is perfectly correct, for "when on the alert a lion always lies like this, and only bends his paws inwards like a cat when resting thoroughly at his ease." Ethnologists will be interested in the remarks about the Masarwas, who are the bushmen of Mashunaland; for these, while possessing in the highest degree the capability for tracking and using small bows with poisoned arrows, are very superior in stature and general appearance to the fierce stunted bushmen of Cape Colony on the one hand, and the pigmies of the forests of the Aruwimi to the northward. Mr. Selous considers that the "Bushmen are probably the direct descendants of the earliest type of man that appeared in Southern Africa; and they probably came from the north and spread down the western side of the continent long before the black races appeared upon the scene"—while the Masarwas have improved their physique by an admixture with the Kaffirs, though without losing their natural talent, and retain their ancient language almost intact. The Mashukulumbi, to the north of the bend of the Zambesi—in whose country he was attacked, lost twelve of his people, and barely escaped with his life—are, he thinks, a mixed people, with a strain of Arab or some northern race. It will be remembered that these aggressive warriors molested the Austrian traveller, Dr. Holub. No less worthy of commendation are the author's remarks about Zimbabwe and the "ruined cities" of Mashunaland; but this is rather a thorny subject and one upon which we will not enter.

The above are only a few of the items which we have noted from the naturalist's point of view. Every one should read the book through; and it is enough to add that it is well illustrated, admirably edited, and reflects the highest credit on all concerned in its production.

H. S.

MISCELLANEOUS.

Holothuria nigra, *Gray, and its Synonymy.*

By the Rev. Canon A. M. Norman, M.A., D.C.L., F.R.S., &c.

The Name.

This species has been commonly styled in Britain "*Holothuria nigra*, Couch." Prof. Jeffrey Bell (in Proc. Zool. Soc. 1884, p. 373) says the first use he can find of the name "*Cucumaria nigra*, Couch," is by Prof. Kinahan (Nat. Hist. Rev. vol. vi., 1859, p. 369), and that he has sought in vain for the use of any such title by Couch himself, and, unable to fathom the mystery, in Cat. Echin. Brit. Mus. (1892) he gives it as *Holothuria nigra*, auct. Curiously enough the solution is to be found in a previous B. M. Catalogue of Echinodermata.

The use of "*Holothuria nigra*, Couch," seems to have arisen out of two mistakes. The specific name originally appeared in J. E. Gray's List Brit. Anim. in Coll. B. M., Radiated Animals, 1848, p. 8, where will be found this entry—

"*Holothuria nigra.*

"*Nigger or Cotton Spinner*, Couch, Ann. & Mag. N. H. xv. 171. t. 14.

" Inhab. Cornwall."

Mistake 1.—Gray, by a *lapsus pennæ*, assigned to the authorship of Couch a paper which had been written by Peach.

Mistake 2.—Authors reading the above entry supposed the specific name to have been given by the writer of the paper referred to, and thus wrote "*Holothuria nigra*, Couch," instead of, as it should have been, "*Holothuria nigra*, Gray." Peach had given no scientific title to his " Nigger."

The Synonymy.

Dr. von Marenzeller, in the paper translated in the 'Annals' of this month, makes *Holothuria nigra* a synonym of *H. catanensis*, Grube, and the latter a synonym of *H. Forskalii*, Delle Chiaje.

He states he arrived at this conclusion from the examination of Bell's figures of *H. nigra* and of a mounting of the spicula of which he had received from myself. Years ago I arrived at a similar conclusion by the comparison of two specimens of *H. catanensis*, which my friend Dr. von Marenzeller sent me, with our British species. On that point, then, we are perfectly agreed. On the high authority of Ludvig and Marenzeller I rely that it is also *H. Forskahli*, Delle Chiaje. The descriptions of the author of the species do not materially help me, and I have not Forskahl's work to refer to.

But not only had I found our British species to be the same as *H. catanensis*, Grube, but that the Holothurians sent out from the Zool. Stat. Naples as "*Holothuria Poli*" are also referable to the species we are considering. Is, then, *H. Poli* = *H. catanensis*?—that is a question which has exercised me for a long time. Delle Chiaje's figure of *H. Poli* (Anim. s. Vert. Napoli, pl. vi. fig. 1; reproduced in Anim. Invert. Sic. Cit. pl. cx. fig. 1) seems to be a good representation of *H. catanensis*. This species sent out as *H. Poli* is evidently common at Naples, and, if not rightly named, how is it that *H. Poli* has not been found, and how comes it that *H. Forskahli*, of which Delle Chiaje writes "Ob ejusdem raritatem viscera haud examinare potui," is common at Naples? Am I to conclude that *Forskahli* has become common and *Poli* disappeared, or are they one species? Theel, in the 'Challenger' Report on Holothuroidea, part ii. 1886, p. 223, is completely puzzled about *H. Poli*.

Will Dr. von Marenzeller or some other authority clear up this matter by giving us good illustrations of the spicules of the body, papillæ, pedicels, and tentacles of *H. Poli*? for by their spicula are the Holothurians most easily distinguished.

The question is, who is right as to the identification of *H. Poli*, the Zool. Stat. or certain authors?—for example, the descriptions of Theel just referred to, the figures by Sars of the spicules (Bidr. til Kunds. Middelhavets Littoral-Fauna, 1857, figs. 75–77), which he called *H. tubulosa*, but Ludvig and Marenzeller refer to *H. Poli*, and those of Selenka (Beit. z. Anat. u. System. der Holothurien, 1867, pl. xviii. figs. 44–46). These figures represent "buttons" (*Theel*); there are no buttons in *H. Poli* as identified at Naples. I do not see why Sars's figures should not have been drawn from "buttons" of *H. tubulosa* (fig. 77 being characteristic) and those of Selenka from *H. Stellati*. Leaving, then, this question of *H. Poli* as one of acknowledged doubt and ignorance on my part, we have—

Holothuria Forskahli, Delle Ch., 1823, = *Nigger or Cotton Spinner*, Peach, 1845, = *Holothuria nigra*, Gray, 1848, = *Cucumaria nigra*, "Couch," Kinahan, 1859, = *Holothuria catanensis*, Grube, 1864, = *Stichopus Selenkæ*, Th. Barrois, 1882, = *Holothuria Forskalii**, Marenzeller, 1893.

I have specimens in my collection from Polperro, Cornwall (*Laughrin*); Valentia, Ireland (*A. M. N.*, 1870); Plymouth (*Marine Biol. Lab.*); Naples (*Zool. Stat.*, as "*H. Poli*"); Lesina (*Marenzeller*, as "*H. catanensis*"); Fosse de Cap Breton, Bay of Biscay (*A. M. N.*, 1880).

* As regards the spelling of this name, we may choose from *H. Forskaolii*, Chiaje, 1823, *H. Forskahli*, Chiaje, 1841, *H. tubulosa*, var. *Forskali*, Lamarck, 1840, = *H. Forskalii*, Selenka, Ludvig, and Marenzeller. The spelling I have adopted is the name as corrected by Chiaje, and is in accordance with the rules of nomenclature.

Spicula.—The *characteristic spicule* is that figured by Grube ('Die Insel Lussin und ihre Meeresfauna,' 1864, fig. 7 *a*) and Jeffrey Bell (Cat. Echin. pl. vi. fig. to left and more magnified above), usually with four foramina and some nodules on the surface and edge; they may be regarded, as Theel observes, as imperfect "tables," the legs being undeveloped—but rarely the foramina are more numerous and the legs are in some measure developed. This characteristic spicule is sparingly scattered over the dermis.

Ventral pedicels.—The stem with no other spicules than of the characteristic form, but the disk capped with a large cribriform plate (the foramina of which are not arranged in any regular order); round the base of this terminal plate the pedicel is surrounded with a circlet of elongated spicula, with foramina more or less developed in a row on each side of the central axis (figured by Bell, fig. 5, to right).

Dorsal papillæ are white with a black tip. Some little distance beneath the dermis is a hollow coil composed of slightly curved rod-like spicules, which in their central portion are smooth and round in section and have their ends expanded and commonly rounded, pierced either with a few foramina or nodulous. Overlying this coil are spicules of the characteristic type, but mixed here with others of a modified and larger size, having eight or even more foramina, the additional foramina having been built on to the sides of the original spicule after the usual manner of spicule growth.

Tentacles invested with spicules which are large towards the base and gradually smaller distally, to correspond with the lessened size of the ramification of the tentacle; spicules arcuate or, more rarely, straight rods, their central portion roughened with a few nodules or blunted spines, the extremities attenuated, rugose with crowded little nodulous points; occasionally at the extremity and sometimes on central portion minute foramina are to be seen; such perforated spicules are somewhat flattened instead of round in section.

Marenzeller is mistaken in supposing that this species does not attain so large a size in the Atlantic as in the Mediterranean. Some beautifully preserved specimens sent to me from the Plymouth Laboratory measure over 8 inches in length.

The total absence of the oval spicules which Theel calls "buttons" at once distinguishes this species from *H. tubulosa*, *H. Stellati*, *H. Sanctori*, *H. Helleri*, and *H. impatiens* of the Mediterranean, with all of which I have compared it; while the absence of the fine "tables" of the northern *H. tremula* and *H. intestinalis* makes it impossible to confound it with those species.

The Phylogeny of the Docoglossa.

By W. H. Dall.

In his concluding fasciculi, contributed to complete Troschel's classical 'Gebiss der Schnecken,' Dr. Johannes Thiele dissents very emphatically from some suggestions of mine in regard to the derivation of the true limpets, made many years ago. At that time it appeared to me that the Lepetidæ might represent the stem, somewhat degenerated, from which the Docoglossa were derived. While I attach, even in the present state of our knowledge, comparatively little importance to speculations of this kind, which can only be placed on a firm footing by extended embryological researches, it still seems to me that there is a solid basis for the hypothesis which I then suggested.

There can be little doubt that the early type of Gastropod gill was situated much as in *Fissurella*, on the "back of the neck" behind the head, and that it was constituted of a stem with lateral lamellæ. Originally paired and symmetrical, by circumstances incident to growth and torsion one gill of the pair has in most cases become aborted, though its "smelling organ" frequently remains, as in the limpets. There is also no doubt whatever that the protolimpet was derived from a form having a spiral shell. I have shown that *Propilidium* by its dentition is closely allied to *Lepeta*. Now *Propilidium* is said to have two gills, but certainly has at least one, of the type of *Acmæa*. It retains a spiral nucleus through life, though it is partly cut off by a small septum, which is never completed. Other Lepetidæ also show a spiral nucleus when very young, but it is cut off completely and lost later. These other, mostly deep- or cold-water forms, have lost their gills and eyes by degeneracy, and the principal teeth of the radula show a tendency to become cemented together, while in *Propilidium* they are more or less isolated. Now in the Acmæidæ and Patellidæ the nucleus is limpet-shaped from the beginning; the uncinal teeth (well developed in *Lepeta*) are degenerate and often lost in the Acmæas, but appear again in the Patellas, not, however, with the individuality and completely chitinous nature which is found in the corresponding teeth of Lepetidæ. We find therefore in Lepetidæ the greatest number of archaic characters (somewhat masked by degeneration of other organs) which remain in any of the three groups, and, whether most ancient or not, so far as these characters go the Lepetidæ are nearest to the protolimpet.

In my work on the 'Blake' mollusks (i. p. 436) I said that Acmæidæ of all the groups of Docoglossa is the most typical; that is, within the limits of that family are found assembled, sometimes in one and the same animal, the greatest number of organs which, taken singly, are characteristic of Docoglossa. This is strictly true; but Dr. Thiele

('Gebiss,' vol. ii. p. 340) has mistranslated me to the extent of saying that I have regarded the Acmæidæ as the most "primitive" group, in opposition to my earlier views, which is quite inaccurate. I have, in the 'Blake Gastropods' (pp. 436, 437), shown why the Patellidæ may reasonably be regarded as derived from Acmæidæ, the original ctenidia having been wholly lost. The row of lamellæ within the mantle-edge have taken up the branchial function, and in some species, as in *Ancistomesus*, become arborescent proliferations. The branchial cordon is occasional in Acmæidæ—I have seen it complete in *Scurria mesoleuca*; it is present, but incomplete, in the common *Lottia gigantea* of California; and, even if Dr. Thiele was correct in supposing that it was absent in *Scurria scurra*, there would still be no ground for his conclusion that its absence in the latter species indicates a failure of the grounds upon which I united in one group, as Proteobranchiata, the Acmæidæ and Patellidæ.

But there is excellent reason for believing Dr. Thiele to have been misled by an exceptionally contracted specimen of *Scurria scurra* and to be entirely wrong in his conclusion that the species is without a branchial cordon. The latter is figured and described by d'Orbigny from living specimens (Am. Mér. p. 478, pl. lxiv. figs. 11–14). I have seen sketches by Couthouy made from life fully confirming d'Orbigny, and, lastly, I have seen, but do not now remember where, an alcoholic specimen which showed them clearly. Dr. Thiele's specimen only appeared "etwas wulstig," somewhat puffed up, in the place where the cordon should be; but there can be no doubt that this puffing up simply represented the alcoholically-contracted lamellæ of the cordon, rendered indistinct by improper preparation.

Many of the minor details in which Dr. Thiele's observations differ from mine may be reasonably explained by the variation which is exhibited by individuals; and my chief criticism upon what is, in the main, a praiseworthy and useful work is that Dr. Thiele has failed to take account of this factor, which more extensive experience with the radula of a single species would have undoubtedly revealed to him. The result has been, not only has he estimated too highly the constancy of minor details of the radula in single species, but he has made an excessive number of so-called "generic" distinctions, the names of which in many cases will simply enlarge our catalogues of synonyms.

In conclusion, I may point out that the relations of the radula in *Lepetella* to that of *Lepeta*, &c., offer additional reasons for thinking that the Lepetidæ are of the limpets those most nearly allied to normal or more usual types of Gastropods, and also that the similarity of the shell of the Silurian *Tryblidium* to that of some recent limpets (*Olana* &c.) by no means authorizes us to conclude that the soft parts of *Tryblidium* were also similar to those of recent Patellidæ. Indeed, when the almost incalculable length of time intervening between our days and the Silurian is considered, together with the similarity of recent limpet shells which are secreted by widely different animals, it is almost inconceivable that the Silurian form should have any closely allied recent representative. The rhythmical manner in which the adductor scars of *Tryblidium* are arranged in pairs clearly indicates a peculiar disposition of the organs, which might indeed have paralleled in some particulars the organization of some of the Chitons of that ancient time.

For the rest, many of the ancient limpets are represented by shells which might well have belonged to *Lepeta* or *Acmæa*, yet of the relations of which, as in the case of many recent limpets, we are not permitted to arrive at any dogmatic opinion for want of the requisite data, a deficiency which, in the case of the fossils, must remain for ever unsupplied.—*Proc. Acad. Nat. Sci. Philad.* 1893, p. 285.

On the Occurrence of Arion lusitanicus, *Mab., in the British Isles, and Descriptions of Four new Varieties.* By Walter E. Collinge, Mason College, Birmingham.

Through the kindness of Mr. H. Burnley Rathborne, of Dublin, I have recently received some specimens of this interesting species of *Arion*, collected at Bevihenen, Bantry Bay, Ireland.

Dr. Scharff, in his work upon the Irish slugs *, mentions a variety of *A. empiricorum*, Fér., in which the retractor muscles "are attached quite close to the receptaculum and the upper portion of the oviduct;" this, I have previously stated †, I consider to be *A. lusitanicus*, Mab. Some months ago I examined specimens from Ireland and compared them with continental examples, and felt sure that I was correct in assigning the former to this species. I hope shortly to obtain further supplies of material, and will then describe in more detail the anatomy. References to the anatomy &c. are given by Pollonera ‡, Simroth §, and myself ‖.

Whilst recording this interesting addition to the fauna of the British Isles I take the opportunity of describing four new colour variations.

Rufescens, var. nov.

Whole of body a dark red. Sides of body bandless. Sent with type by Mr. Rathborne.

Nigrescens, var. nov.

Described from a black specimen sent with type by Mr. Rathborne. I would, however, suggest that the name should include all

* Trans. Roy. Dublin Soc. 1891, ser. 2, vol. iv. p. 539.

† 'The Conchologist,' 1893, vol. ii. p. 7.

‡ Atti Acc. Sci. di Torino, 1889, pp. 405, 406, pl. ix. figs. 1–6; also Boll. d. Mus. Zool. ed Anat. comp. Torino, 1890, vol. v. no. 87.

§ Die Nachtschnecken d. Port. Fauna, 1891.

‖ 'The Conchologist,' 1892, vol. ii. p. 116.

black- or plumbeous-coloured forms, examples of which I have seen from Mentone.

Olivaceus, var. nov.

Various shades of olive-green. Figured by Pollonera (*op. cit.*). I have examined specimens from Mentone.

Flavo-griseus, var. nov.

Yellowish grey. Foot-fringe usually lighter than the body. From Mentone.

It is difficult to separate some forms of *olivaceus* from this variety.

On the Mechanism of the Production of Light in Orya barbarica *of Algeria.* By M. RAPHAEL DUBOIS.

The discovery of the photogenous faculty in the Algerian *Orya barbarica* is of relatively recent date. This fine Geophilid was observed for the first time, in a luminous condition, almost at the same moment by M. Raphael Blanchard at El Kantara (April 1888) and by M. J. Gazagnaire at Nemours (May 1888).

Moreover, a certain number of important peculiarities were mentioned by M. Gazaignaire *; the phosphorescent substance is exuded from pores situated upon the sternal and episternal plates in the form of a viscid yellowish fluid, with an odour *sui generis*, drying rapidly on exposure to the air and insoluble in alcohol.

In September 1887, on observing some specimens of *Scolioplanes crassipes* which had been sent to me from La Fère (Aisne) by M. Huet, I had myself remarked that the luminous fluid was excreted from the ventral surface of the body, contrary to an opinion which I had previously advanced; but I had not published this observation, since I intended to complete it later on. As I was unable to obtain fresh examples of *Scolioplanes*, I went to Algeria to look for specimens of *Orya barbarica*.

Not only have I verified the accuracy of the facts recorded by M. Gazagnaire, but I have been able especially, thanks to the employment of the microscope, of which this investigator did not avail himself, to make new observations which confirm in the most precise manner the correctness of the definitive theory of the mechanism of the production of light, as set forth in my last work on *Pholas dactylus* †.

The facts which I have already recorded in various communications are correct, but their interpretation has sometimes varied in consequence of new discoveries; to-day, however, uncertainty can no longer exist, owing to the facility for observation and experiment

* J. Gazagnaire, "La phosphorescence chez les Myriopodes" (Bulletin de la Société Zoologique de France, t. xiii. p. 182).

† R. Dubois, 'Anatomie et Physiologie comparées de la *Pholade dactyle.*' Paris, G. Masson, 1892.

afforded by *Orya barbarica*, in which the luminous substance is secreted by special organs and can be collected in a state of purity.

This substance is formed in pyriform, unicellular, hypodermic glands, measuring from eight to ten hundredths of a millimetre in length and from five to six in breadth. In sections one hundredth of a millimetre thick, stained with methylene blue or hæmatoxylin, there can be distinguished in the granular protoplasm of the gland numerous rounded or ovoid droplets, which are met with again in the excreted matter. These droplets, which have been considered by observers in the case of other luminous animals to be of a fatty nature, do not turn black when treated with osmic acid, and exhibit the histo-chemical characters of protoplasm or of condensed albuminoids. Immediately after their contact with the atmosphere a very refringent spot is observed to arise at their centre; they then possess the form which caused me to bestow on these little bodies, which are found in all luminous organs, the name "*vacuolides*." This refringent point becomes the centre of a crystal, or, rather, of a group of crystals. The protoplasmic matter excreted thus passes from the colloidal to the crystalloidal condition under the eyes of the observer, while the light is produced. After a certain time the preparation is entirely filled with magnificent groups of crystals in the shape of ferns, or arranged in long fasciculate prismatic needles.

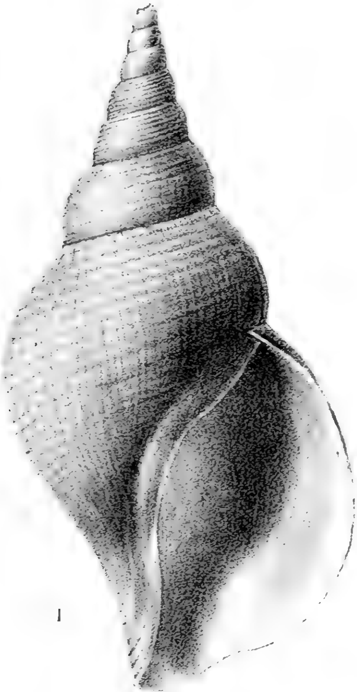
Contact with the air is necessary and stimulates the luminosity, but contact with water is no less essential.

This is due to the fact that the phenomenon is not merely one of oxidation, for if the matter be rubbed between the fingers or dried the light speedily disappears; but the substance is capable of regaining all its brilliancy on being moistened with a little water. Moreover the excretory product is *distinctly acid*, which confirms the inaccuracy of Radzizewski's hypothesis, which sought to explain animal photogeny as being due to a slow oxidation in an alkaline medium.

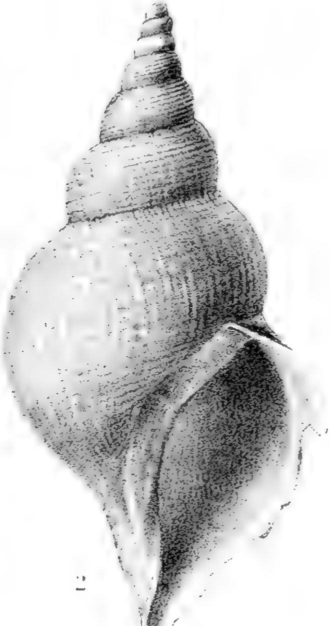
Oxygen permits the respiration of the protoplasmic corpuscles passing from the colloidal to the crystalloidal condition, that is to say, from life to death. This respiration is really active only in protoplasm suitably hydrated, and water is necessary in order that the crystallization may take place under conditions favourable for the emission of light. The oxygen serves to produce the crystallizable substance with the assistance of water, and the water enables the photogenous crystallization to take place.

It was these two successive conditions of the photogenous matter that formerly led me to believe that there were two distinct substances reacting one upon the other.

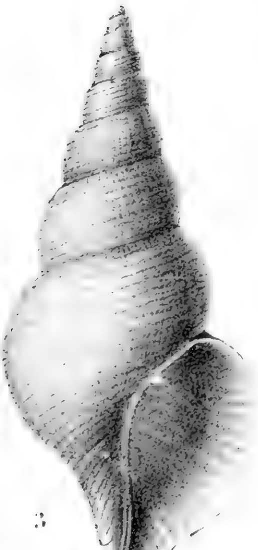
In reality there are only two successive stages of one and the same substance, which is modified by oxygen and water, and for which I shall retain the name *luciferin* until it has been possible to determine its atomic structure.—*Comptes Rendus*, t. cxvii. no. 3 (July 17, 1893), pp. 184–186.



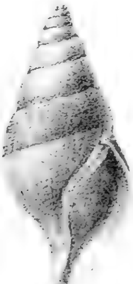
1



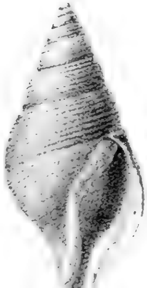
2



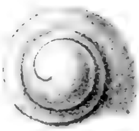
3



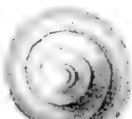
4



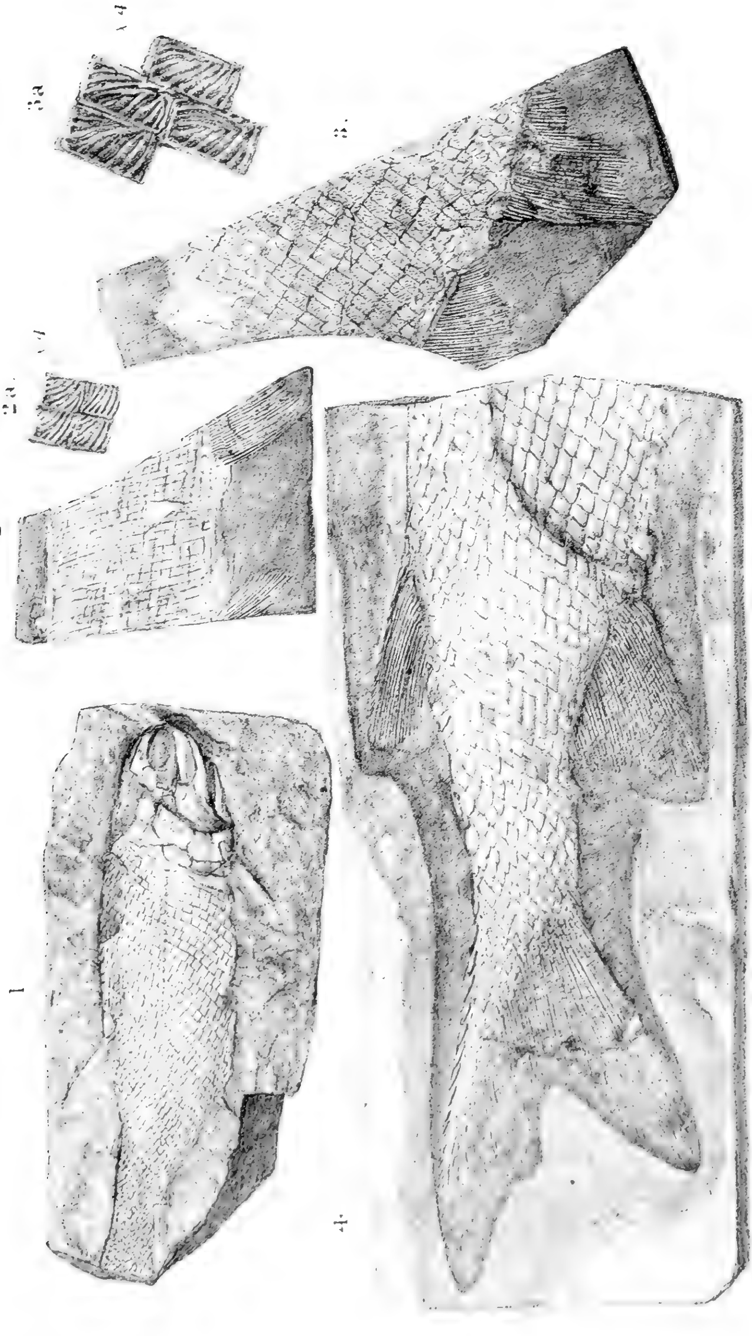
5



4a

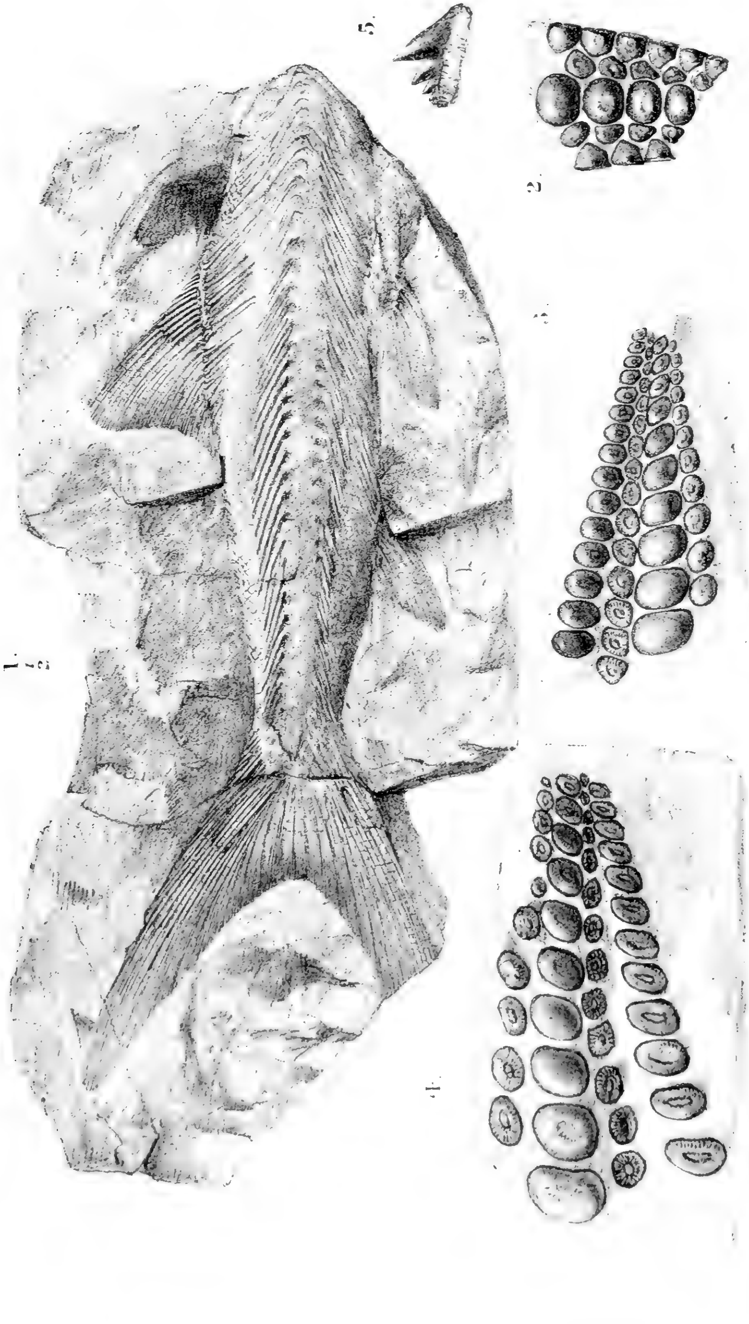


5a



F. H. Michael del. et lith.

Mintern Bros. imp.



F. H. Michael del. et lith.

Mintern Bros imp.

1125

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 72. DECEMBER 1893.

LX.—*A Contribution to the Morphology of the Limbs and Mouth-parts of Crustaceans and Insects.* By Dr. H. J. Hansen, of Copenhagen *.

It was chiefly in consequence of my work upon the Crustacea belonging to "Dijmphna-Togtet's zoolog.-botan. Udbytte" of 1884–1885 that I was led to the study of the morphology of the skeleton of this class of animals. Since then I have more than once devoted some time to similar morphological studies of most of the orders of all four classes of the Arthropoda, and it is my intention to publish a more extensive memoir dealing with a series of such questions in the case of the Insects, Myriopods, and Crustaceans. Many of the figures are already prepared; other circumstances have, however, induced me to resolve no longer to postpone a provisional publication of the greater portion of the most important of my results.

I may be permitted to mention that the views to be detailed in the following pages have been developed in the course of eight years as a result of the periodical investigations to which I have alluded; that I have been able to devote considerable time to repeated consideration, to the acquisition of a good supply of material, and to the practice of the necessary dissection, which is often very difficult owing to the small size of the majority of the objects, in order to make myself familiar

* Translated from the 'Zoologischer Anzeiger,' xvi. Jahrg., nos. 420 and 421 (May 29 and June 12, 1893), pp. 193–198 and 201–212.

with a large number of the animals, as also with the investigations and opinions of the anatomists, embryologists, and systematists with reference to the main details of the morphology and classification of the forms with which we are concerned. The greater part of these investigations have been carried out with the aid of the dissecting-microscope, often with a magnifying-power of one hundred diameters. My experiments show that it is often possible to study the articulation and composition of the mouth-parts much better with this instrument than by means of higher magnification under the compound microscope; the latter, however, is much more frequently employed. A reagent of which I have very often availed myself is a strong cold solution of caustic potash, in which the preparations are placed until the internal tissue is partially or completely decomposed and can be washed away in glycerine. I have frequently found it very advantageous to use specimens which had lain for a very long time in spirit so weak that the muscles and the connective tissue could be removed fairly easily by preparation, whereby I avoided the effect of the potash in making the thin chitin too transparent.

These observations are here made in case any one should wish to test or dispute my results, while at the same time I emphatically urge those who are interested in the subject to investigate in the manner indicated a larger series of forms belonging to several orders. Inducements for a test may possibly be afforded by my chief results, which are as follows:—The demonstration of three segments in the axis of the appendages of Crustacea as the primitive and still frequently existing condition; the division of the Malacostraca, based *inter alia* upon the different structure of the thoracic limbs; the demonstration of the existence in the case of Thysanura and certain Orthoptera of four pairs of mouth-parts, with which those of the Amphipoda are homologous; and the proof of a much greater agreement between the head of a *Machilis* and that of the malacostracous Crustacea than was hitherto assumed to be the case.

It would lead us too far afield to quote (not to speak of discussing) the enormous literature which belongs to the questions here indicated. Only once or twice do I refer to an author more precisely, when I have not found an opportunity of closely investigating the forms which are the subjects of his statements or am entirely ignorant of them; when, as most frequently happens, I content myself with giving the name of an author in parenthesis, it signifies that *the writer in question has expressed the same opinion before me* (thus affording a confirmation of my statement), *but that I* *have myself also seen what is asserted*; besides this I have several times refrained from giving a quotation when it appeared to me to be entirely unnecessary or when an author could not be quoted without lengthy explanations. Certain of the statements alluded to are already to be found in my memoir in "Dijmphna-Togtet &c." (especially in the French *résumé* of the paper), and are there accompanied by figures; in "Cirolanidæ . . . . Musei Haun." some unimportant corrections are given.

I. GENERAL OBSERVATIONS.

1. It is probable that the appendages of the Crustacea primitively consist of an axial portion and two equivalent rami. On practical grounds, however, I employ the term endopodite for the axial portion and inner ramus, so that the outer ramus is considered as proceeding from one of the joints of the endopodite.

2. By comparison of the limbs of the Araneæ, *Thelyphonus*, Scorpiones, Chelonethi (*Chelifer—Obisium*), and Solifugæ we soon discover that the segments, with the exception of the two first, are not homologous one with another according to their parallel numbers (Gaubert). In order to determine the homology enumeration is not sufficient; we must in addition examine the form and length of the segments and especially the direction and form of the articulation. This conception, the correctness of which can easily be perceived in the case of Arachnida, is utilized in the case of the malacostracous Crustacea to deduce new results (§ 22).

3. If we would arrive at a comprehension of the mouth-parts and limbs of Insects, Myriopods, and Crustaceans from a really morphological point of view, we must first study them in different types belonging to the last-mentioned class.

4. In order to understand the structure of the maxillæ in the Malacostraca we must commence with the maxillipedes. For instance, in the case of the Isopods and Amphipods it is easy to see that the masticating-lobes, which arise from the inner side of the second segment or (in Gammarinæ) from the second or third segment, are simple processes starting from the inner angle of the respective segments; in *Eurycope*, for example, a lateral masticating-lobe of this kind is a simple prolongation, while in *Idothea entomon*, on the other hand, it is divided off by a secondary articulation which has a certain power of movement (*vide* "Dijmphna-Togtet," tab. xx.). Similarly the masticating-lobes of the two pairs of maxillæ must be regarded as processes from the sides of the several

segments of the endopodite of the jaw; in proportion to the segments these lateral processes often become extraordinarily large, greatly elongated, separated therefrom by an articulation, and even sometimes transversely divided, in consequence of which it is only with difficulty that they can be understood when but a superficial examination is made. It is therefore necessary to trace the segments in the endopodite of the maxillæ in thoroughly cleansed preparations, and at the same time to find out from which segment the chitinous lamellæ of the masticating-lobes proceed. This appears to me to be the only certain method of procedure, and, if this be done, all the secondary modifications of form &c. which take place in the masticating-lobes will no longer have a disturbing effect upon our conception of the morphology of the structures.

5. From reasons which the sequel will make readily intelligible I propose to term the first pair of jaws in Crustacea *maxillulæ* and the second pair maxillæ.

6. The *hypopharynx* (paragnathi, lower lip, tongue) in Crustacea has nothing to do with the appendages; it is a median and typically bilobed projection from the sternal portion of the head behind the mouth-opening.

II. CRUSTACEA.

a. ENTOMOSTRACA.

7. On examining the integument of the sixth appendage of an *Apus* (*Lepidurus productus* was the particular form I studied) after cleansing it with potash it is easy to see that it consists of six segments, each of which is provided with a lobe; in the case of the first five the lobes are articulated to their respective segments, while the sixth lobe is an immediate prolongation of the corresponding segment; the fourth and fifth segments, at least on the posterior side of the limb, are represented by distinct though small chitinous plates. On the anterior side of the limb it may be distinctly seen that the exopodite proceeds from the base of the third segment and the epipodite from the distal end of the second (*cf.* § 8), while the large first segment is devoid of a plate or outgrowth on the outer side. In the first pair of appendages the lobes of the third to the fifth segments have become very long and narrow and are divided into numerous small rings. In the eleventh pair of appendages in the female the external expansion of the endopodite forms one half and the exopodite the other half of the egg-sac; the epipodite is very small, although distinct.

8. In *Limnetis*, *Estheria*, &c. we find a similar structure; but in consequence of the delicacy of the integument of the appendages the difference between the chitin of the segments and the articulations is more or less indistinct. According to G. O. Sars, in *Cyclestheria Hislopi*: "The endopodite consists of six imperfectly defined segments, each of which is produced on the inner side as a rounded setiferous lobe . . . . the epipodite apparently issuing from the outer side of the second segment of the stem . . . . the exopodite originating immediately below the epipodite, from the outer side of the third segment of the endopodite."

9. Before the exopodite and epipodite, which are both present in *Branchipus*, there arises a very long and broad (partially cleft) plate on the outer side of the first segment. It has been shown by L. Lund (Nat. Tidsskr. ser. 3, 7 Bd., 1870) that a similar plate exists in *Cladocera*.

10. In the most highly developed Copepods, such as *Calanus*, the shaft of the second pair of antennæ is three-jointed (Kröyer) and in the mandibles the exopodite proceeds from the third segment, since after the actual mandible (first segment) there is found a small segment (described by Kröyer) which is usually overlooked. In the large *Metanauplius* stages I also succeeded in discovering three segments in the shaft of the second pair of antennæ and of the mandibles. In *Setella* the three segments in the shaft of the second pair of antennæ can be seen without difficulty.

11. In a series of large larvæ (*Metanauplius* stage) belonging to the family Calanidæ I have found antennules, antennæ, and mandibles, developed as in the *Nauplius*, and behind these five distinct but small pairs of plates, which are the rudiments of five pairs of appendages and of which only the two last show an indication of cleavage; these rudiments are consequently, to give them the designations applied by authors, maxillæ, first and second pairs of maxillipedes, and two pairs of swimming-feet. *There is some considerable distance between the points of origin of the rudiments of the first and second pairs of maxillipedes*, which are therefore entirely independent one of the other; indeed we even see on the dorsal surface and on the side of the animal a distinct articulation which extends across the ventral surface as a faint streak between the two rudiments. That my interpretation of these rudiments is correct is borne out by the fact that I possess specimens of the following stage, with all five pairs of appendages perfectly well developed, and only two of them are swimming-feet. I consider therefore that I am entitled definitely to conclude (indeed, according to Grobben,

the Calanidæ are "phylogenetically the oldest forms" among the Eucopepoda) that *the rudiments of the first and second pairs of maxillipedes arise entirely independently one of the other; consequently they each correspond to their own pair of appendages, and not to the outer and inner branches of one and the same pair.* Owing to the peculiarities in the structure and the relative position of the maxillæ and maxillipedes in the free-living and parasitic Copepods I regard the maxillæ as homologous with the maxillulæ, the first pair of maxillipedes as homologous with the maxillæ in the Malacostraca, and the second pair of maxillipedes as homologous with the maxillipedes (*e. g.* in the Amphipods), and, among other things, as exhibiting the same tendency towards mutual fusion.

12. In *Argulus* the swimming-feet consist very distinctly of a three-jointed shaft and two branches (Kröyer). The basal joint of the shaft is much shorter than the second and somewhat shorter than the third.

13. It follows from §§ 7–12 that *we must assume the presence of three segments in the stem of all cleft appendages in Crustacea to be a primary condition*; and this number has distinctly persisted, at any rate in the cases quoted.

b. MALACOSTRACA.

α. Leptostraca (§§ 14–17).

14. *Nebalia* must be assigned to the Malacostraca (Claus), and in many respects it approaches the Mysidæ, while the Euphausiidæ, on the contrary, are very far removed from it (*vide* § 26).

15. In *Nebalia bipes* the shaft of the second pair of antennæ consists not of three (Claus) but of five segments, and *the fifth segment shows a tendency to be composed of two* (Claus), which are well separated in *Nebaliopsis*; after removing the shield the first segment may be easily found by the aid of a good dissecting-microscope; this segment is somewhat short, but well marked off; the fourth segment is conspicuously marked off on the outer side, but is very short.

16. The limbs of the thorax consist not of seven but of *nine segments.* In *Nebalia bipes* we find on the outer side of the limb at the base a somewhat short but very distinct segment; after this there come the segments with the epipodite and exopodite, and finally the remainder of the limb shows three distinct incisions on the inner margin and three joints. (All these details are best seen in appendages laid

in water [not glycerine] and taken from large specimens which have been preserved for some time in fairly weak alcohol; they can, however, also be observed in ordinary glycerine preparations.) An examination of older preparations (most kindly lent to me by Prof. Claus) of *Paranebalia longipes*, W.-S., displayed no especially distinct conditions, yet in a pair of appendages I observed the small basal segment. In Sars's figure of the last pair of limbs this basal segment may be seen divided off on the outer margin ('Challenger' Report, vol. xix.); if we reckon two more segments for the epipodite and exopodite we get nine segments, since the figure alluded to shows beyond the base of the exopodite six segments, of which the last is very short (I have convinced myself of its existence in some legs from Claus's preparations).

17. The first segment of the maxillulæ bears a masticating-lobe of considerable size, which is articulated to it near the base; the second segment has only a narrow rigid plate of chitin and is destitute of the masticating-lobe; the third segment passes insensibly into a short broad lobe. These conditions can be very easily observed if the muscles are to a certain extent removed. (The composition of the maxillæ I have not been able to determine with certainty.)

β. Eumalacostraca (§§ 18–27).

18. *Mysidæ*.—The antennæ have a six-jointed stem (cf. *Nebalia*, § 15); the outer ramus (squama) arises from the third segment (*cf.* Copepoda, § 10). The mandibles have a "*lacinia mobilis*" (for the explanation of this term see Hansen, "Cirolanidæ"). As in *Nebalia*, the two lobes of the maxillulæ spring from the first and third segments (*vide* "Dijmphna-Togtet"). The lobes of the maxillæ arise from the second and third segments (the boundary between the first and second segments is incorrectly indicated in "Dijmphna-Togtet") and *the exopodite from the third segment.* The first segment of the feet has disappeared, so that the exopodite springs from the second segment; the foot therefore consists of eight segments (*cf.* § 16), for I regard the claw as a modified segment, or, in other words, the terminal segment has become cheliform; the basal segment is much shorter than the second; the "knee," where the chief movement in a vertical direction takes place, is found between the fifth and sixth segments (Boas). In the earliest stages of the larva we find at the end of the abdomen two somewhat firmly chitinized, narrow, hard processes (van Beneden,

Nusbaum), *which must undoubtedly be homologous with the furca in* Nebalia; they are relatively of large size, especially in the penultimate larval stage, and are probably cast off in the penultimate ecdysis in the marsupium.

19. The Cumacea, Tanaidæ (which must be elevated into a separate order), Isopoda, and Amphipoda agree exactly in the structure of the mouth-parts (not including the suppression of the exopodite of the maxillæ, the suppression of the lacinia mobilis in isolated parasitic forms, and similar secondary reductions) and thoracic appendages with the Mysidæ in all the characters which are mentioned in § 18. It is very easy to study the structure of the maxillæ and maxillulæ in Amphipoda (*vide* "Dijmphna-Togtet") and Isopoda (*vide* "Cirolanidæ!"). In certain Isopods the stem of the antennæ is distinctly three-jointed, but in the majority of forms the first segment disappears and probably fuses with the head. Even where the so-called epimeres are strongly developed (as in certain Amphipods) the coxopodite (or the interval between the body and the articulation of the second segment) is always short and several times shorter than the basipodite.

20. In many Isopods the first segment of the six hindmost pairs of thoracic limbs is small and movable; in many other genera it develops as an "epimere," which, *e. g.* in *Idothea entomon*, is very large, marked off on the dorsal side by an arthrodial furrow, and on the ventral surface fused with the ventral ridge ("Bauchschiene"); but in *Idothea hectica* the upper arthrodial furrow has also disappeared and the "epimere" has certainly not been reduced to the point of disappearance, but has become fused with the segments of the body and forms larger or smaller portions of their sides (*cf.* §§ 24 and 49).

21. In certain Isopods (*Janira*) we find a large thorn upon the seventh segment of the thoracic appendages, articulated beneath the cheliform eighth segment, so that the foot is said to have two claws (*cf.* § 51).

22. The Euphausiidæ are a long way removed from the Mysidæ in consequence of a series of characters, certain of which only will be mentioned here. The stem of the antennæ is two-jointed; the mandibles have no lacinia mobilis. The limbs are composed of only seven segments (they are without the "claw"). The "knee" lies between the fourth and fifth segments; the first segment is almost equally as large as the second. I suppose the segments beyond the knee to be homologous with the sixth, seventh, and eighth (claw) segments in *Mysis*, and the fourth segment to be homologous

with the fourth and fifth segments of the Mysid limb taken together. I derive this conclusion from the development and direction of the articulations, and, moreover, I would point out that a precisely similar condition is found in the Pseudo-scorpions: for, in the first two pairs of limbs in *Chiridium* (as I have proved with absolute certainty in Nat. Tidsskr. 3 R. Bd. xiv., and in a paper at present in the press) the femur is undivided; in *Chelifer* it is divided into a short "trochantin" and the true femur; while in *Garypus*, and still more in *Obisium*, the femur is differentiated into a long *pars basalis* and a short *pars tibialis**, so that it is impossible to determine the homology of the segments by means of numbers (*vide* § 2). The maxillulæ have lobes *on the first and third segments, and, in a certain larval stage, also on the third segment, an exopodite, which subsequently disappears; while the organ which in the adult animals is regarded as an exopodite by authors is a plate-like development of the first segment, which appears later on* †. The maxillæ as regards the origin of the lobes agree with the Mysidæ.

23. The Decapoda approach the Euphausiidæ very closely. The second segment of the maxillulæ is fused with the first, so that the lobes proceed from the first and second segments. The segmentation of the limbs is essentially the same as in Euphausiidæ (Boas), but it follows from § 22 that the names bestowed by H. Milne-Edwards upon the several segments cannot be employed without consideration in the case of the orders mentioned in § 19 according to the number of each segment, with the exception of the first three.

24. As shown in § 20, the coxopodite does not disappear in the Idotheidæ, but forms a portion of the lateral region of the body; *if we assume that the first segment of the limbs which has been described in the Phyllopoda*, but overlooked or misunderstood by the majority of authors, *likewise does not disappear, it consequently forms a larger or smaller portion of the pleuræ.* This view seems to be capable of explaining the fact that in the Decapods branchiæ are found both upon the pleuræ, upon the arthrodial membrane between the pleuræ and the limb, and also upon the coxopodite; since the portion of the pleuræ provided with branchiæ is to be regarded as originally belonging to the limb, so that we now find its vanished segment represented by branchiæ alone. Compare

* This latter condition must be regarded as the primitive one, and therefore a fusion of segments takes place; but for practical reasons I have employed the expressions used.

† *Vide* G. O. Sars ('Challenger' Report), who has figured this correctly, but given it a wrong interpretation; *vide* also "Dijmphna-Togtet."

with this the plate situated upon the outer side of this same first segment in *Branchipus* and Cladocera (§ 9), which probably subserves the purpose of respiration. In the same manner we may also explain the presence of the branchiæ arising from the body at the base of the limb in *Lophogaster*, *Gnathophausia*, and *Eucopia*.

25. According to §§ 22 and 18 the exopodite of the maxillulæ and maxillæ, if it is present at all, always proceeds from the third segment in the case of the orders mentioned; it therefore follows that in these two pairs of oral appendages the primitive number of segments in the stem of the appendages is preserved and that the first segment comes to belong to the same category as the mandible, but not the coxopodite of the limbs.

26. The Leptostraca are decidedly the lowest of the Malacostraca. The Mysidæ stand much nearer to them than do the Euphausiidæ in the structure of the second pair of antennæ (§§ 18 and 22), in the structure of the limbs, in the development of the larvæ, in the presence of the furcal rami in the earlier larval stages (§ 18), in the shape of the heart, and in the presence of a conical projection for the orifice of each vas deferens; they appear to me to be the lowest of the Eumalacostraca.

27. The old division into Thoracostraca and Arthrostraca strikes me as being quite untenable even when (with Grobben) we have excluded the Stomatopoda as being a section of equal value. The arrangement appears to me to be based altogether too much upon only two conditions—the presence of a shield and of stalked eyes, as opposed to absence of a shield and sessile eyes,—and, moreover, none of these characters is constant (Tanaidæ, Cumacea). I consider that the Eumalacostraca can be arranged much better in three divisions, of which the first will contain the Mysida, Cumacea, Isopoda, and Amphipoda, while the second comprises the Euphausiida and Decapoda. The first division possesses *a lacinia mobilis upon the mandibles; eight segments in the limbs, of which the last segment is cheliform and the first several times shorter than the second, while there are five segments before the knee; a marsupium; larvæ which are at first motionless and have a peculiar development; an elongated heart; shorter or longer processes for the orifices of the vasa deferentia; and no spermatophores*: while the second division is distinguished by having *mandibles without a lacinia mobilis; limbs composed of seven segments, of which the first is almost as well developed as the second, while before the knee there are only four segments, of which the fourth is certainly homologous with the*

fourth plus the fifth in the case of the previous division; no marsupium; motile larvæ, which in the case of the lower forms have a Nauplius *stage and a large series of ecdyses; a short heart; no processes for the orifices of the vasa deferentia;* and, lastly, *by the possession of spermatophores.* The third group is constituted by the Stomatopoda, which agree in some of their characters with the first and in others with the second division, but in various other respects occupy a very isolated position.

III. INSECTA.

α. Machilis (§§ 28–35).

28. The mandibles of *Machilis* are homologous with those of the Malacostraca; *in form they resemble those of the Cumacea, having a well-developed almost cylindrical pars molaris,* though they are without a lacinia mobilis; *in articulation and musculature they exhibit a surprising agreement with,* e. g., *Diastylis* and *Nebalia* (*vide also* § 37), *and herein diverge to the utmost extent from,* e. g., *Orthoptera and Coleoptera.*

29. The maxillæ are composed of three segments and an eight-jointed palpus. The basal segment (*cardo*) has no masticating-lobe; the second segment is produced into a long lobe, which is transversely segmented at the tip; the third segment is also produced into a lobe (*galea*) and the palpus arises from its outer side. *The structure of the maxillæ* (which may be very easily examined in a preparation which has been cleared with potash), *as regards the origin of the lobes from the second and third segments, consequently agrees precisely with that of the maxillæ of the Eumalacostraca, while, on the other hand, it is totally different from that of the maxillulæ.*

30. In the Isopoda (see a figure in "Cirolanidæ") and Amphipoda we find that the maxillipedes are situated very close together in the median line, and, moreover, in the latter order their first (or first and second) joints become fused together; the maxillæ are articulated in front and at some little distance from the median line, while the maxillulæ are attached somewhat further still from the median line, and the hypopharynx projects between and before their points of articulation; lastly, the mandibles are inserted far away from the median line, obliquely outside and above the maxillulæ and maxillæ. We meet with a similar arrangement of the mandibles, maxillæ, and labium in *Machilis* and, *e. g.*, also in the Orthoptera and Coleoptera.

31. *I regard the maxillæ in* Machilis (*vide* §§ 29, 32, and 39) *as decidedly homologous with the maxillæ (second pair of*

maxillæ of authors) in the Malacostraca, and the labium as homologous with the maxillipedes and agreeing in many respects with these appendages in the case of the group mentioned. The submentum is homologous with the first segment, which is fused in the Gammarinæ, and the mentum with the second segment, which in the Hyperinæ is likewise fused. At the tip of the mentum we find a segment, produced on each side into four lobes, which, as may be seen with sufficient clearness, belong to two lobes, each of which is cleft; and these I regard (among other reasons on account of a comparison with Orthoptera and Amphipoda, although I cannot bring forward any cogent proof derived from the skeletal parts) respectively as a lobe from the second segment (the innermost cleft lobe) and as the third segment of the labium with its cleft lobe: the palpus arises from the outer side of the third segment.

32. The hypopharynx is conspicuous, almost rectangular in shape, slightly emarginate in front, and homologous with the hypopharynx (paragnathi) in the Malacostraca. The organs which are termed "paraglossæ" by authors have nothing to do with the hypopharynx; in the skeleton of the head they are articulated at the bottom of the hypopharynx and have a somewhat complex structure, with an external process like a small single-jointed palpus, and towards the tip a distinct tendency to cleavage into two lobes. I regard these "paraglossæ" as homologous with the maxillulæ of Crustaceans (a supposition which is strengthened in the highest degree by their structure in *Japyx* and the Collembola, *vide* § 39); the essential difference in *Machilis* consists in the fact that they are situated somewhat nearer to the median line and lie partly in front of the hypopharynx; yet in *Argulus*, according to Claus, the maxillæ are enclosed together with the mandibles in the suctorial tube, and are consequently placed before the hypopharynx. (If a carcinologist should raise the objection that in the case of *Apseudes* we find a lobe resembling an appendage upon the hypopharynx, we must reply that in *Apseudes* only the elongated outermost anterior angles are segmented off in a secondary fashion, while in *Machilis*, *Japyx*, and the Collembola the maxillulæ arise from the skeleton of the head at the base of the hypopharynx, which in these animals is not cleft towards the tip.)

33. The thoracic appendages have an elongated coxa, which is attached to the body by means of a small and for the most part firmly chitinized segment, which is freely movable, and which on account of its position and shape we must regard as the first joint of the leg. I regard it as homo-

logous with the coxopodite in the Malacostraca (it resembles the first segment of the leg of a *Mysis*, but is, however, somewhat longer); the coxa therefore becomes homologous with the basipodite. To the outer side of the coxæ of the second and third pairs of legs there is articulated a conspicuous hairy "style," which is perhaps homologous with the exopodite (Wood-Mason).

34. The abdomen consists of eleven segments (ten + the telson), a number which is met with again in the Cicadaria, *Ephemera*-larvæ, and other forms; according to Lacaze-Duthiers it is the primitive number in the Insecta. The well-known styles on the underside of most of the segments are without doubt portions of rudimentary appendages, and we may perhaps, on account of their position and agreement in form with the styles of the thoracic legs, regard them as exopodites (Wood-Mason). The triangular plates which bear the styles, and from which the hindmost in particular, especially in the case of specimens which are scarcely half-grown, project backwards as somewhat large processes, I consider with tolerable certainty to be homologous with the stems of crustacean appendages (Wood-Mason). The styles of the tenth segment constitute the well-known "cerci," which are homologous with the cerci in other Insects.

35. In the Mysidæ and Amphipoda we find, as is well known, four pairs of mouth-parts, and behind these fourteen segments, of which the last is without appendages. I have shown above that in the case of *Machilis* the corresponding four pairs of oral appendages exist, and behind them we also find fourteen segments, the last of which is likewise devoid of appendages. The tendency, which in the Malacostraca is of frequent occurrence, to develop the last pair of abdominal feet in a peculiar manner and to retain these, while the five preceding pairs undergo reduction (Mysidæ, Cumacea), is also met with in the case of *Machilis* and other Insects.

β. Campodea, Japyx, Collembola (§§ 36–39).

36. In the formation of the head and the structure of the mouth-parts these three types are very closely allied. They are especially distinguished by the well-known peculiarity, that the mandibles and maxillæ, with the exception of their tips, "lie within the head." This has arisen in consequence of the fact that the integument behind their points of insertion has become folded forwards and around them, like a reduplicature which contains tissues; and on the underside of the head the edges of this reduplicature have become firmly united with the lateral margins of the labium, so that the

latter throughout almost the whole of its length is connected with the lateral wall of the head. Consequently the mandibles and maxillæ do not really lie within the head at all, but, as in the case of *Machilis*, are attached to the integument of its sides, which has here become thin and smooth; and since the articular region of the inner lobes of the maxillæ and labium has undergone elongation, we understand how the reduplicature can extend almost as far as the end of the labium. (The necessary investigation is difficult, since the integument on the inner side of the reduplicature and on the portion of the lateral wall of the head which is covered by the reduplicature is very thin.)

37. The musculature of the mandibles resembles that of the Crustacea even more than it resembles the musculature of *Machilis*. It is only necessary to compare Meinert's figure of *Japyx* with my figure of *Diastylis Goodsiri* in "Dijmphna-Togtet" (I have only reproduced the three largest muscles or their tendons), or with Sars's figure of *Diastylis sculpta*, to be struck by the astonishing agreement in the form and direction of the muscles and of the large median muscle-plate. The mandibles are without a pars molaris, but, on the other hand, we find in *Campodea* a small lacinia mobilis.

38. The maxillæ consist of a cardo and second segment, which (as in *Machilis*) is continued into a lobe exhibiting a transverse segmentation in the neighbourhood of the tip. On the other hand, the third segment and the palpus are entirely wanting. What is termed by authors the outer lobe and palpus is not connected with the maxillæ (see especially Stummer-Traunfels, "Vergleichende Untersuchungen über die Mundwerkzeuge der Thysanuren und Collembolen," Sitzungsber. k. Akad. Wiss., math.-naturw. Cl., c. Bd., iv. Heft, Wien, 1891, Taf. i. figs. 7, 10, 11) and does not belong to them, but is, on the contrary, united to the "paraglossæ" and to the underside of the skeleton of the head which is covered by the labium.

39. In *Japyx solifugus* the hypopharynx is short and rounded off; the firm chitin of the "paraglossæ" is articulated to the chitin of the head behind the base of the hypopharynx. The paraglossæ themselves lie in front of the latter and coalesce with it for a certain distance; each of these "secondary tongues" is on the outer side connected by means of firm chitin with the outer lobe alluded to in § 38, and with a distinct three-jointed palpus. This entire structure, which lies in front of the maxillæ, constitutes the conspicuous and, in their basal portions, somewhat abnormally constructed maxillulæ. The inner lobe is the "paraglossæ"; the other two portions become the outer lobe and palpus. In the

higher Collembola the hypopharynx is of large size and the maxillulæ have only an inner and an outer lobe ("paraglossæ" and palpus). Stummer-Traunfels furnishes us with a good *résumé* of the extremely divergent interpretations of these parts by different authors, such as Meinert, Lubbock (who terms the "paraglossæ" the "second maxilla"), and Tullberg (whose description is on the whole excellent and who possessed a keen eye for the difficulties in the interpretations given by the two previous writers). The maxillulæ are, as has been already stated, inserted before the maxillæ and behind the point of origin of the hypopharynx; they have nothing to do with the labium.

40. It appears to me that the facts detailed in §§ 28–32 and 36–39, when taken together, show the great agreement that exists between the mouth-parts of the primitive Insects named and those of the Malacostracous Crustacea and that they render evident the homologies which I have set up.

41. *Lepisma* stands, as regards the structure of the mouth-parts and the thoracic feet, between *Machilis* and the Orthoptera.

42. *Hemimerus talpoides*, Walk.*, is a genuine Orthopteron, and in the structure of its mouth-parts approaches very near to *Forficula*.

43. ORTHOPTERA.—The muscles of the mandibles, *e. g.* in *Acridium*, exhibit conditions which are very divergent from those found in the Thysanura. By comparison with *Machilis* (§ 29) and by a process similar to that adopted in the case of the Isopoda it may be shown that the maxillæ, *e. g.* in *Forficula*, are composed of a first segment (cardo) without a lobe, a second (transversely divided) segment with the masticating-lobe, and a third (very obliquely cleft) segment with the galea, together with a palpus proceeding from the third segment; the second and third segments with their four parts together constitute the "stipes." (In the interpretation of the boundary between the lobe and the segment in the case of the second and third segments I have here on practical grounds not followed the certainly more correct interpretation employed in the case of the Crustacea, according to which the basal division alone is termed the segment; but the question has the less interest since it only turns upon the determination of the actual boundary between the segment and its lobe.) The hypopharynx is well developed; the maxillulæ are still present in various forms (*e. g.* Forficulidæ and larvæ of Ephemeridæ) as a lobe, which is attached to the skeleton at the base of the hypopharynx.

* A paper of mine on this animal is nearly ready for the press.

44. Coleoptera.—The mandibles, maxillæ, and labium agree with the utmost exactness with those of the Orthoptera in structure and relative position. A difference arises in consequence of the fact that the hypopharynx is either so much reduced in size as to disappear, or, as seems to me more probable, has become firmly attached to the inner side of the labium, which on the whole becomes pressed upwards against the underside of the head more closely than in the case of Orthoptera; many peculiarities (*e. g.* in *Melolontha*) point to the probability of the latter explanation. The maxillulæ are entirely wanting.

45. The hypopharynx is a freely projecting organ only in the Thysanura, Orthoptera, and Diptera; apparently we also find it in the Rhynchota as a short free point (Wedde, and my own observation in *Nepa*). It is often termed "tongue," which may well be admissible, but is not very happy. On the other hand, many authors frequently employ the term "tongue" in a very arbitrary and objectionable manner for portions of the labium; "paraglossæ," a term which should be entirely rejected, is used sometimes for portions of the labium, and at others for parts of the maxillulæ.

46. The antennæ in Insects are sometimes regarded as homologous with the antennules and sometimes as homologous with the antennæ in Crustaceans. As an argument in favour of the former supposition we have the fact that the antennæ of Insects, as also the antennules of Crustaceans, are innervated from the deuterocerebrum (Viallanes); the second theory is supported by two reasons. As has been demonstrated with respect to both classes by a series of authors, the rudiments of the antennæ are postoral in position both in Insects and in Crustaceans; it is true that a single author has stated the same thing with reference to the antennulæ, but this is certainly very much open to doubt. In the terrestrial Amphipods (*Orchestia*) the first pair of antennæ, the antennules, have become very short, and in the most characteristic land-Isopods (*Armadillidium, Armadillo, Tylos, Syspastus*) they have become extraordinarily small and are reduced even to the point of disappearance, while the second pair of antennæ are well developed.

47. Upon the mandibles of certain Coleoptera and larvæ of several species of Ephemeridæ I have found a well-developed lacinia mobilis.

48. How far the embryonic provisional lobes which have been found by different authors in several of the higher orders of Insects (and with respect to which Korschelt and Heider write on p. 793 of their text-book: "This lower-lip-forma-

tion may be best compared to the paragnathi of Crustacea, although a homologization with the latter structures may well appear to be out of the question") can belong to the maxillulæ is a question which must receive further elucidation from future embryological investigations.

49. In different Insects we can (with especial ease in all Cicadaria in the case of all legs, with exception of the last pair in Fulgoridæ) demonstrate the existence of a plate, which moves together with the coxa and which is decidedly homologous with the first segment in the legs of *Machilis* (§ 33); this plate, which is termed the trochantin, consequently becomes homologous with the coxopodite in the Malacostraca. It therefore does not belong to the same type of structure as the mandible and the cardo of the maxillæ (§§ 28, 29, and 25).

50. The trochanter in the legs of Insects, as is well known, often attaches itself closely to the femur, but is nevertheless not to be regarded as a portion of the latter which has been secondarily constricted off; on the contrary, it is to be considered as homologous with the ischiopodite of the Malacostracan limb.

51. With reference to the origin of the paired claws in Insects, I think that I may make the following statement:—In the Collembola we meet with a structure which agrees in the closest manner with the condition discussed in § 21 in the case of certain Isopods. We find that the leg ends with a short but well-developed and very freely movable segment, from the tip of which there proceeds a long and powerful claw (with a somewhat large cheliform process on each side), while to the underside of the segment another smaller claw is articulated. If we now start from my morphological interpretation in the case of the Mysidæ (§ 18) the short movable segment becomes the penultimate segment of the foot, the large claw the last segment, and the lower claw a large thorn (*vide* a good figure in Tullberg). In *Japyx solifugus* the lower claw has passed up on to the side of the movable segment, though scarcely to the same level as the large claw, and it is also somewhat smaller than the latter. The transition to the ordinary double claws now becomes very simple. I recommend the foot of a large *Acridium* for examination; the claws have here attained an equal size and proceed from a segment which is well developed, especially on the underside of the foot, and of which the lamelliform prolongation between the claws forms an empodium.

As an attentive perusal of the preceding pages will show, the majority of the facts and interpretations which have been developed above are most intimately connected with a series of other, partly new and partly old, facts which have been adduced by other authors; so that it is impossible arbitrarily to dispute some of them without subjecting a series of others to renewed investigation in various orders.

LXI.—*Descriptions of new Australian* Hesperiidæ. By W. F. Kirby, Assistant in Zoological Department, British Museum (Natural History).

The butterflies noticed in the present paper were sent with others to the British Museum for determination by Messrs. Anderson and Spry, who are engaged in the preparation of a work on Victorian butterflies. They wished those specimens which appeared to be new to be deposited in the British Museum on condition that they should be described at once and the names communicated to them. All the species were taken within the limits of the colony of Victoria. A species which appears to be identical with one described by Plötz has been added, as the descriptions of this author are not very accessible and are cast in a form which often renders them somewhat difficult to follow.

Trapezites Andersoni.

Exp. $1\frac{1}{6}$ inch.

Male.—Upperside golden brown, with a slight purplish shade towards the borders of the wings. Fringes unspotted, dark grey on the anterior wings, lighter on the hind wings. Anterior wings: a broad pale yellow blotch, with its outer end suddenly widened upwards, fills up the outer half of the cell; beyond this are the three usual whitish subcostal spots, and there are also two square whitish spots just below and beyond the cell, separated by the middle median nervule. Within the lowest commences a straight oblique raised line of black scales, extending to the inner margin. The base below the cell is clothed with dark golden hair nearly as far as this black line. Posterior wings thickly clothed with golden hair, except along the costa, for two thirds of their length, and towards the inner margin nearly to the anal angle.

Underside pinkish grey; anterior wings with the pale markings as above, the space between inclining to blackish;

an ill-defined greyish space at the hinder angle; posterior wings with two indistinct dusky lines.

Antennæ wanting.

Closely allied to *T. donnysa*, Hewitson, but in the latter species the discoidal spot is much smaller, the row of three subapical spots is curved, the discal spots are more numerous, at least beneath, and on the underside of the posterior wings there is a row of small black dots, sometimes ocellated.

Trapezites dispar.

Exp. $1\frac{7}{12}$-$1\frac{3}{4}$ inch.

Male.—Greenish brown; anterior wings rather pointed, with the hind margin very oblique; the terminal third of the cell filled up with a yellowish blotch, gradually thickened at the extremity; the three usual subcostal vitreous spots running obliquely downwards; a yellow spot between the two upper median nervules, within which a raised black scaly line runs a little obliquely inwards nearly to the inner margin. Fringes concolorous. Base of all the wings clothed with greenish hairs, succeeded on the posterior wings by a long blotch of dark yellow scales above the upper median nervule contiguous to a smaller one below it; fringes of posterior wings reddish grey, with three large black spots rather below the middle.

Underside reddish grey. Anterior wings with a long yellow band running nearly from the base below the subcostal nervure and contiguous to the discoidal spot; three yellow discal spots between the nervures, of which only one is represented above, and below them a large whitish space on the inner margin before the hinder angle. The greater part of the anterior wing is black or blackish from the base as far upwards as the yellow subcostal markings and towards the margins to beyond the discoidal and discal spots. The two lower subcostal vitreous dots are bordered with black on the outer side. Fringes brown, with blacker spots at the ends of the nervures. Posterior wings uniform reddish grey, with three black dots on the disk beyond the middle, the two lowest nearer together than the other; fringes with three black spots as above, but otherwise unicolorous.

Antennæ black above, ringed with white; club mostly black above, red below and at the tip, and white on the sides. Body green above, whitish below; legs reddish.

Female.—Upperside dark brown, clothed with greenish hair in the neighbourhood of the inner margin for one third of the length of the anterior wings, and nearly to the anal angle in the posterior wings. Anterior wings with three large, contiguous, yellowish-hyaline, subcostal dots; a large oval yellowish blotch at the end of the cell, contiguous to a large blotch, hardly separated into spots by the nervures, extending from the upper median nervule to below the lowest, where it is connected by a short isthmus with another semicircular spot standing on the submedian nervure. Nearer the base and just at the extremity of the hairy patch is a smaller yellow spot resting on the submedian nervure. Fringes dull grey, with black spots on the nervures. Posterior wings with the centre filled up with a large orange blotch, narrowed towards the base. Fringes tawny yellow, with about four black spots on the nervures.

Underside nearly as in the male, but on the anterior wings the yellow markings are continuous round the black basal space and are bordered outside by a curved black band. Towards the inner margin the yellow space extends as far as the fringes, which are brownish grey above and slaty grey below, and spotted with black on the nervures. Posterior wings nearly as in the male, but with only one black spot on the disk between the median nervules.

Body greenish above, whitish below. Antennæ as in the male.

The male remarkably resembles *T. donnysa*, Hew., in which species the sexes are nearly alike; the female, however, much resembles *T. symmomus*, Hübn., on the upper surface. A comparison of the underside and of the antennæ leaves little doubt that I have correctly united the sexes of *T. dispar*. It is probably allied to *T. idothea*, Miskin.

Telesto comma.

Exp. 1 inch.

Female.—Upperside greenish brown, fringes chequered with white, the basal lower half of all the wings clothed with long greenish hair. Anterior wings with a large vitreous spot at the end of the cell and two smaller whitish ones below it between the median and submedian nervures, just at the extremity of the hairy region; costa slightly arched towards the extremity, the raised portion yellowish, and below it the usual three vitreous spots, the lowest of which is produced into a curve like a comma. Obliquely, and halfway between the discoidal spot and the hind margin are two adjacent vitreous spots between the median nervules, the lowest somewhat nearer the base than the other; below them is a whitish spot resting on the submedian nervure. Hind wings with two well-separated vitreous spots on the disk at two thirds of their length.

Underside light grey, dusted with brown; base and lower part of fore wings blackish, the yellow costal fold well-marked, the spots below the discoidal spot and the outer one on the submedian nervure smaller than above; fringes rufous brown, the black spotting rather indistinct. Posterior wings uniform light grey, dusted with brown, with two rows of obsolete blackish spots, in the outermost row of which the vitreous spots are placed; fringes grey, with large square black spots.

May be distinguished from any described species by the two vitreous spots on the hind wings. The British Museum has undescribed species from Port Darwin and Tasmania which exhibit this character, but not the comma-like form of the third subcostal vitreous spot.

Telesto arsenia.

Telesto arsenia, Plötz, Stettiner entomologische Zeitung, lxv. p. 384 (1884).

Exp. 1 inch.

Female.—Upperside brown, with greenish hairs towards the base. Fringes white, rather indistinctly spotted with brown. Anterior wings with seven vitreous spots—one transverse, at the end of the cell, three small, contiguous, subcostal, slightly oblique, two between the median nervules, and a very small one below them on the submedian nervure.

Underside grey, densely scaled, but with no distinct markings, except the vitreous spots of the upperside.

Antennæ black, narrowly ringed with white, and white below; club rufous at the tip beneath. Body brown; thorax clothed with green hair above; orbits and palpi beneath white, the latter densely clothed with white hair.

It is often difficult to be sure of the identification of Plötz's species; but the specimen described above appears to agree with the characters of his *T. arsenia.* The locality which he gives is simply "New Holland."

Hesperilla peronata.

Exp. $1\frac{1}{3}$ inch.

Female.—Black, the body and base of the wings covered with long yellowish-green hair; head mostly white, banded with black above, before, behind, and between the antennæ; tips of palpi ferruginous; antennæ black, with a whitish longitudinal streak towards the base of the club beneath: under surface of thorax densely clothed with yellowish hair, as also the femora on each side beneath; legs reddish, the femora beneath and the tibiæ and tarsi above shading into blackish; abdomen clothed with yellowish-green hair at the base above; incisions and under surface whitish, tuft yellowish.

All the wings with the fringes chequered with whitish or pale yellow. Anterior wings with a large yellow spot at the end of the cell, widened in both directions above, two paler spots above the submedian nervure, at one third and two thirds of the length of the wing respectively; at three fourths of the length of the wing is a transverse subcostal spot crossed by two nervures; between this and the outer spot above the submedian nervure is a larger one between the median nervules, crossed by one nervure, and nearer the hind margin are two confluent and more indistinct whiter spots opposite the cell. Hind wings with the centre crossed by a slightly curved and moderately broad deep yellow band.

Underside: Anterior wings nearly as above, but with the spots more distinctly crossed by the nervures, which are yellowish towards the base and brown towards the margin. The two largest spots are more distinctly yellow than the others. The two submarginal spots above correspond to the lower end of a yellowish subcostal band crossed by three nervures, and connected with a smaller spot placed obliquely above it between the band and the subcostal spot. The large spot at the end of the cell is also surmounted by a small irregular spot. Posterior wings very pale yellow, with a large oval black spot at the base, the inner margin broadly black, five rather large black dots on the upper half of the fringes, which are tawny towards the anal angle: three rows of large black spots; the first consists of four large spots—the uppermost long, narrow, and pointed outwards, the second much shorter, with its narrowest end inwards, the third forming a long triangle, its inner angle truncated and its centre filled up with pale yellow, the fourth forming a large angular projection from the black hind margin. The outer rows consist of about six spots, separated by the nervures, and of various sizes and shapes; these are surmounted by a long subcostal spot, produced nearly to the first of the black dots on the fringe.

Closely allied to *H. ornata* and *H. picta*, Leach. On the under surface the anterior wings resemble those of the latter species and the posterior wings the former. Easily distinguished from most of the allied Australian species, except *H. croites*, Hew. (to which it has little resemblance otherwise on either surface of the wings), by the presence of the pale submarginal spots opposite the cell on the upper surface of the anterior wings.

LXII.—*On a new Species of* Zamenis *and a new Species of* Bufo *from Egypt.* By Dr. JOHN ANDERSON, F.R.S.

Zamenis Rogersi.

This snake is allied to *Z. rhodorhachis*, Jan, but differs from it in its body being less slender, the number of ventral and subcaudal shields falling below the range that occurs in that species, in which the former shields vary from 214 to 262 and the latter from 113 to 154, whereas in *Z. Rogersi* the ventrals, in five specimens, range only from 195 to 201, and the subcaudals from 95 to 105. It is also distinguished from *Z. rhodorhachis*, Jan, by the rostral shield being considerably broader than high, as its height only equals about one half of its breadth; whereas in *Z. rhodorhachis* the height of the rostral equals two thirds of its breadth or even more. The head of *Z. Rogersi* is broader than in *Z. rhodorhachis*, and its snout is not so pointed as in that species. The frontal is considerably longer than the interval between its anterior margin and the end of the snout. The temporals are 2+2, rarely 2+3, which is the reverse of what occurs in the species just mentioned. In the other details of its head-shields, with the exception of the præfrontals, which are occasionally united into one shield (two specimens from Shaloof, near Suez), and in the number of scales round the body it resembles *Z. rhodorhachis*.

It is also separated from Jan's *Zamenis* by its coloration. A longitudinal line of moderately large, more or less round, olive-brown spots commences behind the head, with a lateral series of smaller spots alternating with them. The two series, as they are traced backwards, become confluent about the middle of the length of the snake, behind which the colour of the upper surface is uniform olive-brown or nearly so. The spots are separated from one another, and also the more or less transverse bands formed by their confluence, by narrow yellowish-white areas. The upper surface of the head is brown, with very obscure dark markings. The rostral region is yellowish orange-brown, and a narrow somewhat obscure dark band occurs behind the nostril, followed by a bright yellow, almost orange, band before the eye. A dark oblique band below the eye. An orange band occurs behind the eye, succeeded by a broad dusky band crossing the temporals and the last upper labials, with a short yellow band behind it. The sides of the neck are suffused with orange. The underparts are yellowish white. A somewhat obscure dusky spot occasionally occupies the angle of every third or fourth ventral, and sometimes a few obscure dusky small spots are seen between the angles of the ventrals and their keels.

The first specimen of this snake (a young one) was observed by Mrs. Anderson in the desert to the east of Helouan, near Cairo. Dr. Rogers Pasha sent me two adults from Beltim, between Rosetta and Damietta; and an Arab in charge of the salt concession at Shaloof, near Suez, forwarded two specimens from that locality.

I have much pleasure in connecting Dr. Rogers's name with this new form, as he has given me most invaluable assistance in my researches in Egypt.

Bufo Pentoni.

This toad in its general appearance resembles the pale irregularly spotted form of *Bufo regularis*, Reuss, so common in Egypt. So far, however, as its real affinities are concerned, it seems to be most closely allied to *B. viridis*; but it is at once distinguished from all the Old-World toads by the presence on the middle of the tarsus of a well-marked horny tubercle. The front of the snout of the adult is covered with a horny induration extending from the nostrils to the anterior angle of the eye, and backwards and between the eyes to the commencement of the interorbital space, but more or less traversed in the mesial line by a longitudinal furrow. This protection to the snout, the presence of two metatarsal tubercles, the innermost of which is a powerful shovel-shaped structure, and the existence of the tarsal tubercle, are features which would seem to indicate that this is a burrowing toad. The tympanum is vertically oval, and its transverse diameter equals about one half of the diameter of the eye from canthus to canthus. The breadth of the upper eyelid equals the interorbital space. The paratoid is large and somewhat oval in shape. The limbs are rather short and stout, and the hind limb when laid forwards has the tarso-metatarsal joint reaching the ear. The toes are moderately webbed.

The general colour in alcohol is olive-grey with a yellowish tinge, irregularly covered with more or less confluent dark markings. A darkish band across each eyelid. The dorsal glandules may be either reddish or yellowish.

This species was found by Dr. Penton, of the Egyptian Army, whose name I have associated with it, in the Shaata Gardens, situated about one mile outside Suakin. I am indebted to him for many other most interesting specimens from Suakin.

LXIII.—*A Month on the Trondhjem Fiord.* By the Rev. Canon Norman, M.A., D.C.L., F.R.S., &c.

[Continued from p. 367.]

[Plate XIX.]

BRACHIOPODA.

1. *Terebratulina caput-serpentis*, Linn.

Trondhjem.

Var. *septentrionalis*, Couthouy.

Rödberg, on the precipices. I have always regarded, and must still regard, this as only a variety of *T. caput-serpentis*, notwithstanding the opposite opinion held by G. O. Sars *, Davidson †, and Fischer and Œhlert ‡. Sars thought he had found a permanent difference in the structure of the loop; but that has been proved not to be the case; the later authors rely on trifling differences, and I cannot find anything, either by the comparison of the hundreds of specimens which have passed through my hands or in the descriptions given, on which to found a valid species; the more specimens are examined the weaker is the evidence of real distinction, and *T. caput-serpentis*, var. *germana*, F. & Œ., is a mere link in a chain. Davidson quotes in the memoir referred to, without apparently the least suspicion that anything was wrong, these words from Binney's edition of Gould's 'Report Invert. Massachusetts':—"The downy epidermis is a character too rare and too singular to be overlooked. This, however, is rubbed off very easily." In his description of the species also Gould had written:—"The whole [*i. e.* shell] covered by a thin, silvery, fibrous epidermis;" and, again, "Deshayes conjectures, probably with justice, that

* G. O. Sars, 'Mollusca reg. arct. Norwegiæ,' 1878, p. 10.

† Davidson, "Mon. Recent Brachiopoda," Trans. Linn. Soc. ser. 2, vol. iv. (1886), p. 28.

‡ Fischer and Œhlert, Exped. Sci. 'Travailleur' et 'Talisman,' Brachiopodes, 1891, p. 29; and Result des Campag. Sci. Prince Monaco, fasc. iii., Brachiopodes de l'Atlan. Nord, 1892, p. 9.

the *Anomia pubescens* of Gmelin is the same thing." If we turn to Gmelin, Linn. Syst. Nat., edit. xiii., we find that the name *Anomia pubescens* is given to a shell on which Müller (Zool. Dan. Prod. 1776, no. 3007) thus writes :—" *Terebratula pubescens* testa tomentosa, subquadrangulari, longitudinaliter striata, tomentum non omnes æqualiter vestit, spongiamque parasiticam suspicor;" and Gmelin's own observations are "testa pilis brevissimis erectis distantibus, an forsan a Spongiæ specie adherente? hirta." The suggestion of these two old writers was the true one, while modern writers like Gould and Davidson have mistaken this hispid coating of sponge for an epidermis! But it must not be supposed that the hispid coating is due to one particular species of sponge. Two such are described by Bowerbank—*Microciona lævis*, Bow. (Brit. Spong. vol. iii. pl. xxiii. figs. 7–11), and *Halichondria albula*, Bow. (vol. iii. pl. xlv. figs. 21–24). I have now taken three specimens at random procured at Rödberg and examined the hispid covering; all looked alike to the naked eye, but each shell had on it a sponge not only specifically but generically distinct from the others, and none of them belonging to either of the species found on *Terebratulina* by Bowerbank*. Fischer and Œhlert give the same solution of the "epidermis," having found an incrusting sponge on their specimens which is yet another species, *Suberites capillitium*, Topsent. It would seem that the slightly roughened shell, combined probably with the advantage afforded in the way of nutriment brought by the currents of water which the Brachiopods set in motion, serve to make *Terebratulina* a friend highly esteemed among the Spongozoa.

2. *Waldheimia septigera*, Lovén.

This fine species is not rare at some spots near Rödberg; but I only myself found one living specimen on the precipices on the west side of the fiord at a great depth, probably 300 fathoms. I have also dredged it at a nearly similar depth off Batalden, near Florö. The Rödberg specimens are, however, larger than any I have seen from other places,

* One of the three is *Myxilla ambigua*, Bow. (=*Microciona ambigua*, Bow.). This is *Hastatus ambiguus*, Fristedt, who also found it incrusting *Terebratulina*.

whether taken by myself or by the 'Porcupine' Expedition of 1869. The example procured is a narrow and very tumid form, measuring $1\frac{1}{2}$ inch long, $1\frac{1}{5}$ inch broad, and 1 inch deep; but, if my memory deceives me not, I saw larger specimens than this in the Trondhjem Museum, and fully the size of Davidson's measurement of his largest specimen. Fischer and Œhlert have figured on pl. iv. of the 'Travailleur' Report a very remarkable triangular form of this species, with almost straightly sloping sides and straight anterior margin, where it is of great breadth. Indeed, judging from the figures I should have thought that the form might possibly be referable to *W. floridana*, Pourtales, rather than to *W. septigera*.

3. *Waldheimia cranium*, Müller.

From 70 fathoms downwards, Trondhjem and Rödberg. This species I find generally distributed in the West Norway fiords, and I have also taken it in Lang Fiord, Sydvaranger, close upon the borders of Russia.

4. *Crania anomala*, Müller.

In 40–250 fathoms. Specimens from the precipices are large.

TUNICATA.

As there were several Tunicata which I was unable to determine I sent the animals of this class to Professor Herdman, who has kindly examined them and sent the following notes. They will be more fully treated of in a paper which Professor Herdman has in preparation on the Tunicata of Norway.

"Ascidiæ Simplices.

"Fam. I. **Molgulidæ.**

"1. *Molgula eugyroides*, Traustedt*.

"Three specimens from Rödberg, 250–300 fathoms. These agree so well with Traustedt's description and figures that I cannot separate them, although *M. eugyroides* has only been found previously off Bahia, South Atlantic.

* "Vestindiske Ascidiæ simplices," Vidensk. Meddel. fra den Naturh. Foren. i Kjöbenhavn, 1882, p. 37, pl. v. figs. 1–3.

"Fam. II. **Cynthiadæ.**

"Subfam. *Styelinæ.*

"2. *Polycarpa pomaria*, Sav. (?).

"About two dozen specimens from Rödberg, 150–250 fathoms, and several from Bergen Fiord (*A. M. N.*, 1878). These agree in almost all anatomical details with British specimens of *P. pomaria*, but the branchial sac has no intermediate horizontal membrane across the meshes. However, I do not lay great stress upon this, and I feel pretty sure that the specimens belong to *Polycarpa pomaria.*

"3. *Polycarpa pusilla*, Herdman *.

"Four specimens from Rödberg, 250–300 fathoms, and one specimen (in regard to which I am still a little in doubt) from Trondhjem, shallow water. This species was only previously known from the North Atlantic, 40 miles off Valentia, Ireland, 110 fathoms.

"Fam. III. **Ascidiidæ.**

"4. *Ascidia compressa*, O. F. Müll.

"Three specimens from Trondhjem, 20 fathoms, and Rödberg, 40–70 fathoms, and one from Rödberg, 20–40 fathoms. These are all rather small, an inch to an inch and a half in length, but agree well with large specimens from the north of Norway. They have the pharyngo-cloacal slit in the branchial sac like that of *A. mentula.* I am inclined to think that the *A. obliqua* of Alder may be this species, and *A. falcigera*, Herdman, from off Nova Scotia is at least very closely related.

"5. *Ascidia plebeia*, Alder.

"Two specimens, about half an inch long, from Trondhjem, shallow water. Also two smaller specimens, in regard to which I have some doubt, from Rödberg, 100–200 fathoms. There are also a few other small Ascidians, which I consider too young to identify with certainty.

"6. *Ascidiella venosa*, O. F. Müll.

"Trondhjem, shallow water.

* "Report Tunicata 'Lightning' and 'Porcupine' Expeds.," Trans. Roy. Soc. Edin. vol. xxxii. 1884, p. 224, pl. xxxv. figs. 4-6.

"7. *Ascidiella*, sp.

"One specimen from Rödberg, 150–200 fathoms, is possibly a new species characterized by its very large stigmata, of which there are only two in each mesh, and by the very slender bar of the branchial sac.

"8. *Ciona intestinalis*, Linn.

"Trondhjem, 20–40 fathoms, under western shore.

"9. *Corella parallelogramma*, O. F. Müll.

"One from Trondhjem, near Munkholmen, 20–40 fathoms.

"ASCIDIÆ COMPOSITÆ.

"Fam. **Didemniidæ.**

"10. *Leptoclinum tenue*, Herdman *.

"Rödberg. This species was previously known from the coast of South America and from the Faroe Channel.

"Fam. **Polyclinidæ.**

"11. *Amaroucium pomum*, M. Sars (?) †.

"From Rödberg.

[*Note by A. M. N.*—Two specimens growing side by side dredged in shallow water, each thus far agreeing with Sars's description :—" Polyparium magnitudine pugni, luteo-cinereum, subcartilagineum, globosum, absque pedicello, papillis parum eminentibus obtectum. Animalia flava (straminea)." From a memory of this description, at the moment when I dredged them, it flashed into my mind that these fine large compound Ascidians were Sars's species; but further than that I cannot say, as I did not dissect out the animals before sending them to Professor Herdman.]

"12. *Psammaplidium*, sp. n.

"From Rödberg. All the species of this genus previously

* Report 'Challenger' Tunicata, pt. ii., Ascidiæ Compositæ, 1886, p. 281, pl. xxxix. figs. 8–11, pl. xl. figs. 3–5.

† Beret. Somm. 1849 foretagen Zool. Reise i Lofoten og Finmarken (Nyt Mag. for Naturvid. vol. vi., 1851), p. 35.

known are from the Antarctic, the South Atlantic, or the Australian Seas.

"13. *Aplidium*, sp.

"Several small colonies, which cannot be identified with any certainty."

POLYZOA.

Having during previous dredgings in Norway paid much attention to the Polyzoa, I had a large mass of material, examined and unexamined, belonging to this Class from the fiords. I did not therefore, on the present occasion, search for incrusting species, but gave the time thus saved to other things. The few incrusting forms in the following list were accidentally noticed, but it will be seen that the arborescent Polyzoa are of great interest.

1. *Menipea Jeffreysii*, Norman. (Pl. XIX. fig. 1.)

1868. *Menipea Jeffreysii*, Norman, "Notes on some rare British Polyzoa, with Descriptions of new Species," Quart. Journ. Micr. Sci. n. s., vol. viii. p. 213, pl. v. figs. 4–8.

1880. *Menipea Jeffreysii*, Hincks, Brit. Marine Polyzoa, p. 42, pl. ix. figs. 1, 2.

Menipea Jeffreysii was described from two very minute fragments, each about 2 millim. long, which were picked out by the late Mr. C. Peach from shell-sand dredged by Jeffreys and myself off Shetland and in the Minch. The description of these worn fragments was therefore imperfect, and I will now give full details of this very distinct species.

Zoarium very transparent and glassy, arising from a single stem composed of a coil of chitinous tubes, and attached by the base usually to a small pebble or fragment of shell, dichotomously branching, branches all in one plane. Zoœcia 6 to 9 and sometimes more in each internode, aperture regularly elliptical, occupying half the length of zoœcium; in young cells armed in front with three long spines, the innermost much more slender than the others, but in older zoœcia this innermost slender spine has generally been broken off at the base and is no longer perceptible, while the others remain as short, more or less stumpy spines; fornix (operculum) attached near the upper end of the inner margin, very large, convex, cap-like, and so closely fitted down to the aperture that, viewed from above, it appears to be part of the cell, and only careful lateral inspection shows the narrow open line which marks its separation from the mouth-margin; the illusion is heightened by the fact that the anterior edge of the operculum is projected at a right angle across the mouth, leaving in front an opening exactly semicircular in form. The whole cell thus mimics the appearance of a Lepralian. Two avicularia on each cell—one central, raised, situated a little behind the aperture; the other lateral, in the usual position, very small, the outer margin of the cell embracing it from below without any angularity. The oœcium is rather longer than wide, not globose, but depressed slightly above, inclining inwards.

But a most marked peculiarity of this *Menipea* is seen at the back of the zoarium, which is overlaid throughout from the base to the most recently developed cells by chitinous tubes; these tubes, where not so numerous, generally wind in and out among the cells, but on the lower part, where they are more numerous, they completely cover the whole back; moreover, one of these tubes generally (if not always) passes round the base of each bifurcation (see Quart. Journ. fig. 6, and here, Pl. XIX. fig. 1, *c*), as though to give strength to that part; sometimes also one of the tubes runs along the edge of each side of the zoarium, so that, when viewed from above, there is seen a transparent margin (Pl. XIX. fig. 1, *b*) extended outside the cells. Height of my tallest specimen 32 millim. (not quite $1\frac{1}{2}$ inch).

Rödberg, Trondhjem Fiord, 150 fath.; also Kors Fiord, 180 fath.; Hardanger Fiord, 150–180 fath.; Florö, 35 fath.; and Bog Fiord, East Finmark, 150 fath.

Specimens from all these localities agree in every particular. They are at once distinguished from all other species of the genus by the peculiar dorsal overlying of chitinous tubes and the large close-fitting cap-formed fornix, as well as by the presence of the central and the small size of the lateral avicularia.

The description and figure here of this species are so different from those previously given that some explanation is necessary. Alder's figure illustrating my paper (pl. v. fig. 8) and Hincks's figure (pl. ix. fig. 1) were both taken from the same specimen; the former incorrectly thought that the broken remains on the upper oœcium-bearing cell represented a branched fornix. This error I corrected in my description, and Hincks drew it as entire, adding two similar fornices to two other cells where they were not actually present in the specimen. I mention this trifle because the curious circumstance is this, that all the time there was a perfect fornix on the lowest zoœcium of the right-hand side, which we none of us recognized as such, its character being so entirely different from any previously known form of that organ. Alder represented on fig. 6 certain organs on the back of these zoœcia, which apparently I could not see, as I did not describe them. These, I take it, were the central avicularia appearing through by transmitted light, and their position rather altered by refraction. Lastly, the very small imperfect lateral avicularia, which I had mistaken for broken spines, Hincks rightly recognized as avicularia.

2. *Kinekoskias Smitti*, Danielssen. (Pl. XIX. figs. 2–5.)

1867. *Kinekoskias Smitti*, Danielssen, Förhandl. Vidensk.-Selsk. Christiania, 1867, p. 23 (quoted from Dan. & Kor.).
1868. *Bugula Smitti* (*Kinekoskias*, Dan.), M. Sars, Forsatte Bemærk. over dyriske Livs Udbred. i Havets Dybder (Vidensk.-Selsk. Förhand. 1868), p. 255 (name only).
1877. *Kinekoskias Smitti*, Dan. & Koren, Fauna Littor. Norvegiæ, 3die Hefte, p. 104, pl. iii. figs. 12–44, pl. xii. figs. 4–8.

I had the satisfaction of procuring several perfect examples of this rare and remarkable Polyzoon in about 70 fathoms at Rödberg. I was previously indebted to Dr. Danielssen for the head of a specimen of the species he had described, but had not seen the perfect form until I went to Trondhjem.

Other known localities for this species are Stotholmen Fiord, Nordland, 80 fathoms (*Danielssen*), Kors Fiord, entrance to Bergen Fiord, 150–200 fathoms (*Danielssen and Koren*), 300 fathoms, no locality (*M. Sars*).

Among the Polyzoa of the 'Challenger' Expedition two species attracted great attention— *Cephalodiscus dodecalophus*, M'Intosh, and one which Wyville-Thomson described as *Naresia cyathus*, and which Busk afterwards found to be so closely allied to *Kinekoskias Smitti* that he had some doubt whether it was distinct or not. It will be well therefore to clear up this matter, and I am indebted to the British Museum for a small fragment of the type of Thomson's species which enables me to make direct comparison. I shall take it for granted that the descriptions already given of the two species have been consulted, and shall only draw attention to points of difference or corrections of errors.

A. *Kinekoskias Smitti*, Dan. (Pl. XIX. figs. 2–5.)

The total height is 4½ inches; of this the first three quarters of an inch is composed of the dense mass of fine rootlets which are distributed through the mud and hold the zoarium in its position; the next three inches are the stem, which is about

2 millim. in diameter at the base, and thence tapers gently to the summit, where it is half that diameter. When living the stem is cylindrical and vertical, so that the crown of branches is held at its height above the mud; but when dead all efforts to preserve it in its natural form failed and the sides entirely collapsed, and it is thus evident that the stem is composed of a very delicate smooth surrounding membrane, filled with fluid; the fluid must escape, I think, at the top of the stem between the bases of the branches, as I cannot find any rupture in the side-walls. Delicate as the membrane which forms the stem is, it is of considerable strength; the stem may be bent in any number of folds, it will not break. At the summit of the stem this membrane expands and invests the base of the crown, extending a little distance up the branches, on the sides of which it is extended as a thin film. The crown is about $\frac{3}{4}$ inch high, and is composed of dichotomously dividing flexible branches.

The zoœcia viewed from above (Pl. XIX. fig. 3) have the lateral margin straight, without any sinus, and the terminal spine-point is small and does not rise above the slightly projected anterior margin of the zoœcium; viewed laterally (fig. 4) the dorsal margin is seen to be straight or only very slightly arcuate. The avicularia (fig. 5) are greatly elongated and at the base the point of attachment is extremely fine; they spring from the delicate lateral margin of the zoœcium about or a little above the middle, and are so long that they project when directed forwards considerably beyond the summit of the zoœcium, sometimes by the whole length of the mandible.

B. *Kinekoskias cyathus* (Wyville-Thomson). (Pl. XIX. figs. 6–8.)

1877. *Naresia cyathus*, Voyage of the 'Challenger,' The Atlantic, p. 142, and woodcut.

1881. *Bugula (Kinekoskias) cyathus*, Busk, Quart. Journ. Micr. Sci. n. s. vol. xxi. p. 1, pl. i. figs. 1, 3, 4.

1884. *Kinekoskias cyathus*, Busk, Report 'Challenger' Polyzoa, The Cheilostomata, p. 44, pl. viii. figs. 1 and 1 *a–c*.

Judging from the figures given, as well as from the fragment which I have had the opportunity of examining, this species is much less flexible and more charged with calcareous matter than the last. Hence its crown, which is also considerably larger than that of *K. Smitti* in relation to the height of the stem, stands up more stiffly. But be that as it may, the following points afford good specific characters.

The zoœcium seen from above (Pl. XIX. fig. 6) has the outer margin flexuous; at a short distance from the base it suddenly falls back, forming here, as Busk says, "a sort of step;" from this point it arches very gently forward, terminating in a spine-point; this spine-point is rather larger than in the last species and extends beyond the anterior margin of the zoœcium; viewed laterally (fig. 8) it is seen that the back of the zoœcium is very convex, the form being spoon-shaped and reminding one of that of the cell in *Mollia patellaria*, Moll*. The avicularium (fig. 7) is much shorter and stouter than in the last species, and is attached behind the middle of the zoœcium to the "step" described; when directed forwards it does not nearly reach the end of the lateral margin.

Thus both in form of zoœcium and avicularium this species is quite distinct from *K. Smitti*.

The figures of the avicularia in the 'Challenger' Report are very inexact. They are represented as mounted on a pedicel, and in some instances an articulation is drawn at the summit of the pedicel. There is nothing of this. The avicularium itself tapers downwards to a very small point, which point is the attachment to the zoœcium.

I do not see in my specimens of *K. Smitti* that the "lower narrower part of the posterior surface" is "transversely striated," as described by Danielssen and Koren, and referred to by Busk as perhaps of specific importance to distinguish that species from *K. cyathus*.

An interesting point in *Kinekoskias* is the development of the mass of root-fibres by which the species anchor themselves in the mud. Observations on this subject will be found in Busk's paper in Quart. Journ. Micr. Sci. I do not remember any other Polyzoa which have rootlets of this character, though different species have very varied modes of attachment. But it is an interesting fact that among many classes of mud-inhabiting animals similar modes of anchoring are found. The throwing out of a bundle of fibrous processes which, permeating through the fine mud in all directions, act in the way of roots to support the animal in an upright position, occurs not only in *Kinekoskias* among the Polyzoa, but also among the Echinodermata in *Rhizocrinus lofotensis*, M. Sars, among the Hydrozoa in *Aglaophenia radicellata*, G. O. Sars, and among the Spongozoa in many species, preeminently in *Stylocordyla borealis*, Lovén, and *S. stipitata*, Carter.

* Why is *Diachoris*, Busk, 1851, used for this genus instead of *Mollia*, Lamouroux, 1816? The fact that the name has been misapplied by some authors is no reason why it should not be rightly used, and *Eschara patellaria*, Moll, is the type of Lamouroux's genus.

3. *Scrupocellaria intermedia*, sp. n. (Pl. XIX. figs. 9, 10.)

Rödberg, on the precipices.

I cannot assign this form satisfactorily to any known species. It comes nearest to *S. scrupea*, a southern form not yet known north of the south of England. With that species it agrees in the form of the fornix, of the lateral avicularia, and of the vibracular cells, which latter are present on every zoœcium, and in the absence of an avicularium on the front of the cell. It differs in its more slender habit and more elongated cells (in *S. scrupea* the mouth-openings overlap each other, here they are quite distinct), and in the oœcium, which in *S. scrupea* is wider than high and very convex, here is somewhat loop-formed, being narrower at the mouth than a little above it, much longer than wide, and flattened centrally; there are four spines at the summit of the cell. In habit this species approaches more nearly to *S. scruposa*, from which it is distinguished by the presence of a fornix. From the northern *S. scabra* it differs in the absence of an avicularium on the front of the zoœcium and the entirely different form of the vibracular cell *.

4. *Caberea Ellisii*, Fleming.

Rödberg and Trondhjem, frequent.

5. *Bicellaria Alderi*, Busk, = *B. unispina*, M. Sars.

Trondhjem, 150 fath.; Rödberg.

6. *Flustra Barleei*, Busk.

Not uncommon on the precipices. Here, and in all other West-Norway fiords where I have taken the species, the habit of the species is different from that of specimens from the sea round Shetland. For the form of the latter see Hincks, pl. v. fig. 6, which was drawn by Mr. Alder from a specimen in my collection. In Norway, on the other hand, the zoarium generally assumes the form of long narrow strips. *Flustra Barleei* is common in the West-Norway fiords. It

* I take this opportunity of dissenting from Mr. Hincks's view that my *S. inermis* is the same as the Miocene fossil *S. elliptica*, Reuss; one of that author's figures shows three spines on the front margin of the cells, and the dorsal view looks quite different, representing the zoœcia as very tumid in that part. Many of Reuss's species described in this and other papers may prove to be recent; but it is difficult, except in the case of very marked forms, to judge, without comparison of specimens, of the identity of fossil with recent species, especially in such a genus as *Scrupocellaria*, where most of the organs in a fossil are in an imperfect state.

is not referred to in Smitt's original work; but he subsequently recorded it from off the West-Finmark coast, and pointed out the differences between this species and his *Flustra membranaceo-truncata.* They may at once be separated by their avicularia, which in the former are nearly circular and are *placed obliquely* (*vide* Hincks, pl. v. fig. 7) and in the latter are oblong and are *placed uprightly* with respect to the zoarium (*vide* Smitt, pl. xx. figs. 2, 3). I have examined many specimens of Smitt's species, including a type received from the describer.

[To be continued.]

EXPLANATION OF PLATE XIX.

Fig. 1. *Menipea Jeffreysii*, Norman. *a*, the fornix; *b*, chitinous tube from the back, here running along the side of the zoarium; *c*, chitinous tube forming a loop uniting the divaricating branches.
Fig. 2. *Kinekoskias Smitti*, Danielssen, nat. size.
Fig. 3. Ditto. Zoœcia seen from the front.
Fig. 4. Ditto. Zoœcia seen from the side.
Fig. 5. Ditto. Avicularium.
Fig. 6. *Kinekoskias cyathus* (Wyville-Thomson). Zoœcia viewed from the front; part of the type 'Challenger' specimen.
Fig. 7. Ditto. Zoœcia viewed from the side. *a*, back of the further row of zoœcia appearing in the hollows of the zoœcia of the nearer row; *b*, an organ I do not feel sure about, possibly the point to which the muscles of the animal are attached, but I cannot see any muscles thus attached.
Fig. 8. Ditto. The avicularium.
Fig. 9. *Scrupocellaria intermedia*, Norman. Front view of zoœcia.
Fig. 10. Ditto. One of the upright vibraculum cells from the back of the zoœcium, more enlarged than fig. 9.

LXIV.—*On some new or little-known Species of Coleoptera from the East.* By the Hon. Walter Rothschild and Dr. K. Jordan.

1. *Theodosia Howittii* (Cast.).

Among some specimens of this fine species recently received from Kina Balu, North Borneo, is a large male, measuring 52 millim. from the tip of the prothoracic horn to the apex of the abdomen; the horn on the head is more than 30 millim. long. Both horns are deep coppery, tinged with purple.

2. *Theodosia magnifica*, sp. n.

♂. *T.* viridis, elytris, abdomine femoribusque flavescentibus; caput cornu longo aureo-igneo simplice; prothorax cornu aureo-igneo, apice truncato, infra ante medium uni-, versus apicem bituberculato, densissime granulato-punctulatus, fortiter convexus, lateribus medio rotundatus, postice angustatus, angulis posticis rotundatis; scutellum elytraque tenuissime punctulata.

Long. 30, elytr. 14, lat. 12 millim.

Distinguished from *T. Howittii* (Cast.) by the yellowish colour of the elytra, abdomen, and femora, by the prothorax being shaped almost as in *T. telifer*, Bates, with the sides rounded in the middle, gradually attenuated near the base, and with this narrowed portion without an elevate margin. The prothoracic horn differs from that of *T. Howittii* (Cast.) in having three small tubercles underneath, one towards the base and two (one at each side) near the tip. The punctuation is extremely fine and dense; there are no coarse and scattered punctures either on the prothorax or on the elytra, whilst *T. Howittii* (Cast.) has (besides the fine punctuation) such scattered punctures on the middle of the prothorax and rather dense umbilicate punctures at the base of the elytra. The prothorax is much more convex and the elytra are relatively shorter and broader.

Kina Balu, British North Borneo. One male.

3. *Pseudochalcothea planiuscula* (Bates).

As the male of this species is not yet described we give the following diagnosis:—

♂. Tibiæ anticæ inermes, intermediæ intus sinuatæ, posticæ ante medium intus lobo longo, tibiæ æquali, sat lato, apice minute dilatato, longitudinaliter impresso, fere spatuliformi; abdominis segmentum ultimum apice sat late sinuatum; pygidium apice læviter bilobum.

Kina Balu.

4. *Pseudochalcothea pomacea* (Bates).

♂. Tibiæ anticæ extus inermes, intermediæ parum arcuatæ, intus indistincte sinuatæ, postice intus ad basin lobo tibiis multo longiore dimidio basali subparallelo, dimidio apicali angustissimo, versus apicem filiformi; abdominis segmentum ultimum sinuatum; pygidium longitudinaliter impressum, apice bilobum.

Kina Balu.

5. *Pseudochalcothea Staudingeri*, Vanderpoll.

This very interesting species, almost similar in colour to *P. pomacea* (Bates), but a little darker, is smaller than the latter, measuring only 25 millim. The middle of the prothorax is punctured, the strigulose area at the sides of the elytra is large, the process of the mesosternum short. The chief character of the species is the process of the posterior tibiæ of the male scarcely extending beyond the tip of the tibia, strongly dilated at the apex, with the tip somewhat emarginate.

♂ ♀. Kina Balu.

6. *Eutrachelus borneensis*, sp. n.

♂ ♀. Differt ab *E. Temmincki*, Latr.: elytris maculis parvis, grossissime catenulato-punctatis, stria suturali lævi, punctis præcipue versus latera interstitiis duplo aut triplo latioribus.

♂. Long. 75, elytr. 28, lat. 11 millim.
♀. „ 55, „ 25, „ 10 „

This species very much resembles *E. sumatrensis*, Waterh., both having the spots of the elytra very small, and may be only a Bornean form of *E. Temmincki*, Latr.

The male has a very feeble carina on the head in front of the insertion of the antennæ. The prothorax, usually more slender and less rounded than in *E. Temmincki*, Latr., is finely and sparsely granulate, chiefly so in large males. The spots of the elytra are arranged as in *E. Temmincki*, Latr., —one at the base, occupying only the third interstice, elongate; a second, very small, at the base of the fifth interstice; a third near the suture in front of the middle, almost as broad as long, occupying the third and fourth interstices; a small elongate spot on the fifth and one spot on the eighth and ninth interstices, both behind the shoulders; a postmedian macula on the third to the fifth and two elongate anteapical spots on the third and on the ninth interstices, all these spots coloured as in *E. Temmincki*, Latr. The sutural stripe of the elytra is smooth, the second punctulated in the middle; the punctures of the other stripes are large, with the interstices between them somewhat elevate; the biggest male has the punctures of the fifth to the eighth rows relatively not so large as they are in smaller specimens.

Kina Balu.

Varies very much in size, like *E. Temmincki*, Latr.

7. *Eutrachelus achilles*, sp. n.

♂. *E.* ater, tibiis apicibus tarsisque infra brunneo-pubescentibus;

elytris striis tribus suturalibus, striis octava et nona, cæterarumque partibus apicalibus lævibus.
Long. 75, elytr. 28, lat. 11 millim.

Entirely black, with the elytra shining. Inner side of the tibiæ (except the base) and the under surface of the tarsi clothed with a brownish pubescence. Head and prothorax shaped as in *E. Temmincki*, Latr., with the tip of the rostrum strongly dilated. Elytra with fine stripes; the first, second, third, and ninth stripes smooth, the fourth with fine punctures except at the base and apex, the fifth to seventh punctured, with their apical third smooth; the eighth with a few punctures behind the base. Under surface as in *E. Temmincki*, Latr.

One male. Java.

8. *Eurybatus borneensis*, sp. n.

♀. *E.* niger, prothorace supra et infra elytrisque aurantio-rufis, capite medio profunde canaliculato; antennis scapo pyriformi, articulis tertio, quarto, quinto processu apicali robusto sat longo apice tumido, articulis 6° et 7° apice dentatis; prothorace disco utrinque macula rotunda nigra; scutello nigro apice profunde sinuato; elytris elongatis, quarta parte apicali et singulo maculis quatuor nigris, maculis prima et secunda rotundatis postbasalibus, transverse dispositis, prima versus suturam, secunda minore versus latus, tertia mediana transversa in disci medio, quarta sublaterali ante aream nigram apicalem rotundata cum hac area conjuncta.
Long. 33, elytr. 22, lat. 8 millim.

The apical process of the third joint of the antennæ a little thickened at its tip, conspicuously curved, standing at right angles to the joint; the process of the fourth joint is shorter but of nearly the same shape, standing obliquely to the joint; the fifth joint has the tip of the short process also rounded, whilst the sixth and seventh joints have a short and sharp tooth.

Kina Balu.

LXV.—*Two new Species of Lepidoptera from German New Guinea.* By the Hon. Walter Rothschild and Dr. K. Jordan.

1. *Acræa Sanderi*, sp. n.

Male.—Upperside. Anterior wings transparent, with scarce black scales which are somewhat denser at the costa and apex, forming ten maculæ in the basal half of the wing, and with a marginal row of very small markings between the nervules; moreover there is a submarginal row of elongate pale buff maculæ, rather inconspicuous, the two posterior of which are triangular. The base has three markings of a pale buff, two of them in the cell.

Posterior wings black, feebly tinged with brown, with a pale buff transverse fascia parallel to the outer margin and crossed by the black nervules.

Underside. Anterior wings with very sparse scales, arranged according to the maculæ of the upper surface.

Posterior wings similar in colour to the upperside, moreover with three basal spots and one or two spots near the apex of the cell pale buff; a submarginal row of rounded markings between the nervules also pale buff, these markings, as well as the before-mentioned spots, showing more or less through on the upperside.

Abdomen with the apical margin of the segments beneath and a subdorsal row of rounded spots buff.

Exp. 55 millim.

Hab. Simbang, near Finschhafen, German New Guinea (*Micholitz*, June 1893).

We name this species in honour of Mr. Sander, of St. Alban's, from whom we have received a small but fine collection of butterflies and moths taken by his orchid-collector, Micholitz, at Simbang.

2. *Panacra Micholitzi*, sp. n.

Male.—Upperside. Ground-colour of the anterior wings olive-green, tinged with brown at the costa; a longitudinal streak extending from the base to near the apex and a narrow submarginal line, nearly parallel to the streak and somewhat curved in the middle, straw-yellow. The inner side of the streak as well as of the line bordered with blackish olive-green, the space between the streak and the line with two slightly marked blackish olive-green lines. The outer margin marked with blackish olive-green at the ending of the nervules.

Posterior wings orange-rufous, with a blackish and somewhat ill-defined marginal band.

Underside. Fore wings orange-rufous, more rufous than the upper surface of the hind wings, with the costa and the outer margin greyish olive, with a longitudinal streak of straw-yellow washed with ochraceous rufous, and with a linear straw-yellow spot near the apical angle, these markings corresponding with those of the upperside.

Posterior wings greyish olive, spotted with olive, and with the hind margin ochraceous buff.

Upper surface of the body with longitudinal buff- and brown-olive streaks; the under surface white, with a tawny line running along the middle of the abdomen.

Exp. 57 millim.

Hab. Simbang, near Finschhafen, German New Guinea (*Micholitz*, June 1893).

Named in honour of the collector.

LXVI.—*On a Small Collection of Lepidoptera from Chili.* By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

A short time since Herr G. Ruschewegh, of Buenos Aires, wrote to ask whether I would undertake to determine a series of Chilian Geometræ, conditionally on the specimens being presented to the British Museum; to this I agreed, and during September a box of Lepidoptera in papers came to hand, some of which, indeed, are not Geometræ and several of which, when set up, I found to be in such bad condition as to be unrecognizable. The latter are numbered respectively as follows:—Deltoids (nos. 12, 78, and 120), Geometræ (nos. 17, 61, 63 in fragments, 111, 137, and 147), these nine examples being all worn, rubbed, and more or less broken. Herr Ruschewegh forwarded with the specimens a letter, in which he proposed a number of names for the new species, the majority of which are, however, so unclassical in character that it would not be possible to employ them. The following is a catalogue of all the recognizable species:—

Hepialidæ.

1. *Dalaca subfervens*, Butler.

Dalaca subfervens, Butler, Trans. Ent. Soc. 1882, p. 25. n. 39.

In my account of the Bombyces of Chili I recognized six species of *Dalaca*, five of which Mr. Hampson has since put together under the name of *D. pallens*, Blanch.: breeding alone will decide whether he is right in so doing; at present, judging from the extraordinary variability of many of the Chilian Lepidoptera, it is quite as possible as it is at present unproved.

Noctuæ.

2. *Peridroma saucia*, Hübner.

Peridroma saucia, Hübner, Samml. eur. Schmett., Noct. fig. 378.

The examples are links between typical *P. saucia* and *P. hostilis* and are labelled D, F, H, and C 6 respectively.

3. *Leucania impuncta*, Guenée.

Leucania impuncta, Guenée, Noct. i. p. 83. n. 117 (1852).

Labelled "E, F. Oxyacanthæ."

4. *Leucania unipuncta*, Haworth, var. *separata*, Walker.

Leucania unipuncta, Haworth, var. *separata*, Walker, Lep. Het. xxxii. p. 626 (1865).

Labelled G 3.

5. *Plusia gammoides*, Blanchard.

Plusia gammoides, Blanchard, in Gay's Fauna Chilena, vii. p. 84. n. 1, pl. vi. fig. 11 (1854).

Labelled A.

6. *Plusia chilensis*, Butler.

Plusia chilensis, Butler, Trans. Ent. Soc. 1882, p. 138. n. 43.

Labelled B.

As already noted, the Deltoid Noctuæ are in too poor condition for recognition.

The remainder of the collection consists wholly of Geometræ. I have followed Mr. Warren's recent arrangement of this group.

GEOMETRÆ.

7. *Psilaspilates cavifasciata*, Butler.

Panagra cavifasciata, Butler, Trans. Ent. Soc. 1882, p. 384. n. 65.

Numbered 55.

8. *Psilaspilates ceres*, var., Butler.

Lozogramma ceres, var., Butler, Trans. Ent. Soc. 1882, p. 383. n. 63.

Numbered 66.

9. *Psilaspilates venata*, Butler.

Liodes venata, Butler, Trans. Ent. Soc. 1882, p. 382. n. 62.

Numbered 151.

It will be seen that Mr. Warren has associated together under a new genus of his own three species which I regarded as belonging to different recognized genera; it is possible that, in spite of their different aspect, they may be strictly congeneric; it is also not improbable that the genera to which I assigned them may not differ in essential characters, but at present I cannot spare time to examine into this point critically. As regards *Panagra*, it is certain that Walker associated together several very distinct genera under one name.

10. *Pharmacis mixta*, Butler.

Pharmacis mixta, Butler, Trans. Ent. Soc. 1882, p. 375. n. 52.

Labelled No. 96.

Var. *seriata*, Butler.

Pharmacis mixta, var. *seriata*, Butler, *l. c.*

Labelled Nos. 97–99.

11. *Pharmacis latifasciata*, Butler.

Pharmacis latifasciata, Butler, Trans. Ent. Soc. 1882, p. 377. n. 54.

Labelled No. 77.

12. *Heterophleps ophiusina*, var., Butler.

Heterophleps ophiusina, var., Butler, Trans. Ent. Soc. 1882, p. 423. n. 133.

Nos. 4, 134, and 155.

13. *Neorumia lutea* and *gracilis*, Bartlett-Calvert.

Neorumia lutea and *gracilis*, Bartlett-Calvert, Trans. Ent. Soc. 1893, pp. 216, 217.

N. lutea, typical. Nos. 86 and 87.

N. gracilis. No. 88. This is only a suffused variety of *N. lutea*.

14. *Anisogonia deustata*, var. *carnea*, Butler.

Paragonia deustata, var. *carnea*, Butler, Trans. Ent. Soc. 1882, p. 353.

♂ ♀. Nos. 43, 44, 81, and 113.

Var. *rosea*, Butler.

Paragonia deustata, var. *rosea*, Butler, *l. c.* p. 354.

♂ ♀. Nos. 10, 27, 41, 45, 49, 59, 64.

Var. typ. *deustata*, Felder.

Paragonia deustata, var. typ., Felder, Reise der Nov., Lep. v. pl. cxxiv. fig. 8 (1875).

♂. No. 18.

Var. *cinerea*, Butler.

Paragonia deustata, var. *cinerea*, Butler, *l. c.* p. 354. n. 22.

♂ ♀. Nos. 51, 96, 106.

Since I separated the forms of this species so many new and intermediate types have come to hand that I am forced to the conclusion that the whole are sports of one extremely variable species.

15. *Syncirsodes valdiviana*, Butler.

Apicia valdiviana, Butler, Trans. Ent. Soc. 1882, p. 342. n. 5.

♂ ♀. Nos. 15 and 16.

The female is larger than the male (48 millim.) and the ground-colour above is of a slightly greenish-cream tint; otherwise it resembles the male; the males, however, vary somewhat in the colouring of the upper surface; it is therefore possible that females having the upper surface-colouring of the typical male may occur.

16. *Euangerona valdiviæ*, Butler.

Euangerona valdiviæ, Butler, Trans. Ent. Soc. 1882, p. 359. n. 29.

Seven examples (numbered respectively 82, 83, 84, 91, 105, 108, 155), showing somewhat similar variations to those occurring in *Angerona prunaria*, but duller throughout.

17. *Odontothera virescens*, Butler.

Odontothera virescens, Butler, Trans. Ent. Soc. 1882, p. 409. n. 105.

No. 112.

18. *Odontothera debilis*, Butler.

Odontothera debilis, Butler, Trans. Ent. Soc. 1882, p. 410. n. 106.

♂. No. 95. The primaries greener and the secondaries greyer than the type of the female.

19. *Digonis aspersa*, Butler.

Digonis aspersa, Butler, Trans. Ent. Soc. 1882, p. 361. n. 31.

No. 13.

20. *Microclysia Philippii*, Bartlett-Calvert.

Microclysia Philippii, Bartlett-Calvert, Trans. Ent. Soc. 1893, p. 200.

No. 75.

21. *Mœandrogonaria* (Warren) *valentina*, sp. n.

Primaries with the basal third ferruginous; a short white oblique line immediately followed by a quadrate spot on the costa; central area bounded and crossed by three oblique dark lines, angulated towards costa, equidistant on inner margin;

the two inner ones rufous brown, enclosing a white belt striated with ferruginous, and divided by rufous-brown veins; the third line slaty grey; the interval between the second and third lines also white, similarly interrupted to the belt already mentioned, but interrupted below the subcostal vein by a patch of greyish coffee-brown; the costal extremities of all three lines commencing in oblique quadrate ferruginous spots, separated by similarly shaped white spots, one of which also follows the third line; external third coffee-reddish, slightly suffused with greyish and sericeous; an almost triangular patch of white, striated with fine lines of the ground-colour, tapering from costa; fringe interrupted by lunate white spots: secondaries sericeous white, traversed from about the middle of abdominal margin by two subparallel well separated grey lines, which become indistinct and are angulated towards costa; the inner line less defined than the outer; abdominal and external areas suffused with rosy coffee-brown, darkest at anal angle; fringe rufous brown, interrupted by white lunules: body ferruginous, the abdomen sericeous and paler than the thorax. Wings below paler than above, with the markings more sharply defined; the apical patch and costa of the primaries ochreous; the basal area whitish; the secondaries almost like the primaries in character, sparsely striated with ferruginous: the frons and palpi deep ferruginous; the body whitish, densely irrorated with ferruginous at the sides; the legs white, clouded with ferruginous externally and regularly spotted with dark rufous brown. Expanse of wings 35 millim.

No. 140.

The form of this species corresponds with that of my *Azelina corticalis*, but the pattern and colouring are unique.

22. *Perusia precisaria*, Herrich-Schäffer.

Perusia precisaria, Herrich-Schäffer, Auss. Schmett. fig. 415.

♂ ♀. Nos. 1 and 2.

23. *Casbia lapidea*, Butler.

Tephrina lapidea, Butler, Trans. Ent. Soc. 1882, p. 378. n. 56.

No. 3. I think this insect would have been better left in *Tephrina* than in *Casbia*; but it is more convenient for purposes of reference to follow Warren's arrangement.

24. *Scordylia vittata*, Philippi.

Euclidia vittata, Philippi, Linnæa Entom. xiv. p. 295. n. 32 (1860).

No. 133. I cannot follow Warren in calling this genus

Heterusia until it has been decided, first, that *Devanica*, Moore, shall supersede *Eterusia* (*sic*) of Hope; and, second, that the species of *Scordylia* are congeneric with the very dissimilar species figured by Hübner as the type of his genus. Mr. Warren appears to have followed Felder in adopting *Heterusia*, Hübner, for the species of *Scordylia*.

25. *Eucosmia exacta*, Butler.

Scotosia exacta, Butler, Trans. Ent. Soc. 1882, p. 415. n. 114.

No. 8.

26. *Anchiphyllia* (Warren) *olivacea*, Butler.

Sarracena olivacea, Butler, Trans. Ent. Soc. 1882, p. 421. n. 129.

No. 30. Warren associates under one name *S. olivacea*, *pellicata*, and *declinata*, ignoring marked differences in form of wing and pattern. Of course this is a purely arbitrary decision, not supported by a particle of evidence. Although it is possible that the three types may eventually prove to be seasonal forms or alternating generations of a single species, it is, to say the least, not usual for three types of wing-outline combined with three types of wing-banding to occur in one species; therefore, until their identity has been proved or disproved by breeding, I shall not bow to Mr. Warren's decision.

27. *Phyllia triangularia*, Blanchard.

Phyllia triangularia, Blanchard, in Gay's Fauna Chilena, vii. p. 89. n. 1, pl. vii. fig. 5 (1852–54).

Nos. 9, 23, and 116. Varying slightly in tint; my *P. cinerescens* is probably a well-defined variety of the same.

28. *Chlorotimandra viridis*, Butler.

Chlorotimandra viridis, Butler, Trans. Ent. Soc. 1882, p. 369. n. 45.

♂ ♀. Nos. 57 and 62.

29. *Rhopalodes virescens*, Philippi.

Tomopteryx virescens, Philippi, Stett. ent. Zeit. xxxiv. p. 315. n. 3, pl. ii. fig. 7 (1873).

♂. No. 78.

Warren placed this under two genera, believing probably that I had wrongly identified Philippi's species; now that we have the male, it is perfectly evident that my identification was correct.

30. *Tomopteryx læta*, Philippi.

Tomopteryx læta, Philippi, Stett. ent. Zeit. xxxiv. p. 314. n. 2, pl. ii. fig. 6 *a* (1873).

♀. No. 36.

The female is larger than the male and has the well-developed secondaries of all females of the family.

31. *Tomopteryx esmeralda*?, Bartlett-Calvert.

? *Rhopalodes esmeralda*, Bartlett-Calvert, Trans. Ent. Soc. 1893, p. 218.

No. 31.

I have not been able to find any specimen in the collection answering to the description and believe it cannot have been forwarded with Mr. Bartlett-Calvert's other species; the specimens before me are not in good condition, but probably represent the species, the only additional character being a small triangular white spot at the end of the cell of primaries with a dusky spot below it.

32. *Tomopteryx botulata*, Felder.

Tomopteryx botulata, Felder, Reise der Nov., Lep. v. pl. cxxxi. fig. 18.

No. 46. Should be the type of a different genus.

33. *Hoplosauris heliconoides*, Butler.

Hoplosauris heliconoides, Butler, Trans. Ent. Soc. 1882, p. 399. n. 87.

No. 118.

34. *Hoplosauris valeria*, sp. n.

♂. Primaries above greyish brown, traversed by numerous irregular darker lines; an irregular trifid pyramidal black spot, its base resting upon the inner margin near the base, its outer edge bordered with white; just beyond this two ill-defined blackish, angulated, parallel, sinuous stripes; central belt white internally, its outline represented by subconfluent black spots, the inner edge subangulated and sinuous, the outer edge running obliquely from costa to upper radial, where it is acutely angulated, from which point to inner margin it is regularly, deeply, but unequally bisinuated to inner margin; it is also bounded externally by a narrow whitish band intersected by a brown line; a sinuous white submarginal stripe, internally bounded and partly interrupted in the centre by four black spots, of which the first two are fusiform and larger than the others; a marginal series of numerous black dots: secondaries sericeous white, slightly brownish at apex. Body above grey-brown, the thorax dark;

below altogether paler than above; the markings almost obliterated. Expanse of wings 32 millim.

No. 53.

35. *Hoplosauris? edelmira*, sp. n.

♂. Bronzy greyish brown; primaries crossed by numerous irregular black lines; the central region darker from about the seventh to the tenth line, indicating a central belt, the outer edge of which commences in an irregular ≷-shaped character, and is thence regularly undulated to inner margin; a small transverse elliptical white spot at end of cell; a regularly dentate-sinuate submarginal whitish line, immediately beyond which towards apex are two or three partly confluent black spots; a marginal series of numerous black dots: secondaries and under surface sericeous whitish; the primaries browner in certain lights and showing traces of the markings of the upper surface. Expanse of wings 40 millim.

Nos. 145 and 152.

36. *Epirrhoë Edmondsii*, Butler.

Fidonia Edmondsii, Butler, Trans. Ent. Soc. 1882, p. 385. n. 68.

No. 38.

37. *Epirrhoë decipiens*, Butler.

Coremia decipiens, Butler, Trans. Ent. Soc. 1882, p. 412. n. 109.

No. 22.

38. *Cidaria ceres*, Butler.

♀. *Cidaria ceres*, Butler, Trans. Ent. Soc. 1882, p. 417. n. 119.

2 ♂. Nos. 29 and 29 *x*.

The male differs from the female in its inferior size, the primaries either greenish or reddish towards outer margin, and with a submarginal band dentated or zigzag externally, either red-brown or slaty grey, and sometimes separated into contiguous spots.

39. *Cidaria corticalis*, Butler.

Anticlea corticalis, Butler, Trans. Ent. Soc. 1882, p. 411. n. 108.

No. 136.

I can hardly think this species rightly placed in *Cidaria*; it bears no resemblance to any other species referred to that genus by Mr. Warren.

40. *Cidaria misera*, Butler.

Cidaria misera, Butler, Trans. Ent. Soc. 1882, p. 415. n. 117.

No. 154.

41. *Cidaria adela*, sp. n.

Sericeous greyish brown; the general aspect of *C. squalida* of New Zealand, but the primaries more acuminate at apex, the secondaries with irregularly dentated outer margin; the central belt of the primaries having more nearly the outline of *C. capitata* of Europe, but black-edged, crossed by black lines, and enclosing a black discocellular dot followed by a whitish nebula; beyond this belt one or two ill-defined crinkled transverse lines, followed by a series of black or blackish spots, bounded by submarginal white lunules; nervures on external area pale sandy brownish, interrupting an externally white-edged black undulated marginal line; fringe black-brown at base, white, tipped and spotted with blackish brown, externally: secondaries paler than primaries excepting towards outer margin; the external area being bounded internally by two or three scarcely discernible parallel lines slightly darker than the ground-colour; on the abdominal margin these lines terminate as blackish lunules; a short white dash at anal angle, being the last of a series of badly defined submarginal spots; marginal line and fringe as in primaries. Wings below with black oblique discocellular dashes or spots, one in each wing; an angulated zigzag blackish discal line and a whitish badly defined zigzag submarginal line; marginal line and fringe almost as above; costal area of primaries and whole of secondaries irrorated with whitish; tibiæ and tarsi dark grey-brown, banded with whitish. Expanse of wings 37 millim.

Nos. 69 and 147.

42. *Euphia hymenata*, var., Felder.

Cidaria hymenata, var., Felder, Reise der Nov., Lep. v. pl. cxxxii. fig. 41, ♀.

♂ ♀. Nos. 141 and 143.

The female in the present series is paler than in Felder's figure, the primaries being stramineous instead of deep ochreous. The male has shining pale copper-brown primaries varied with pale ochreous on basal area and just beyond the cell; the upper portion of the central belt is also of this colour; the latter is represented by two slightly divergent nearly straight grey stripes, the outer one of which is interrupted just beyond the cell by a white 7-shaped character; the secondaries are sericeous, cream-coloured, acuminate at apex; the neuration is peculiar, the internal vein absent, the three median branches placed near the abdominal margin, and the lower discocellular veinlet absent; the subcostal branches spring from the end of the cell, not from a footstalk, as in the female.

I have followed Warren in calling this a species of *Euphia*, though the character of the male points rather to a relationship to *Remodes* and allied genera.

43. *Spargania pastoralis*, Butler.

Ypsipetes pastoralis, Butler, Trans. Ent. Soc. 1882, p. 408. n. 104.

No. 20.

44. *Spargania bellissima*, sp. n.

Sericeous; primaries pale argillaceous brown; an irregular black-brown basal band, bounded externally by a zigzag white line; central belt irregular, white, shaded with buff in the centre and at inner margin enclosing three large irregular black-brown patches, two costal and one crossing the median branches, also two small black markings on inner margin, connected with the latter on each side by a slender line; the central belt is of nearly equal width from the inner margin to the lower radial vein (vein 5), but from thence rapidly widens to costa, where it is of double the width; a large apical blackish patch, divided by an irregularly zigzag submarginal line; the latter interrupted below the black patch by an oblique patch of white and bounded internally by a broad diffused band of smoky brown; fringe pale argillaceous at base, white externally, traversed by a central grey line and regularly spotted with black: secondaries silvery grey, darkest at outer margin; a black dot at the end of the cell; fringe paler than on primaries, with smaller black spots: head and collar buff, varied with black; thorax whitish; abdomen buff, with blackish subdorsal dots in pairs. Under surface silvery greyish; primaries with faint indications of the upper surface markings: secondaries, when examined with a lens, white, speckled with grey, crossed beyond the middle by an arched dentate-sinuate blackish line, followed by an ill-defined grey band; a black dot at the end of the cell: body below brownish; palpi black, banded with white. Expanse of wings 27 millim.

No. 132.

I was not able to adopt one of Herr Ruschewegh's names for this very charming little moth.

45. *Psaliodes signata*, Butler.

Psaliodes signata, Butler, Trans. Ent. Soc. 1882, p. 418. n. 122.

No. 124.

46. *Psaliodes diana*, Butler.

Cidaria diana, Butler, Trans. Ent. Soc. 1882, p. 416. n. 118.

Nos. 32 and 472.

Var. *cynthia*, Butler.

Cidaria diana, var. *cynthia*, Butler, *l. c.*

No. 37.

47. *Eupithecia corralensis*, Butler.

Helastia corralensis, Butler, Trans. Ent. Soc. 1882, p. 406. n. 100.

♀. Unnumbered.

The female is considerably larger than the male, but quite like it in colouring and pattern.

BIBLIOGRAPHICAL NOTICE.

Elementary Palæontology for Geological Students. By HENRY WOODS, B.A., F.G.S. 8vo. 222 pages, with numerous cuts. University Press, Cambridge, 1893.

THE study of palæontology of course requires a knowledge of existing forms, as these are the outcome of the older creatures and have close relationship as well with them as one with another. The relics of extinct organisms, though distinct enough, as material consisting usually of silica or carbonate of lime, rarely correspond to all parts found in recent forms, and therefore, though supplying little enough to a Zoologist, are all that can be made useful by a Geologist, knowing their value as zoological indications, and competent to recognize the history of their embedment in deposits, the mineral changes they may have undergone, and any altered positions of the strata that contain them.

This little guide-book (one of the "Cambridge Natural-Science Manuals") confines itself to a succinct account of those fossil Invertebrata which are of most use to the Geologist; and the student is expected to have the opportunity of consulting a collection of fossils.

In the Introduction some short remarks are offered on the conditions and methods of fossilization of the hard parts of plants and animals; also on the "geological record" and the use of fossils to the Geologist.

1. Of the *Protozoa*, the *Rhizopoda* are here mainly represented by the *Foraminifera*. As with the other groups, a short account of the general structure and features precedes that of the subgroups. A careful note on *Eozoön* is given at page 21, and the *Radiolaria* are also referred to.

2. Of the *Porifera*, the notes on the several orders and their distribution are concise and clear.

3. Of the *Cœlenterata*, the *Hydrozoa* are interesting as comprising the Graptolites, and, with the *Actinozoa*, are treated, both as to structure and distribution, as fully as limits permit.

4. The *Echinodermata*, including Asteroids, Ophiuroids, Echinoids, Crinoids, Cystids, and Blastoids, have their structure, relationships, and distribution represented to the student in succinct but useful notes, such as he would gladly have in his notebook when studying the indicated fossils.

5. Of the *Vermes* very few fossil representatives are here noted. The annelidan jaws found in palæozoic (and mesozoic) strata are alluded to.

6. The *Polyzoa* and *Brachiopoda* of the *Molluscoidea* receive their proportionate share of attention.

7. The *Mollusca* (Lamellibranchs, Gasteropods, Scaphopods, and Cephalopods) have necessarily most attention, being the most numerous and commonly useful kinds of fossils. The bathymetrical distribution of the recent groups and the distribution in time of the fossil forms are indicated with some precision; but space did not admit of the modern divisions and subdivisions of the Ammonoid and other Cephalopods.

8. The very extensive subkingdom of the *Arthropoda* or *Articulata*, though evidently appreciated, are provided with very limited accommodation in this little book. The *Trilobita* (one of the "groups of doubtful position") are more fully enumerated than the others, of which few genera are taken as types for the student.

"A list of some important palæontological works" is given as an appendix, a few "general," and others special for each group of Invertebrata, but necessarily, though numerous, far from all that a real student would have to use. The Index of group-names and genera will be found useful as far as it goes.

In the text are fifty-six illustrations, especially of the structure of the organisms, showing the names of parts concerned; but very few generic forms are figured, the learner being supposed to have recourse to a collection of the fossils themselves.

We object to the propagandism of the vicious style of nomenclature here affected—for instance, one of the oldest and best-known specific names given by Linné is printed here as *Rotalia "beccari,"* instead of the authorized *Beccarii*; the latter being the genitive of the only Latinized form that Dr. Giacomo Bartolomeo BECCARI's name could take. On the same page the unwarranted liberty is taken of docking another such word; and elsewhere the Greek origin of *Saccammina* is falsified in "Saccamina."

Doubtless this is a well-devised handbook, and, though limited by conciseness of method, both in choice of typical fossils and in treatment, it will be useful to students as a suggestive and trustworthy guide in palæontology, especially as to the most probable subjects to be taken up in examinations.

MISCELLANEOUS.

Cucumaria Montagui (*Fleming*) *and its Synonymy*. By the Rev. Canon A. M. Norman, M.A., D.C.L., F.R.S., &c.

Cucumaria Montagui (Fleming).

1808. *Holothuria pentactes*, var., Montagu, Linn. Trans. vol. ix. p. 112, pl. vii. fig. 4.
1823. *Holothuria Montagui*, Fleming, Hist. Brit. Anim. p. 483.
1882. *Cucumaria Lefevrii*, Th. Barrois, Cat. des Crust. Podoph. et Echin. à Concarneau, p. 52, pl. ii. figs. 1–8.
1889. *Semperia Drummondii*, Hérouard, Rec. sur les Holothuries des côtes de France, p. 683, pl. xxxi. D. figs. 1–10, figuræ bonæ (nec *Holothuria Drummondii*, Thompson).

Colour whitish, or often deep purple above and whitish below; tentacles always deep purple. Length of my largest specimen (A) is a little over $2\frac{1}{2}$ inches, but the body is in an extreme state of contraction, and when alive probably the animal would have been 4 to 5 inches. Specimen B is also $2\frac{1}{2}$ inches long, but scarcely one fourth the circumference of the last, being fully expanded in length. I now proceed to give an account of spicula of these and of a young specimen.

Specimen A.—Body-spicule ovate, with indented margin, having four foramina, one foramen (oval) on each side and one (round) at each end of a central bar; a surface-nodule at each end of the bar itself, and ten (rarely twelve) nodules on the margin of the spicule. Upper small body-spicule campanulate; height of bell greater than or subequal to the breadth, upper portion of bell formed of four ribs which arch down from the extremities of a very short central bar; near the mouth of the bell the ribs divide into two branches, which, inclining right and left, unite with the branches coming from their neighbours, and, just prior to their union, each branch throws out downwards a little nodulous spur, so that the bell rests, as it were, on eight little legs. This is the description of the type; but slight irregularities of growth often present themselves.

Pedicels of feet surrounded with flattened strap-shaped spicules, generally arcuate, sometimes slightly dilated in breadth in the middle, or at this part throwing out a lobe; the spicule is perforated with a few foramina, which, except in the case where the spicule is dilated centrally, are usually arranged in single file. Terminal plate not observed in this specimen.

Tentacle-spicules: the larger very like in general character to those of the pedicels, but often a little expanded at the extremities and bearing in that part three or more foramina; other spicules are cribriform, often elongate, more generally very irregular in form; the smallest of these, which clothe the extremities of the ramifications of the tentacle, are very delicate in their structure.

Specimen B.—Body-spicule like that of A, but only a spicule here and there showing any nodulous growth, the vast majority presenting a perfectly smooth surface; nor are they so universally confined to the number of four foramina, the spicules often having an additional foramen at each end (*i. e.* four in a direct central longitudinal line); among them were also very many in an early stage of growth, spectacle-formed, two foramina being united by the central bar. No bell-shaped spicules have been found in this specimen, though they have been thoroughly sought for. Pedicels with lateral spicules, some just as in A, but here more generally with about three small foramina at each end; termination of pedicel with an arborescent delicate cribriform plate in the centre, and at the edges several much stouter cribriform plates of irregular outline (it is possible that these disunited plates ultimately coalesce into one cap). Tentacle-spicules as in A.

Specimen C.—Young, only 14 millim. long. Body-spicule exactly as in B, but here I could not find a single one that was nodulous, and no bell-shaped spicules. Pedicel-spicules as in B. Tentacle-spicules: the smaller of these, having to clothe very minute terminating branches of the tentacle, are much smaller than in A, and the ramifications greatly reduced in size, so that under a usual power of microscope for examination they look like little round or nodulous bodies, and it requires the use of a considerable power ($\frac{2}{3}$ inch and high eyepiece) to reveal their structure.

Specimen A corresponds very closely with Hérouard's figures of the spicules of his "*Semperia Drummondii*," the only slight difference being that the spicules he draws have attained a yet higher degree of calcification, especially shown in figs. 3 and 7, where the foramina are much more contracted in size than in my specimens.

Specimen B corresponds closely with Th. Barrois's figures of his *Cucumaria Lefevrii*, with this curious exception—in his figs. 4 and 5 additional foramina are shown which are built on to the side, so that the number of *lateral* foramina is increased. In mine a large number of spicules are enlarged beyond the usual four openings, but it is in almost every case in the central line, one *at each end*, and no tendency whatever is shown to increase laterally.

My specimens were procured for me in 1865 at Polperro by the old naturalist there, Laughrin, and I also have a mounting of spicules from Belfast corresponding exactly with A.

It is possible that *C. Lacazei*, Hérouard, is also a synonym of *C. Montagui*; but this could only be the case by supposing that the author has mistaken the position of some of the spicules, and that 4, 12, and 13 belong to the summit of the pedicel, as 6 and 7 do to its sides, and 14 to the centre of the termination.

The specimens B and C, in which I have failed to find the upper dermal bell-shaped spicules, were obtained at the same time and preserved in the same way, in spirits only, as A. I have often failed to find the small upper spicules of other Cucumarians where they ought to have been. How does this happen? Is it that these are the last developed spicules and only occur in adult individuals?

Cucumaria Koellikeri, Semper.

Semper's work is not in my library; Ludvig's reference to it is 'Reise im Arch. der Philippinen-Holothurien,' pp. 237, 271, pl. xxxix. fig. 17. I have, however, many specimens of this species received at different times from the Zoological Station at Naples. The examination of the calcareous deposits in two specimens gives the following results:—

Body-spicule with 3, 4, and up to 8 foramina, but by far the largest number with 4, the others being exceptional. The four-holed spicule differs, however, from that of *C. Montagui* (specimens A, B, C) in being shorter in proportion to the length. Moreover, these spicules are not only highly nodulous, but the nodules at their summits split, as it were, into little riblets, which riblets ultimately become minutely spinous. This is a peculiarity which I do not remember to have observed in any other spicule of this genus. In the second specimen the body-spicule agrees in character with the last, but those with many foramina are much more numerous, 8 being here very common, and ranging thence up to 18; there is the same tendency of the nodules to break out into spine-points, but less commonly and markedly than in the first specimen.

Upper Body-spicules.—In the first I perhaps see two or three, but am unable to make them out satisfactorily; in the second I cannot find any.

Pedicel-spicules.—The lateral spicules in character like to those of British *C. Montagui*, but more generally dilated centrally and in that part with the foramina in double line. The spicula of the summit also and those of the tentacles do not exhibit any marked divergence from those of *C. Montagui*, but the larger of the last more generally with a double row of foramina, at least in their central portion.

I think it is evident that these Naples specimens have been killed with acid, as in the first-mentioned not a single spicule is to be seen in the tentacles, and in the others only the larger forms. This may account for the absence of the second form of body-spicules.

Observations.

It is most likely that when Dr. Marenzeller speaks of *C. Montagui* as a distinct British species he does so on the authority of specimens which I sent to the Vienna Museum in 1886 as "*Cucumaria Montagui*, Fleming, Polperro." The specimens sent were taken from the same bottle as those here described, but were probably smaller than A and B (which are the largest I have) but larger than C.

Now the curious circumstance is that *C. Montagui* seems unquestionably synonymous with *C. Lefevrii*, Th. Barrois, and *Semperia Drummondii*, Hérouard; Marenzeller assigns these names as synonyms of *C. Koellikeri*, while he keeps *C. Montagui* as a distinct species from *C. Koellikeri*, and refers to *Colochirus Lacazei*, Hérouard, as a synonym. This last I cannot thus recognize as a synonym of *C. Montagui* unless I am allowed to suppose that Hérouard has mistaken the position of some of the spicules which he figures; moreover, figs. 8 and 18 would be wanting in accuracy, but fig. 11 accurately represents the form and mode of growth of the very minute spicules which I have mentioned as investing the extremities of the tentacles of the specimen C of *C. Montagui*.

An interesting point has come out in this investigation. It is a circumstance quite new to me that in two specimens of the same species the mode of growth in a spicule should proceed on two entirely different plans. In *C. Montagui* (B) I have described the two additional foramina made to the original four-holed spicule as almost always being added to the extremities of the spicule; while in *C. Lefevrii*, Th. Barrois (presumably the same species), the drawings show the additional foramina as being added on laterally. In the Naples *C. Koelliker*i the additions to the original spicule appear always to take place laterally (that is, out of the central line), even if added at the extremities it is at the side of the extremity and not apically. In this respect there is agreement with *C. Lefevrii*.

Thyone Portlockii, Forbes.

I believe this species to be another synonym of *C. Montagui*, for the following reasons:—In 1864 or 1865 I wrote to Belfast, probably—but my memory fails me—to Professor Wyville Thomson, to endeavour to clear up the question what *Holothuria Drummondii*, Thompson, and *Thyone Portlockii*, Forbes, were. As well as I recollect, I learnt that the former was not to be found in the Belfast Museum; but a piece of the skin of the latter was sent to me. Among my collection of Holothuroidean spicules at the present moment is a mounting thus labelled: "*Cucumaria Montagui*, Fleming, Belfast Museum." Unfortunately there is no further information; but I suspect that a re-examination of the specimen referred to will prove that my recollection is right. At any rate the mounting referred to agrees absolutely with the specimen here described from Polperro as *C. Montagui* (A).

On the Salivary Apparatus of Birds. By Dr. A.-H. PILLIET.

The system of salivary glands appears to be somewhat slightly developed in birds, and there scarcely exist any comprehensive memoirs upon the subject.

This is due to the difficulty of isolating very small groups of glands buried beneath corneous membranes, of which the dry and apparently unlubricated surface negatives the very idea of a salivary secretion. Milne-Edwards barely devotes a few lines to the matter; these excretory organs, he states, have but little importance, and are only very imperfectly known. The fact is that Duvernoy, Meckel, Müller, Sebold, Stannius, Chauveau, and Wiedersheim have only described glands large enough to be isolated by the scalpel—such as the sub-lingual gland of the goose, the palatine glands of the ostrich; the groups of glands of the woodpecker, the parrots, and the climbers; and even the descriptions of these authors convey the impression of isolated and not coordinated facts. Prof. Ranvier in his course of lectures for 1883 * returned to the study of these glands, and gave a general description of them, while insisting that the classifications of the old anatomists were fallacious as a natural consequence of their method. As as matter of fact, by analogy with higher animals, parotid, sub-lingual, and submaxillary glands were described in the comparative anatomy of birds. Now, the morphological type represented by the bird, which is very far removed from that of mammals, on the contrary greatly resembles that of the Saurians and Chelonians: and it is with the members of the latter groups, in which the glands of the mouth and pharynx locate themselves where they can, and are spread out and hidden beneath a more or less rigid mucous membrane, that the bird must be compared.

We have studied the salivary glands of birds with respect both to their situation and their structure. The method of examination was as follows: the head was fixed by means of a preservative fluid, decalcified with picric acid supplemented with formic acid, hardened, and cut into slices. These successive manipulations are not without detriment to the study of the cellular substance, but they are of great service in enabling us to make out the situation of the groups of glands; and sections made from strips of excised mucous membrane have rendered it possible for us to give precision to the typographical information afforded by the broad slices.

I. ARRANGEMENT OF THE GLANDS.—a. *The upper jaw.*—In the duck the glands form very abundant groups in the upper jaw, especially at its centre. They do not exist at the base, and the

* L. Ranvier, Journal de Micrographie, 1884, p. 146.

groups cease towards the tip of the beak, where they are replaced by Herbst's corpuscles; the latter are so numerous that, in certain preparations, they are seen to entirely fill the cavities of the spongy bone which forms the skeleton of the beak. In the crow no glands are seen in the median third of the beak; the fowl, on the other hand, shows well the two palatine groups of glands, which are in contact the one with the other in the median line.

b. *The lower jaw and tongue.*—The study of the glands of the tongue is inseparable from that of the lower jaw. The organs are those which, in the species in which they are found, have been described under the name of sublingual and submaxillary glands. In the just-hatched chick frontal sections affecting the base of the tongue show two groups of glands of considerable size and another smaller one. The most important group opens by a series of orifices into the furrow which separates the tongue from the jaw. This group is composed of glandular lobes which are developed, not beneath the tongue, but in the floor of the mouth, beneath the mucous membrane which covers the mandible, and which almost come into contact with the bone. The second group of smaller size occupies the two corners of the tongue, which, in frontal sections, naturally presents the appearance of a triangle, with its base uppermost and the apex beneath serving for the insertion of the organ. In the two free corners of the tongue are found the groups of glands which penetrate into the interior, as far as the three bones, as yet in a cartilaginous condition, which form the skeleton of the organ.

The third group is situated in the actual thickness of the beak, at the level of its free edge and internally to the inner margin of the upper jaw ("en dedans du bord interne du maxillaire supérieur"); it is composed of somewhat small lobes, which open opposite the edges of the tongue, and consequently correspond to the glands of the second group.

In the tongue of the adult duck, the two islets which form our second group are greatly developed at the base, at the level of the fatty-fibrous cushion which reduplicates the mucous membrane; as has been shown by M. Ranvier, they are non-existent at the tip.

c. *The pharynx and œsophagus.*—In the chick some considerable time before it is hatched we find in the pharynx only very voluminous and greatly swollen epithelial buds, comparable to the buds of feathers, but penetrating inwards instead of projecting from the surface. They form two groups—the one anterior, which occupies the pharyngeal side of the laryngo-œsophageal septum, and the other posterior, composed of two lateral masses which come into contact in the median line. The house-sparrow furnishes us with the complete development of this simple condition, for in this species we may count as many as six distinct groups of glands—two median and four lateral ones.

The anterior median group is situated between the œsophagus and the larynx; it is quadrate in shape, and extends in breadth from one mucous membrane to the other, so that, although we have not, however, succeeded in observing glandular orifices in the larynx, we may believe that it is common to the two mucous membranes with respect to which it is intermediate. The posterior median group is likewise quadrilateral in sections. The two lateral groups on each side are quite unequal as regards both volume and shape. The larger one occupies the pharyngeal commissure, and is therefore distinctly lateral in position; it is composed of well-developed and very bulky lobes. The second lateral group is situated between this and the posterior [median] group; it is composed of flattened lobes and forms an extended sheet, which, in certain specimens, may join the posterior group.

Of these glands, the lateral groups of the commissures are much the more important and descend into the œsophagus, where they form two wonderfully well-developed masses—especially in the duck, in which they continue as far as the glands of the crop, which are recognizable by the special characters described by Prof. Renaut.

From this anatomical study it may be gathered that the salivary apparatus of birds is but seldom arranged in the form of bulky glands, but that it exists none the less and is very well developed, forming sheets beneath the mucous membrane, which are sometimes confluent. Since adipose tissue is altogether rare in the heads of birds, the anatomical character of these glands can be seen to perfection. They locate themselves where they can, between mucous membrane, bone, and muscle. This explains their apparent absence and their neglect by anatomists. Although this is apart from our subject, we might note here the presence of limited groups of glands in the nasal fossæ of the fowl.

II. Structure of the Glands.—As we have already stated, the glands are composite tubular organs. They arise first as a swollen bud which becomes hollowed out, and, instead of producing agminated swellings at its periphery, as in the case of the salivary glands of mammals, transforms itself into a sac, which bristles with papillary protuberances; hence we get three stages in these glands, stages which can be easily followed in the same animal, for we always find very small lobules side by side with others of full size (a condition which is likewise not met with in mammals). In its first stage the gland is utricular, scarcely composed of protuberances; it is, on a small scale, the *reticulum* of the stomach of the ox. In a more advanced stage these protuberances have risen; they have contracted the lumen of the glandular cavity and are charged with secreting cells, the result of which is that each protuberance or papillary compartment encloses a short tubular gland. Finally a third stage shows these glands individualized and uniting in a common excretory duct with a differentiated epithelium. The development of these villous and very vascular structures perhaps explains the fact, mentioned by M. Ranvier, that the lobes which are thus formed, and which attain the size of the head of a small pin, are not found to be each enveloped in a distinct basal membrane.

In a very partial degree there may be found in man glandular structures which are comparable to these, with extra-glandular papillary protuberances; we may mention the glands of the cervix uteri (Cornil) and those of the prostate (Regnauld).

The cells vary according to the glands. We have stated that the existence of serous glands was demonstrated by M. Ranvier. As a general rule, the smallest glandules, those which are utricular, are clothed with very narrow and greatly elongated caliciform cells, comparable to the elements of the cutaneous mucous glands of the frog. The glands of large size, which are situated at the base of the tongue and in the pharyngeal commissure, present a very granular appearance after being treated with hæmatoxylin; some are even opaque and fatty after being mounted in glycerine. We have shown in another paper * that it was possible to prove the mingling of aqueous and fatty secretions in the cutaneous glands of birds. It is therefore not surprising that we should meet with this fact again in a dermo-mucous gland.

But this analogy with the sebaceous glands ceases if we consider the excretory ducts. These are, as a matter of fact, clothed with a cubic epithelium, which continues through the layers of the epithelium of the mucous membrane, which are always very thick. The cells composing this epithelial lining are longitudinally striated, as in mammals, but their cytoplasm is much more opaque. The ducts are very wide and not infrequently exhibit papillary protuberances. They finally open with bell-shaped mouths at the bottom of the folds of the mucous membrane. The contents of the ducts are chiefly composed of desquamated cells, forming granular masses which fix the reagents and have not the characters of a mucous secretion, although the cells with which the glandular villi are loaded are almost all ovoid and caliciform.

The salivary glands of birds have therefore a special form, and their cells appear to be charged with very complex functions, since they secrete mucus, ferments, and fatty bodies.

Summary of results.—1. Salivary glands are abundant in birds, although concealed beneath the mucous membrane.

2. We must cease to class them according to the characters of the salivary glands of mammals, and on the contrary compare them with the glands of the lower vertebrates, as has already been stated to be necessary by Wiedersheim and M. Ranvier.

3. The type of the salivary glands is entirely similar to the general type of glands in birds, which is very peculiar, of which the structure, like the morphology, enables us to compare it with that of reptiles, while removing it from that of mammals. Herein we have a confirmation from the standpoint of general anatomy of the resemblances long since established by zoologists between birds and reptiles.—*Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, 9e sér. t. v. no. 12, March 31, 1893, pp. 349–352.

* A. Pilliet, "Note sur la glande sébacée des oiseaux et sur le type glandulaire dans cette classe de Vertébrés," Société Zoologique de Fránce, June 11, 1889.

On the Development of the Branchial Pouches and Aortic Arches in Marine Turtles, from Investigations upon Embryos of Chelonia viridis. By Dr. J. F. van Bemmelen, of Batavia.

1. The earliest rudiments of the branchial pouches and aortic arches in turtles entirely agree with those found in lizards and snakes; their subsequent development, however, pursues a different course, and is more in accordance with the conditions observed in birds than with those exhibited in the case of the other reptiles.

2. As in the last-mentioned animals, the rudiments of five branchial pouches and six aortic arches are primitively formed. Besides these, on the posterior wall of the hindermost branchial pouches, where the branchial section of the gut narrows to form the pharyngeal portion, an additional pair of pouch-shaped evaginations are developed, just as the same process takes place in snakes. They lie to the right and left in the region in question, where in lizards there arises on one side only, namely on the left, an epithelial evagination, which becomes constricted off in the form of a vesicle previously termed by me the "supra-pericardial body" ("Supra-pericardialkörperchen"), since I regard it as homologous with the derivatives of the branchial gut in the Selachians, upon which I bestowed the same designation.

3. The three foremost branchial pouches are undoubtedly open during a short time. Whether this is also the case with regard to the two hindermost ones I cannot definitely say, but it appears to me to be probable with respect to the fourth branchial pouch.

4. As in the Amniota, the *tuba Eustachii* arises from the dorsal portion of the first branchial pouch: its external aperture soon closes again, while the tympanic cavity does not develop until much later.

5. The second branchial pouch lies close behind the first; the portion of the branchial gut separating the one from the other possesses a wider lumen than the section following further towards the rear. The dorsal apex of the second branchial pouch expands into a follicle-shaped epithelial bud: this, however, does not become constricted off, as in the case of the lizards, where it forms the first (foremost) lobe of the thymus. Neither does the second branchial cleft become entirely constricted off from the branchial gut, to remain as an epithelial vesicle lying in the midst of the connective tissue of the neck, as in the case of the snakes. In the subsequent development of the embryo the second branchial pouch simply becomes aborted, as in the birds.

6. The cleft-shaped external apertures of the foremost branchial pouches undergo, as in the case of birds, a considerable backward movement. This shifting of position is occasioned by the backward outgrowth of the branchial arches, which consequently commence to cover one another in imbricated fashion. The second branchial cleft in particular undergoes so much backward displacement that the corresponding branchial pouch becomes greatly elongated in the

form of a tube. This tube persists until the later stages of development, and grows in length with the whole cervical region without increasing in circumference, so that it finally constitutes a long, thin, caudally directed, cervical, fistulous canal. In young developmental stages of snakes and lizards we certainly meet with a similar canal in a rudimentary condition; in these forms, however, it undergoes no further development, but disappears much earlier.

7. The third branchial pouch swells out into an epithelial follicle, with many secondary evaginations. This becomes constricted off from the branchial gut, and the evaginations transform themselves into thymus-tissue, in the interior of which, however, the central epithelial follicle persists. The latter may be regarded as the homologue of the carotid body in the lizards.

8. The fourth and fifth branchial pouches develop jointly with the above-mentioned supra-pericardial evaginations from a lateral cæcum-shaped fold at the posterior end of the branchial gut (*recessus præcervicalis*), similarly to what is found to be the case in snakes. They soon become entirely constricted off from the branchial gut, and in this manner form a complex of three epithelial vesicles in connexion one with the other. Now, if their further development also takes place on the same lines as in the snakes, the two foremost of these vesicles, which represent the remnants of the fourth and fifth branchial pouches, should develop into thymus-tissue, while the third and hindermost should, on the contrary, remain in an epithelial condition. This, however, is not the case: all three retain an epithelial character, and are met with in this shape, even in much later developmental stages, between the aortic and pulmonary arches. They do not come into connexion with the thyroid.

9. The aorta develops from the artery of the fourth branchial arch, the pulmonary artery from that of the sixth. The fifth aortic arch, the rudiment of which arises between the fourth and fifth branchial pouches, very soon becomes aborted again, as I have also shown to be the case in snakes and lizards.

10. The observations here detailed confirm the theories as to the probable origin of the thymus and of the epithelial rudiments in the cervical region, which I arrived at in the anatomical investigation of young turtles, and to which I have already drawn attention in a previous memoir ("Beiträge zur Kenntnis der Halsgegend bei Reptilien: I. Anatomischer Teil," published in 'Bijdragen tot de Dierkunde, uitgegeven door het Genootschap Natura Artis Magistra te Amsterdam,' 1880).—*Anatomischer Anzeiger*, viii. Jahrg., nos. 23 and 24, October 10, 1893, pp. 801–803.

Observations on the Karyokinetic Phenomena in the Cells of the Blastoderm of Teleosteans. By MM. E. Bataillon and R. Kœhler.

In a previous communication we have described the results of our researches upon the extension of the blastoderm on the surface of the ovum in the dace. We now propose to give an account of the curious phenomena which we have observed in the division of the cells of the blastoderm during the first days of the development of the embryo.

Method.—Before proceeding to the examination of our results, we must say a few words as to the method which we employed in order to determine their precise signification. The embryos, after being liberated from their shells, were fixed in Flemming's fluid, and the sections were treated in the following manner:—They were stained with borax methylene blue, then passed into water and very quickly into a strong aqueous solution of eosin, finally they were dehydrated and mounted in balsam.

Let us consider, for example, a transverse section from the dace a few days before being hatched (eight days after fertilization). Under a very slight magnifying-power we perceive, it may be in the nerve-centres or in the masses of mesoblast, blue spots, which form a contrast with the ground-colour of the section, which is distinctly of a reddish hue. Under a sufficiently high magnifying-power we discover that these blue spots are beautiful karyokinetic figures, the chromatin of which exhibits in all the stages a very delicate affinity for the methylene blue. The granulations of the resting nucleus are stained by the eosin: only one or two granules, which are clearly indicated, react like the chromatic portions of the figures of division, and may be regarded as nucleoli. Two important conclusions result from these observations:—

1. *Methylene blue is, under these conditions, a genuine reagent for chromatin in an active state.*

2. *With the exception of the nucleolus or nucleoli, the granulations of the resting nucleus have not the same reaction as the chromatin of division; their chemical composition must therefore undergo a change when they become constituent parts of the filament.*

We would remark that if the action of the eosin is too prolonged, or if the decoloration with alcohol is pushed too far, the blue tint will entirely disappear. Here we have a device of preparation. But since the results of this device are constant for the various stages, in numerous sections and in different tissues, it must correspond to a constant condition. The method indicated seems to us to be of value for the *technique* of cytology, which is, moreover, made up of devices.

Results.—Let us apply this method to the study of division in the first stages of development. During the whole of the first day the blastoderm-spheres, which multiply rapidly, exhibit all the stages of indirect division. In these cells we observe the rays of the asters extending from the periphery of the nucleus to the membrane throughout the whole mass of the protoplasm. These asters are either simple or double; all the stages in the division of the centrosomes and their migration towards the poles are easily followed. Until the moment when the spindles appear the nuclei look like clear areolæ bounded by a delicate membrane; not only are the few granulations which they contain not coloured blue, but the paleness of the nuclear cavity contrasts strongly with the violaceous ground of the protoplasm, which, in this stage, seems to be impregnated in a diffuse fashion at once with the methylene blue and the eosin.

The division-spindles, of which the centrosomes alone have somewhat more colour, contain neither granules nor chromatic fibrils. It is necessary to examine at the end of the first day blastoderms with from ten to twelve rows of cells, in order to find, in certain cases of karyokinesis, a few extremely minute blue granules, which constitute the first equatorial plate. It is, moreover, at this stage that the protoplasm commences to exhibit the interesting peculiarities upon which we shall proceed to dwell.

From the thirty-sixth hour the methylene blue constantly reacts in the manner which we have indicated above.

Our double coloration therefore renders clearly evident the fact mentioned by MM. Henneguy and Sabatier, namely that the nuclei of the earliest embryonic stages are difficult to stain; but it has enabled us besides to recognize the appearance in the protoplasm of the cells of elements to which we attribute great importance, because they seem to us to give the key to this peculiarity. Between the twenty-fourth and the thirty-sixth hour, when only a few figures of division exhibit affinity for the methylene blue, this stain sharply distinguishes in the cellular protoplasm certain spherules, of which the tint is so much the deeper in proportion as their dimensions are reduced. With objectives of high power we perceive that the largest spherules differentiate in the interior of their paler mass smaller granules of very deep colour, which are marked out within the surrounding protoplasm. In neighbouring cells it may be observed that these granules, whether isolated or arranged in a series, are supported by the filaments of an aster: it seems that the latter serve to attract them, or, at least, to direct them towards the middle of the spindle, in order to furnish the elements of the equatorial plate. Henceforth all the cells in process of division will exhibit, contrary to what was seen in the first karyokineses, equatorial plates which are very distinct and of a vivid blue colour.

We do not think that the existence of these chromophilous granules, representing the earliest condition in which the chromatin substance manifests itself in the cells, has been mentioned before. In a memoir upon the development of bony fishes Miecz. von Kovalevsky represents the protoplasm of the cells of the blastoderm as containing granulations which may be compared with those which we are describing, but which are designated by him *vitelline granulations* ("granulations vitellines"). Owing to the fact that the investigations of this naturalist were conducted upon other material and by the aid of methods different from our own, it is impossible for us to discuss the interpretation which he gives to these elements. We would merely observe, and we insist upon this fact, that in our better preparations, where the chromophilous granules are intensely stained by the blue colour, the vitellus is perfectly colourless, and that it is impossible to consider these granules as vitelline elements, since the methylene blue solely affects chromatin in an active condition, as we have already stated.

CONCLUSIONS.—1. *In the first stages of development in the dace the blastoderm-cells exhibit no individualized chromatin, and the karyokinetic figures are exclusively formed of achromatic elements.* This important fact furnishes support to the opinion which the most recent researches tend to make the prevalent one, namely that in the cell the essential *rôle* does not belong to the chromatin, as was formerly believed, but must rather be ascribed to the centrosomes.

2. *The chromatin at first exists in a diffused condition in the protoplasm, as certain authors have stated. It becomes differentiated and individualized in this protoplasm in the form of granulations which can be stained by means of reagents; then it becomes incorporated into the nuclei to constitute the equatorial plates which are absent in the first stages.*—*Comptes Rendus*, t. cxvii. no. 16, October 16, 1893, pp. 521–524.

On the Cerebral Nuclei of Myriopods.
By M. JOANNES CHATIN.

It is well known how much interest attaches at the present time to the study of the elements of the nervous system in Invertebrates. By putting into precise form the results thus obtained by zoological histology, and contrasting them with the facts revealed by histogeny, we shall succeed in elucidating and interpreting exactly the comparative structure of the nervous tissue, with respect to which so many points still remain obscure or imperfectly understood.

One of these points is the notion of the *cerebral nuclei*, *ganglionic nuclei*, &c., which have been stated to occur in the Articulata, and especially in the class Myriopoda, where, in the accounts of various investigations, mention has been made under this name of elements which are represented as formations of a special character and of high functional value. It is, however, only necessary to compare these descriptions in order to prove that they apply, in the respective cases, to different elements, the importance and independence of which henceforth become somewhat doubtful.

Since, therefore, it was imperative that the subject should be re-examined in a rigorous fashion, I undertook with this object a series of researches which were devoted especially to various species of the group Chilopoda (*Lithobius forficatus*, *Scolopendra morsitans*, *Scutigera coleoptrata*, &c.). I purposely chose these types because they had been mentioned as exhibiting the cerebral or ganglionic nuclei with exceptional distinctness.

According to the statements to which I have just alluded, these structures should be chiefly found in the frontal lobe *, where they ought to appear particularly abundant; now the histological examination of this region brings to light three kinds of nervous elements:—

1. Normal nerve-cells, generally unipolar or bipolar, with a bulky body and a globular nucleus, the chromatic power of which varies according to the development of the nuclein substance.

2. Other nerve-cells, differing from the foregoing by the existence of two or several nuclei. These nuclei are feebly stainable by the colouring reagents; the nuclein substance is here found to be frequently represented by ovoid corpuscles, as may be demonstrated by the aid of a good immersion objective.

3. Little cells, measuring on an average 4 μ, and possessing so large a nucleus that the body of the cell is frequently found to be reduced to a delicate peripheral layer of protoplasm. These cells reproduce fairly well the old type termed *myelocyte*.

We observe that these various elements are distinctly cellular and that it is impossible to admit the existence of free cerebral nuclei. This conception is without doubt the result of a hasty and incomplete study of the third histic form which has just been described. In reality wherever nuclei appear they are accompanied by a protoplasmic mass, the boundaries of which, though often difficult to follow, are nevertheless incontestable.

The comparative histology of the principal groups of Invertebrates had, moreover, established during the last few years † the existence in them of elements identical with those which, in the case of Myriopods, have been pointed out as new and of a special character. It is sufficient in all these cases to multiply observations, in order to perceive that the pretended free nuclei become united by means of numerous transitional forms to the normal type of nerve-cell; they represent nothing but a simple variety of the latter.—*Comptes Rendus*, t. cxvii. no. 5, July 31, 1893, pp. 291–293.

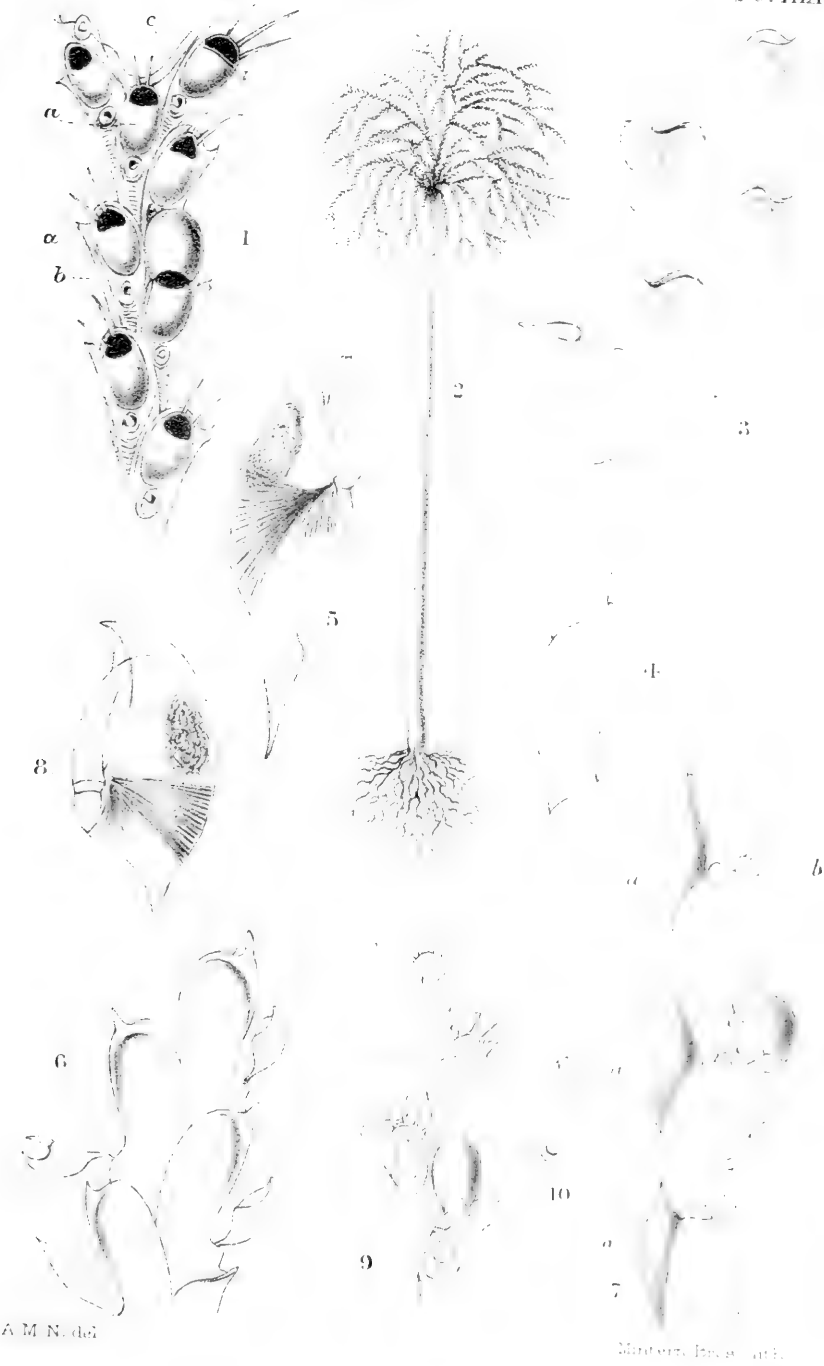
* It would be necessary to formulate certain reservations with respect to the employment of this term and to the limits of the region which it serves to designate; but I have not to consider here the details appertaining to the descriptive anatomy of the nervous centres in Myriopods.

† Joannes Chatin, "Sur les Myélocytes des Invertébrés," Comptes Rendus, 1888.

INDEX TO VOL. XII.

END OF THE TWELFTH VOLUME.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.



A. M. N. del.

Mintern Bros. lith.