THE

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OF

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(SECOND SERIES.)

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CORRIGENDA.

Page 13, line 2—for *Typhlops affinis* read *Typhlops affinis*.
Page 18, line 18—for *C. (S.) graminifolium* read *S. graminifolium*.
Page 30, line 20—for *Busaria spinosa* read *Bursaria spinosa*.
Page 100, line 22—for *C. australasiæ* read *C. australasiæ*.
Page 103, line 13—*for* NYCTOZOILUS, SLOANEI *read* NYCTOZOILUS SLOANEI.
Page 173, line 28—*for* Pl. XIV. fig. 12 *read* Pl. XIV. fig. 11.
Page 174, line 26—*for* Pl. XIV. fig. 11 *read* Pl. XIV. fig. 12.
Page 220, line 18—*for* Pl. XVII. figs. 2-11 *read* Pl. XVII. figs. 2-9.
Page 298, line 17—for *Uromastrix* read *Uromastix*.
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Page 392, line 29—for *B. macleayi* read *P. macleayi*.
Page 414, line 3—for *H. cyanea* read *H. cyaneum*.
Page 460, line 11—for *Byronia* read *Bryonia*.
Page 640, lines 20-22—for *Didelphis* read *Didelphys*.

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

WEDNESDAY, MARCH 28TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

DONATIONS.

(Received since the Meeting in November, 1893.)

"Department of Mines and Geological Survey of N.S.W.—Records." Vol. iii. Part 4 (1893). *From the Hon. the Minister for Mines and Agriculture.*

"Société d'Horticulture du Doubs, Besançon — Bulletin." Nouvelle Série, Nos. 34-36 (Oct.-Dec., 1893). *From the Society.*

"Perak Government Gazette." Vol. vi. (1893), Nos. 26-30; Vol. vii. (1894), Nos. 1-4. *From the Government Secretary.*

"Royal Microscopical Society—Journal, 1893." Parts 5-6. *From the Society.*

"Department of Agriculture, Brisbane—Bulletin." No. 25 (June, 1893); Second Series, No. 1 (Sept. 1893): "Bulletin on Sugar-Planting in Queensland": "Botany Bulletin." No. vii. (1893). *From the Secretary for Agriculture.*

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"Verein für Erdkunde zu Leipzig — Mittheilungen, 1887." *From the Society.*

"Zoologischer Anzeiger." xvi. Jahrg. Nos. 432-436 (1893); xvii. Jahrg. Nos. 437-439 (1894). *From the Editor.*

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"Royal Swedish Academy of Sciences — Bihang: Botany." Afd. iii. 16-18 Bd. (1890-91): "Zoology." Afd. iv. 16-18 Bd. (1890-91). *From the Academy.*

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"Journal de Conchyliologie." T. xxii. (1892). *From the Editor.*

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"Results of Rain, River, and Evaporation Observations made in N. S. Wales during 1892." *From the Director, Sydney Obser vatory.*

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"Essex Institute—Bulletin." Vol. xxiii. (Nos. 1-12), Vol. xxiv. (Nos. 1-12), Vol. xxv. Nos. 1-3 (1891-93): "Henry Wheatland, M.D.—a Memoir." *From the Institute.*

"K. K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen." Jahrg. 1893, 1 u. 2 Quartal. *From the Society.*

"Naturforschende Verein in Brünn—Verhandlungen." xxx. Bd. (1891): "Meteorologischen Commission—Bericht x." (1892). *From the Society.*

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"Société des Sciences de Finlande—Bidrag till Kännedom." Häft. li. (1892) : "Oëfversigt." xxiv. (1891-92). *From the Society.*

NOTES ON AUSTRALIAN *TYPHLOPIDÆ.*

By Edgar R. Waite, F.L.S., Zoologist, Australian Museum.

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(Plate I.)

*4. Typhlops batillus, sp.nov.

(Pl. I. figs. 1-3.)

Habit slender and of moderately even thickness. Snout prominent, much depressed and shovel-shaped. Head shields granulated above and below. Rostral half the width of the head, extending almost to the level of the eyes, widest in front, the portion visible from beneath as broad as long; nasal completely divided, the fissure much curved and extending from the second labial; nostrils lateral, close to the rostral; preocular smaller than the ocular, in contact with the second and third labials. Eye very distinct. Internasal, supraoculars, and parietals larger than the scales on the body. Four upper labials. Diameter of the middle of the body fifty-three times in the total length. Tail longer than broad, terminating in a blunt spine. Twenty-four scales round the body.

Colours.—In spirits, tawny above, the edges of the scales forming noticeable longitudinal lines, lighter beneath.

Dimensions.

Total length 320 mm.	Length of head 5 mm.
Width of head 5 mm.	Width of body 6 mm.
Length of tail 7 mm.	Width of tail 5 mm.

Hab.—Wagga Wagga, New South Wales. One example.

* Articles 1-3 were published in the Records of the Australian Museum, ii. pp. 57-62.

Type.—In the Macleay Museum, Sydney. No. 3.

Note.—Connecting the parietal with the fourth upper labial is a broadened scale; this is shown in figs. 1 and 3, but I have not included it in the general description, as the fusion of two or more scales is a common occurrence in the Ophidia, and is very probably in this instance an individual peculiarity. I mention it here, however, as the scales on both sides of the head are precisely alike.

The completely divided nasal is a character not shared by any Australian form hitherto described, and at once serves to distinguish this species.

I am indebted to the Trustees of the Macleay Museum for having kindly granted me permission to describe this, the only new species in the series.

5. Typhlops diversus, sp.nov.

(Pl. I. figs. 4-6.)

Habit slender, slightly thickened posteriorly. Snout rounded. Rostral nearly half the width of the head, extending almost to the level of the eyes, slightly narrowed in front, the portion visible from below about as long as broad; nasal incompletely divided, the fissure extending from the anterior edge of the preocular to slightly beyond the nostril; nostrils lateral; preocular narrower than the ocular, in contact with the second and third labials. Eye distinct. Internasal, supraoculars, and parietals larger than the body scales. Four upper labials. Diameter of the middle of the body about sixty-seven times in the total length. Tail a third longer than broad, terminating in a very minute spine which scarcely projects beyond the scales. Twenty scales round the body.

Colours.—In spirits, light horn-colour throughout, slightly darker on the dorsal surface.

Dimensions.

Total length 212 mm.	Length of head 3 mm.
Width of head 3 mm.	Width of body 3·2 mm.
Length of tail 4 mm.	Width of tail 3 mm.

Hab.—Mowen, Central Railway, Queensland. One example.

Type.—In the Queensland Museum. No. D 4432.

The peculiarity of the nasal fissure not touching the labials distinguishes *T. diversus* from all other Australian forms, and the only described species with which it might be confounded is *T. braminus*, Daud.* It differs from this species in having the nasal incompletely divided, the head more depressed, the rostral of greater width and of different shape, and the body of more slender form.

I am enabled to describe and figure this interesting species owing to the kindness of Mr. C. W. De Vis, who has placed in my hands the whole of the Australian *Typhlopidæ* in the Queensland Museum.

6. Typhlops unguirostris, Peters, and T. affinis, Boulenger.

As previously mentioned, I have received a valuable collection of Australian *Typhlopidæ* for study and determination from the Queensland Museum, kindly sent to me by the Curator, Mr. C. W. De Vis. An examination of this collection placed me in a position to understand the discrepancies which, since the publication of the British Museum Catalogue,† I saw existed in either the descriptions or the figures of the species above-named.

In the collection are two examples which I identify as *T. unguirostris.*‡ In both these specimens the nasal fissure is in contact with the first labial, and although Peters does not mention this, his figure shows very clearly that such is the case in the type specimen.

In the British Museum Catalogue, Boulenger remarks of this species that the nasal cleft proceeds from the second labial. This,

* *T. accendens*, Jan, has similar characters, but differs in having twenty-two rows of scales round the body.

† Boulenger, Cat. of Snakes in B.M. Vol. i. p. 49.

‡ Peters, Monatsb. d. K. Akad d. W. Berlin, 1867, p. 708, f. 3.

in view of the evidence above given, I should regard as a mere oversight, did it not cause some difficulty with regard to another species, *T. affinis.*

When describing *T. unguirostris,* Peters stated that in an old example the body scales are in twenty-four rows, while in a young one there are eighteen rows only. In 1889 Boulenger* very properly elevated this small form to specific rank under the name *T. affinis,* remarking that it agrees with *T. unguirostris* in every respect except in having eighteen scales round the body (instead of twenty-two or twenty-four) and a somewhat longer tail.

From observations on the material at my disposal, I would suggest that Boulenger is in error in stating that the nasal cleft of *T. unguirostris* proceeds from the second labial, and if so his description of *T. affinis* (being comparative) is also incorrect, for he figures this species† as having the cleft connected with the second labial. This figure I am able to verify, for the Queensland collection contains a small specimen which, at the first glance, I took to be a third *T. unguirostris.* I found that it differed from my other examples and from Peters' figure in having the nasal cleft in contact with the second labial. It perfectly agrees with the figure of *T. affinis,* and if my conclusions are correct, this species is much better marked than even Boulenger suspected.

As the two examples of *T. unguirostris* have in addition to the character mentioned twenty-four rows of scales and a short tail, and as my single example of *T. affinis* has eighteen rows of scales, and the tail longer than broad, I am able to agree with and verify the other points of Boulenger's descriptions and now characterise the species as follows :—

Typhlops unguirostris, Peters.—Nasal cleft proceeding from the first labial, twenty-four (or according to Boulenger, twenty-two or twenty-four) scales round the body, tail nearly as long as broad.

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* Boulenger, Ann. Mag. Nat. Hist. (6) iv. 1889, p. 363.

† Boulenger, Cat. of Snakes in B.M. i. pl. III. f. 3.

Typhlops affinis, Boulenger.—Nasal cleft proceeding from the second labial. Eighteen scales round the body. Tail longer than broad.

7. Typhlops wiedii, Peters.

(Pl. i. figs. 7-9.)

This is the only Australian species of which no figure has hitherto been published. In order to complete the series, I therefore show three aspects of the head.

Out of very many examples which I have examined, the total length of the largest does not exceed 295 mm.

8. Typhlops polygrammicus, Schlegel.

Until recently, the largest specimen I have seen is the one mentioned in a former article* under the name *T. nigrescens*, Gray, as being 570 mm. in length. This must be regarded as exceptional, however, for out of at least 200 examples which I have seen very few exceed the figure given in the British Museum Catalogue, namely, 435 mm. Lately I have had the opportunity of measuring a specimen which has attained dimensions eclipsed only by the African species *T. humbo*, Bocage, which reaches 775 mm.

The Australian gigantic specimen was obtained at Kempsey on the Macleay River, New South Wales, and sent to me for determination by Mr. A. P. Kemp, to whom it has been returned.

As comparative measurements are so easy to make on such a large specimen I give its principal dimensions as follows :—

Dimensions.

Total length 717 mm.	Length of head 9·5 mm.
Width of head 10·5 mm.	Width of body 14·5 mm.
Length of tail 15·0 mm.	Width of tail 14·0 mm.

* Records of the Australian Museum, ii. p. 59.

In a future paper I hope to deal with the distribution of the Australian *Typhlopidæ*, and shall be very grateful for the loan of specimens, or for any information with which I may be favoured.

EXPLANATION OF PLATE I.

Figs. 1-3.—Head of *Typhlops batillus*, Waite.

Figs. 4-6.—Head of *Typhlops diversus*, Waite.

Figs. 7-9.—Head of *Typhlops wiedii*, Peters.

ON THE FERTILISATION OF *CLERODENDRON TOMENTOSUM*, R.BR., AND *CANDOLLEA (STYLIDIUM) SERRULATA*, LABILL.

By Alex. G. Hamilton.

(Plate II.)

Clerodendron tomentosum, R.Br.

(Pl. II. figs. 1-2.)

My attention was first drawn to the method of fertilisation of this plant by the fact that a cluster of flowers on my table, though always deliciously scented, gave off a much stronger odour in the evening. This led me to think that it was probably fertilised by some night-flying moth. I therefore studied the development and structure of the flowers with a view to discovering if my theory was correct, and with the following results :—

The flower, as seen in fig. 1, is tubular, the tube about an inch long. The five petals are only slightly irregular, the lower one being sometimes a little larger than the upper. But this is not a constant character. The colour is creamy-white—a common feature of flowers which depend on night-flying insects for fertilisation. The stamens are four in number, and much exserted—one inch or more beyond the tube, and the pistil projects to about the same distance. In the bud, stamens and pistil are compactly coiled up, and fill the interior completely. When the flower opens, the stamens gradually uncoil and straighten, and the pistil bends so as to be below them (fig. 1). The anthers do not burst till the pistil has bent, and the latter is still immature, as is shown by the bifid stigma remaining unopened. The flowers are, therefore, proterandrous. The anthers in some flowers do not all mature at once, sometimes bursting singly and sometimes in pairs, but the usual course is for all to mature and burst simultaneously. The tube produces nectar freely, but it can only be procured by an insect with a very long proboscis, and it seemed most likely to me that the sphinx or hawk moths were usually concerned in the fertilisation. After the anthers have all shed their pollen, they twist downwards, while the pistil straightens and thus brings the stigma, now open and fit to receive pollen, into the position which the stamens formerly had (fig. 2). Now this is exactly in front of the neck of the tube, so that a moth feeding on the nectar is certain, as it poises in front, to be smeared with pollen on the lower surface of the thorax and abdomen, and this pollen is transferred to the stigma when a bloom is visited which has its pistil straight and the stigma mature. Inspection of the immature stigmas when in the lower position showed them to be perfectly free from pollen. But the mature stigmas in the upper position were thickly coated with pollen, and in most cases had scales and long hairs of a moth adhering to them. My conclusion, therefore, was that the sphinx moths in extracting the nectar from blossoms in which the stamens stood out in front of the flower, became coated with the very sticky pollen ; then proceeding to flowers in which the pistil was in position they deposited the pollen on the stigma as they hovered over the flower, and so cross-fertilisation, or to use Kerner's term, allogamy, ensued. That insects are not likely to alight on the flower and so fertilise it, is evident from the fact that the plane of the petals is perpendicular to the axis of the tube, and that they curl round (fig. 2) towards the tube as the flower matures, so that there is no platform for insects to alight upon. The flowers grow in clusters, and in each cluster may be found numbers in all states of maturity. The calyx, tube and backs of the petals, stem and leaves are all covered with hairs, both pointed and glandular, and of a soft texture. This prevents ants and other crawling insects from having access to the flowers, such insects only rifling the tube of its nectar without fertilising the flower.

Having completed my theory, I took the first opportunity of putting it to the test by visiting a flowering plant in the dusk, and I then found that the method was exactly as above set forth. Numbers of hawk moths of the species *Deilephila celerio* were very busy extracting the nectar, and as they balanced on the wing above the flowers, invariably touched the anthers of those in the first stage ; or the stigma in those which had reached the second, both with their legs and their bodies. As might be expected the plant fruits freely but not invariably.

I have little doubt but that the flowers may also be visited and fertilised by the little Cobbler's Awl, *Acanthorhynchus tenuirostris*, which is very fond of visiting tubular flowers, but so far I have not observed them at it. Crowds of small moths were fluttering about the flowers, probably attracted by the sweet scent, but they did not alight : perhaps the depth of the tube and the want of a platform for resting on deterred them.

After writing the preceding, I came across the following, which has a good deal of interest as bearing on fertilisation in this manner. "Natural Science" (Vol. iii. p. 415) notices a paper by Dr. Max Schultz in Cohn's Beiträge zur Biologie der Pflanzen (Vol. vi. p. 305) "On the movements of the stalk and flower, of *Cobæa scandens*."

The flowers are proterandrous and the two upper stamens shed pollen first, the anthers standing up before the entrance to the flower, and then bend downwards out of the way. Then the three lower anthers take up the same position and open, afterwards bending downwards, while the style takes the position formerly held by the anthers, and the stigmas unfold.

After reading this, I watched a plant of *Cobæa* in flower, and was struck with the similarity of the process to that in *Clerodendron.* Although Dr. Schultz (as quoted) says that two anthers open first and then the other three, I noted that in my plant the anthers frequently opened singly, or irregularly as in *Clerodendron*, or all at once.

The notice concludes with the following words :—"These movements of the flower and its stalk are, perhaps, a device for ensuring self-fertilisation where cross-fertilisation by insects has failed. They occur in any case, whether pollination has taken place or not." With my experience of *Clerodendron*, I should say that they undoubtedly point to cross-fertilisation by a flying insect; but I am bound to admit that I have for some two months past watched *Cobœa* for hawk moths every evening, and have never seen one approach it, although they were busy on some *Lonicera* twenty feet away. The flowers were, however, much frequented by bees in search of pollen, and often bear fertile seed, but they often fail. The scent in the flowers at the first stage (at which time the blossom is greenish) is said to be pungent and disagreeable, and in those in the second stage strong and sweet. But, so far as I have observed, the scent is strong and disagreeable at all stages. These differences, however, may be due to the plant growing in a different soil and climate.

CANDOLLEA (STYLIDIUM) SERRULATA, Labill.

[*C. (S.) graminifolium*, Swartz.]

(Pl. II. figs. 3-9.)

The plants of this genus are well known for their irritable column, which springs across the flower on the slightest touch. The purpose of this movement has long been supposed to be connected with the fertilisation of the flower, but I have been unable to find any record of the method by which it secures that end. I therefore hope that the results of my study and observations of the species named may be of interest.

The flowers are strongly proterandrous. The filaments of the stamens and the pistil are connate, forming the sensitive column. In the bud and the earlier stages of the flower, the anthers lap over and conceal the stigma, which is then small, green, and immature (fig. 3). They gradually open, and the pollen lies loose in them and is shed. When they are quite empty they wither rapidly, and the stigma begins to grow out. It soon becomes mature and fit for the reception of the pollen, and is then oval, cushion-shaped, and covered closely all over with fine short hairs (figs. 5 and 6), so that it is not unlike a hair-brush with a curved surface. The corolla consists of five petals uniting in a tube. Four of these have their free extremities extended in a plane at right angles to the tube, and at the mouth of the tube each has a variable number of appendages (fig. 9) forming a corona, and so arranged as to leave an opening at what I may call the front of the flower (fig. 4). The fifth petal (labellum) bends down along the tube, and has a projection at each upper angle, evidently the same as those on the upper petals. At first this is glandular, shining, and soft, but on the flower opening the glands disappear or coalesce so as to make the surface level and smooth, and the texture becomes hard and leathery. The column grows out of the tube and then bends over the neck and downwards between two of the upper petals, lying between the appendages of the labellum, and along the surface of it (fig. 3). It then bends upwards and outwards with a slight twist. The first bend over the tube is the hinge on which the column bends when moving, and is thicker and wider than the parts above and below. It also has transverse ridges at this point, which are coloured pink or crimson, while the other parts of the column are greenish or brownish-green. The whole of the flower-stem, the calyx, and, to a slight extent, the backs of the upper petals are covered with sticky crimson-headed glandular hairs or trichomes (fig. 8), the object of which is evidently to prevent small crawling insects gaining access to the flower and robbing the tube of its nectar, without any advantage to the plant. The trichomes wither on the older flowers and capsules when the necessity for them has passed away.

The flower is fertilised by insects, and it is not self-fertile, as may be seen from capsules withering from want of fertilisation, while in a spike of flowers one or two may sometimes be fertilised between flowers above and below which are not.

The method of fertilisation is as follows :—Any insect such as a bee, visiting the flower, selects the side where is the widest opening between the petaline appendages; this is exactly opposite the hinge or first bend of the column (*a*, figs. 4 & 5), and this bend is the point of greatest irritability. As the insect passes its proboscis down the tube, it inevitably touches the sensitive spot, and the column immediately flies over, the gynæcium striking the bee (if of the ordinary size) on the thorax. If the column be at the first or or pollen-bearing stage, the pollen is deposited on the bee's thorax, where it clogs the hairs. When the insect has completed its work at the flower it moves off, and to do this, it has to come out sideways on account of the way it is clasped by the column ; in this movement the pollen is further brushed out of the anther cells by the hairs on the bee's back. If the insect then visits a flower in which the pollen is all shed and the stigma mature, the same action of the column occurs, but in this case the sticky hairs of the stigma act as a brush to remove the pollen from the bee as it moves off sideways. Consideration of the structure and action of the flowers leading me to form the above theory of its mode of fertilisation, I experimented with flies, but they were either too small or would not go into the flower properly. I therefore went to a spot where the plants were fully in blossom, and soon observed a small native bee working at the blossoms. But on account of its small size it was not effectual—the column striking beyond the insect. I noticed, however, in this instance and with other insects, that the sudden blow from the column did not startle them at all, so that they are evidently accustomed to it. My friend, Mr. J. D. Cox, who assisted me in the field observations, called my attention to a hybrid Italian bee flying about the blossom spikes, and we soon had the pleasure of seeing the bee going to the open side of the flowers. On its inserting its proboscis into the tube, the column at once flew over, and where the anthers were not empty, a little cloud of pollen was seen to fly from the force of the blow. Where the stigma was mature, an examination of it afterwards showed pollen on the surface. We watched the insect visit a large number of flowers, always acting as described. It invariably visited the lower flowers in a spike first, and as these are always more advanced than the upper, and have the stigmas mature, there was little probability of any blossom being fertilised with pollen from the same plant. I then captured the insect, and found it covered with pollen of *Candollea*, and I could not afterwards detect that of any other plant under the $\frac{1}{4}$ inch power of the microscope. I might remark that, as Sir John Lubbock states, bees almost always keep to one species during a trip, but I am able to say that this is not invariable. I have several times seen a bee visit a number of different species of plants, and belonging to totally different natural orders, one after another.

In many flowers, the column had been sprung previous to the bee's visit, and in getting into position to search the tube the insect always rubbed its back against the gynæcium. If in any of these the stigma was mature, it would result in fertilisation just as certainly as if the column had struck the bee. Some columns with the stigma mature I noted standing for a long time without returning, and if an insect seeking nectar brushed against them, fertilisation would ensue if there was pollen on its back. I should not be surprised to learn that an unfertilised column at last lost its sensibility and stood in the sprung position to give the flower a last chance of receiving pollen. But I was not able to make any certain observation of the fact.

It seems important that the insect should be of such a size that the gynæcium should strike the upper surface of the abdomen or the thorax, and this requirement is fulfilled by many native bees and pollen-feeding flies.

Observations and experiments revealed the following facts :— The action is most vigorous on a warm dry day. On a cold day many columns will not respond to a stimulus, and others do so very slowly. Dr. Woolls remarks :—" This [the action of the column] does not take place in moist weather."* I found, however, that most columns would respond to a stimulus on a warm moist day, but on a cold day whether wet or dry, they remained inactive. The column below the hinge, the anthers and the stigma are not sensitive or do not transmit a stimulus, if gentle.

* Lectures on the Vegetable Kingdom, p. 100.

But a rough touch causes action immediately. This is probably due to the roughness moving the sensitive spot. But if touched ever so gently at this point, the column acts, if it be not in a sluggish condition from the effects of weather or previous action.

When an active plant is sprung, the column remains reflexed for a period varying from 2 minutes to 1 hour. The more usual time is from 10 to 20 minutes. The column then begins to return to its normal position, at first by a series of short jerks, till it is perpendicular to the plane of the petals, and then by a slow gliding movement, which is very plainly perceptible in a vigorous flower, till it has reached its normal position. After recovery, it will not respond to a stimulus for a variable length of time, the shortest observed being 20 minutes, and the longest 4 hours. It is as sensitive at night (up till midnight at least) under ordinary circumstances as in the daylight.

When the flowers have been fertilised, they retain their sensitiveness for a period varying from 4 to 24 hours. Sometimes a fertilised flower, if touched, acts vigorously and then moves back till the column is perpendicular, and then remains in that position finally. Soon after the loss of irritability, the petals wither.

A smart current of air driven on the flower by the lips causes the column to act, and doubtless the wind has the same effect. This probably arises from the wind moving the irritable point. But this would not matter, for a sprung flower, as already pointed out, would reach the back of a suitable insect visiting the flower while the column was reflexed, and would perform its proper function of depositing or receiving pollen.

The flowers vary as to the number of appendages on each petal —one, two, or three; and number of petals—sometimes six. But in all cases the front of the flower is the side most easy of access to insects.

There are two points in the structure of the flowers of which I could not make out the utility. The first is the object of the beaded hairs on the gynæcium (fig. 3); these appear to be appendages of the anthers, and wither as the anthers do. The other is the rudimentary petal or labellum folded down the sides of the tube. The two horns on this are manifestly homologues of the coronal projections on the ordinary petals. As the column in its ordinary position lies between these horns, they may be guides to lead it into its proper place as it returns after action. But on several occasions I saw the style get outside the horns.

I was not able to try the effect of chloroform vapour on the plants; tobacco smoke did not affect the column in the slightest either way. Darwin's experiments on Orchids seem to show that the vapour of chloroform is inert as regards sensitive organs of plants.

The plants are gregarious, which must be a decided advantage to them as insect-fertilised. I collected some specimens remarkable for size and number of flowers. Three were specially fine. No. 1 was 3 feet 5 inches high and had 70 flowers, 36 fertilised and capsules swelled, two with withered and empty capsules, 13 open flowers and 19 buds. No. 2: 2 feet 9 inches high, with 52 flowers, 10 fertilised, 23 open flowers and 19 buds. No. 3: 2 feet 6 inches high, 50 flowers, 16 fertilised, 20 open flowers and 14 buds.

In conclusion I would draw the attention of members who have facilities for laboratory work, to the interest which would attach to a series of sections, transverse and longitudinal, of the column, especially of the hinged part, which is the seat of irritability, and which shows, outwardly at least, a differentiation of structure in the presence of strongly coloured ridges across the column.

REFERENCES TO PLATE II.

Clerodendron tomentosum, R.Br.

Fig. 1.—Flower in first or male stage; *a*, anthers, *s*, stigma unopened (× 2).

Fig. 2.—Flower in second or female stage; *a*, anthers curled out of way, *s*, stigma in position and open (× 2).

Candollea (Stylidium) serrulata, Labill.

Fig. 3.—Flower from behind (× 2).

Fig. 4.—Flower from front, showing opening for insect; *a*, sensitive hinge of column (× 2).

Fig. 5.—Anthers concealing stigma (× 5).

Fig. 6.—Stigma from above, anthers withered (× 5).

Fig. 7.—Side view of stigma (× 5).

Fig. 8.—Trichomes on stem and calyx (× 20).

Fig. 9.—Appendage of the petals (× 5).

NOTE ON BUNGWALL *(BLECHNUM SERRULATUM,* RICH.), AN ABORIGINAL FOOD.

By Thos. L. Bancroft, M.B., Edin.

(Communicated by J. H. Maiden, F.L.S., &c.)

Occasionally I have heard the aborigines speak of "Bungwall," a plant which in former times, and to within thirty years ago, served them as food; indeed, it and the nuts of the Bunya Bunya *(Araucaria Bidwilli,* Hook.) were the most important of their vegetable foods in Southern Queensland.

On Bribie Island in Moreton Bay it grew plentifully and to a large size. The chance of finding some of the stones used in the preparation of it induced me to take a couple of blacks and go there to investigate the subject. No account is given of *Blechnum serrulatum* having been used as a food by the blacks in the writings of A. Thozet,* Edward Palmer,† F. M. Bailey, J. H. Maiden or R. Brough Smyth. Mr. Bailey, however, knew that this fern served as food for the blacks, but had not mentioned the fact in his works on the Flora of the Colony.

Blechnum serrulatum is a freshwater swamp fern growing to the height of six feet; it has a wide distribution, not alone in Queensland but throughout the world. The whole root or rhizome is the part eaten; it is first dug out with a sharpened stick, dried in the sun for a short time, roasted and afterwards bruised, when it is ready to be eaten in conjunction with fish, crabs, and oysters.

The Bungwall stone in not unlike a stone tomahawk, the sharp edge being used to bruise the rhizome against a slab of bloodwood

* Pamphlet printed at the *Bulletin* office, Rockhampton, 1866: "Notes on the Vegetable Foods of the Aboriginals of Northern Queensland."

† On Plants used by the Natives of North Queensland, Flinders and Mitchell Rivers, for Food, Medicine, &c., Royal Soc. N.S.W. Aug. 1883.

(*Eucalyptus corymbosa*, Sm.); wood being used in preference to stone to avoid grit, and likewise a stone in preference to a metal instrument to avoid chips.

There is no hard stone on Bribie, so the stones are imported there from the mainland. These are fragments of water-worn pieces of basalt, split by fire into the desired shape. We were fortunate in finding several Bungwall stones and also a Bunya Bunya stone; they were hidden at the butts of large Cypress Pines (*Callitris columellaris*, F.v.M.); in all probability their owners have long been dead.

Almost every native tribe has a distinct name for this plant; the majority of the blacks now in Brisbane call it "Tong-wun"; the word Bungwall is regarded by them as the white man's name, in the same way as are Boomerang for Barran, Kangaroo for Murree, &c.

The blacks are credited with having formerly made use of the roots of *Pteris aquilina*, Linn., for food, but those I have interrogated declare that their ancestors never ate it nor the root of any other fern but the Bungwall.

In a work by James Backhouse, published in 1843, entitled "A Narrative of a visit to the Australian Colonies," there is mention of the roots of *Lygodium microphyllum* (= *scandens*), *Pteris esculenta* (= *aquilina*, var. *esculenta*), and *Blechnum cartilagineum* having served the blacks as food.

Brisbane, February, 1894.

ON THE NESTS AND HABITS OF AUSTRALIAN *VESPIDÆ* AND *LARRIDÆ*.

By Walter W. Froggatt.

The following notes are the records of personal observations extending over a number of years. These wasps are probably best known to most people on account of their fearless disposition and their sociable habits, for they not only build under the eaves and verandahs of houses, but even come inside to construct their nests.

The *Vespidæ* comprise a number of social wasps which form large papery nests, the work of the original builders being supplemented by that of the young wasps as they hatch out, so that an old nest sometimes attains considerable dimensions. Others are solitary; a single pair build the nest, which is composed of clay, and after it is completed, each cell is filled with provisions and the ends sealed up, the larvæ being left to look after themselves.

The two species of *Pison* also build clay nests exclusively, and these are provisioned with spiders, which they capture upon the grass and low bushes.

The value of these insects from an economic point of view is doubtful, for while those that destroy caterpillars are worthy of protection as the gardener's friend, those that prey upon spiders rather counter-balance their usefulness in killing the allies of the horticulturist.

Alastor eriurgus, Saussure, Mon. Guêpes Solitaires, Vol. i. p. 251.

A very common "mason wasp" in the neighbourhood of Sydney; very plentiful in February and March.

Velvety black, about 8 lines in length, covered with scattered ferruginous hairs thickest on the head and frontal portion of thorax; head and thorax closely and coarsely punctured, the segments of the abdomen covered with much finer punctures partly hidden by the fine pubescence clothing the dorsal surface; the face, the inner margin of scape, and a slender v-shaped patch between them, the tibiæ, tarsi, the prothorax, a circular spot on the side, the scutellum, post-scutellum, and a patch on either side of apex of the metathorax deep orange-yellow. The first segment of abdomen orange-yellow with a blackish blotch at the base, second segment very broad and prominent, velvety black, with the apical edge orange-yellow; the three following segments dull orange-yellow, with a narrow line of black at base, and tip dull orange-yellow; the wings large, fuscous, with the nervures black.

The nests are formed on the underside of the overhanging branches of trees, a hollow or depression in the bark being generally chosen for the site. They are invariably composed of bright yellow clay (which makes them very conspicuous), forming several coarsely granulated tubular masses, six lines in diameter, and from two and a half to three inches in length, each containing six or seven cylindrical chambers rounded at the extremities, and separated from each other by a thin clay partition.

Each nest consists of from two to five of these tubular cell-masses, sometimes lying beside each other, but generally when there are more than two or three, the last ones are built along the top of the basal rows; each cell is provisioned with from 18 to 20 small lepidopterous caterpillars, which are eaten as required by the wasp larvæ; the latter when they have emptied their larder do not spin a cocoon to pupate in, but the walls of the chamber are covered with a thin membranous skin fitting closely to the clay. They are subject to the attacks of cuckoo wasps and other parasitic hymenoptera; in one nest I found a small *Bracon* larva beside the young *Alastor*, which it soon devoured, and then spun an elongate white silken cocoon, out of which it emerged ten days after; $2\frac{1}{2}$ lines in length, black, with reddish legs, the hind thighs very much thickened; a beautiful sabre-shaped exserted ovipositor as long as the whole abdomen. The cuckoo wasps (*Chrysis* sp.) are very common in this nest; they eat up the provisions stored for the young wasp, and perhaps also the young wasp, forming a stout brown silken cocoon in which to pupate; I have bred out several specimens. These inquilines are placed in the *Alastor* nest while the builders are out hunting for caterpillars, their active mothers being on the watch to crawl in and deposit the eggs in the owner's absence.

ABISPA SPLENDIDA, Guérin, Voyage de la Coquille, 1830, Insecta, p. 265.

Among our "mason or mud wasps" this takes the palm for being one of the largest and handsomest, only equalled by the closely allied but very distinct species *A. ephippium.* It is $1\frac{1}{4}$ inches in length, very broad and robust, with semi-opaque reddish-orange wings slightly clouded with fuscous at the tips; the wasp is rich velvety black, with the antennæ, face, an elongate mark behind the eyes, the prothoracic collar, and the sides of the metathorax bright orange-yellow; a narrow band of the same colour along the apical edge of the first and second segments of the abdomen, the third, fourth, fifth and sixth rich orange-yellow, only showing a marginal black band at base, while the anal segment and the underside of the four apical ones are orange-yellow. The male and female are generally found together when the site of the nest is chosen, though whether the male assists in its construction I am not certain, but I believe he does.

The nest is very compact and solid, attached to the bark of an overhanging tree, roof of an outhouse, or some sheltered position; it is $5\frac{1}{2}$ inches long, $2\frac{1}{4}$ inches wide, and $1\frac{1}{2}$ inches thick, rough on the outer surface, showing where each ball of clay has been attached, rounded at each extremity; along the centre opening out towards the side is a row of six tubular cells, $1\frac{1}{2}$ inches deep and 4 lines in diameter. The nest when finished is provisioned with small lepidopterous caterpillars, which are captured on the grass, and after being stung are jammed into the cell till it is quite full, the aperture being closed with a thin sheet of clay. The larva, after finishing its food supply, does not spin any cocoon, but undergoes its metamorphosis naked.

This wasp is recorded from Tasmania and Australia ; I have specimens from the neighbourhood of Sydney, and Wellington, N.S.W.

The nest from which my specimens were bred was given to me by Mr. Thos. Whitelegge of the Australian Museum.

ICARIA GREGARIA, Saussure, Ent. Zeit. Stettin, xxiii. p. 137 (1862).

This wasp is much smaller than those of the genus *Polistes*, and is easily distinguished from them by having the apical segments of the abdomen telescopic and retracted into each other, while the former have smooth cylindrical sharply pointed abdomens.

This species is five lines in length ; ferruginous with touches of reddish-yellow on the sides of the thorax, the first joint of the abdomen very slender, the remaining segments chocolate-brown with a beautiful opaline sheen ; the wings large, semi-opaque, with reddish nervures.

The nests are formed of a stouter and stiffer substance than those of *Polistes*, and are always much longer than broad and irregular in form. About Sydney I have always found them built among the prickly twigs of *Busaria spinosa*, with the exception of one found under a cliff attached to the rock. An average well-shaped nest is about 4 inches in length by $1\frac{1}{4}$ inches wide, and contains about 300 hexagonal cells, 5 lines in depth by $1\frac{3}{4}$ lines in diameter. Though these nests are often so elongated, they are usually only attached to the twigs by one pedicle. The eggs and larvæ are attended to in the same manner as those of *Polistes*.

This species is rather common about Sydney and out in the western country ; I have also received specimens of it from the Rev. T. Blackburn of Adelaide, taken by him on the Australian Alps (Victoria) at an altitude of 3000 feet.

POLISTES TASMANIENSIS, Sauss., Mon. Guêpes Sociales, p. 66, 23, t. 6, f. 5.

This wasp is $6\frac{1}{2}$ lines in length, generally of a uniform rusty reddish colour, with the antennæ, legs, and sides of prothorax dull yellow, but the coloration is very variable, often shading into bright yellow or brown; the wings are small, orange-red, and opaque.

The nest is formed of a brown papery substance like that produced by all of these "paper-nest wasps" from some wooden surface exposed to the weather. I have often watched them on a shingle roof obtaining a plentiful supply, which, mixed with their saliva and dessicated, is formed into a fine waterproof brown paper. The nest is commenced by a stalk or pedicle about a third of an inch in length, at the apex of which is formed the first cell; two wasps generally commence the structure, and attach the first eggs to the top of the cells as soon as they have three or four completed. The larvæ soon hatch out and hang head downwards, being fed by their attendant nurses with spiders that they have first masticated and reduced to a pulp. When full-grown the young larvæ spin a silken cap over the aperture, and within a very short time appear as full-grown wasps, and at once commence to work at the nest, so that the colony increases rapidly when once they begin to hatch out.

The nests are always circular and often attain the size of an ordinary saucer; the cells are peaked at the top, but hexagonal at the apex, about 10 lines deep and 3 lines in diameter; an ordinary-sized nest three inches in diameter contains about 250 cells. This wasp is of a very domesticated disposition, being very fond of building its nest under verandahs and the eaves of houses; but as they are very aggressive when disturbed they are not always welcome additions to the household.

It has a wide range over Australia, and is very common in S. Australia, Victoria, and New South Wales.

POLISTES FACILIS, Sauss., Mon. Guêpes Sociales, p. 539.

This wasp seems to take the place of the smaller species in the south-western parts of New South Wales. I have found it very common in the Yass district.

Length 10 lines. Colour dull orange-yellow, with the vertex, coxæ, basal portion of the fore legs, and all the underside of head and thorax black ; in the middle and hind legs the black extends almost, but not quite up to the tibiæ ; the upper surface of the thorax black, except the prothorax and scutellum ; the first segment of the abdomen black, narrowly margined with yellow at the apex ; the second yellow, banded with black at the base ; the third only very slightly marked with black at the base ; on the ventral side of the base of abdomen and an oval patch extending into the third segment black. Wings pale horn-yellow with deep orange-yellow nervures, slightly clouded along the hind margins with fuscous.

P. facilis is one of the largest and most savage members of this genus that I know. It forms a brown papery nest of a slightly irregular circular form, attached by a stout pedicle, as in *P. tasmaniensis*, whose nest it closely resembles, except in the size of the cells, which are somewhat bigger, though I have never seen a very large nest formed by this species. They inflict a very severe sting, and attack one the moment they are disturbed, and as they generally construct their nests in hollow or burnt logs on the ground, the collector while turning these over for ground insects is often startled by their angry hum.

POLISTES TEPIDUS, Fabr., Syst. Ent. p. 366, 17.

The only specimens of this fine wasp that I have seen were presented to me by Mr. W. S. Dun, of the Geological Department, who informed me that they were taken with the nest on the Kogarah side of Botany Bay.

Length 10 lines. Colour black ; the antennæ, the face, jaws, a transverse narrow mark above the insertion of the antennæ, the apex of the femora, the tibiæ and tarsi of the fore and middle legs, a slight patch at the junction of femora, and the tarsi of hind legs bright orange-yellow ; the prothoracic girdle and wings reddish-yellow, slightly clouded with fuscous at hind margins ; apical portion of second abdominal segment and the whole of the following ones dull orange-yellow.

The nest is formed with a stout pedicle in the same manner as that of *P. tasmaniensis*, but the cells are very much larger.

PISON DECIPIENS, Smith, Trans. Ent. Soc. London, 1869, p. 294.

This little wasp was described from Champion Bay, W.A., but is also very plentiful in most parts of N. S. Wales.

Length 3 lines; broad black head and thorax, with the antennæ and legs dull yellow; abdomen small, much constricted at the segmental divisions, base of the first segment, a narrow line at base of second, about two-thirds of the basal portion of third, and faint markings on the anal ones black, the rest of abdomen horn-yellow.

The nest consists of four or five rounded, elongate, irregularly formed, clay cells, 4-6 lines in length, and 3-4 lines in diameter, with a smooth finely granulated surface, very thin and delicate; they are provisioned with small spiders, and the larvæ before pupating spin a stout dark brown silken cocoon.

They are not particular where they build, sometimes coming into the house and attaching the nests to clothes hanging up in a room or upon a wall in a most haphazard manner; in the bush they are sometimes attached to blades of grass or leaves. Each cell is formed separately, but they are usually attached to each other, and sometimes look like three or four little eggs made of clay.

The larvæ are much infested by one of the cuckoo or ruby-tailed flies (*Chrysis transversus*, Sm.). This is a very small species, 2½ lines in length, somewhat smaller than its host. Head, thorax, and abdomen closely and deeply punctured, of a brilliant metallic blue colour with green tints upon the sides.

The nests from which I bred these specimens were sent to me by Miss King of Homebush.

PISON SPINOLÆ, Shuck., Trans. Ent. Soc. ii. p. 79, 1837.

This is a short, stout, black wasp, six lines in length, with the face and thorax covered with fine short hairs, the abdomen oval, with the divisions of the segments marked with a silvery pubescence forming a distinct band; the wings are large, transparent, slightly clouded with brown, darkest at tips.

The nest is a neat but somewhat fragile structure, consisting of about six chambers, 4 lines in width and 5 in length, separated from each other by a thin partition; the nest is elongate, containing only one row of cells, the outer surface very much granulated from the balls of mud not being smoothed down as each is added to the structure; the walls are so very thin that it is almost impossible to remove the nest without its crumbling to pieces. Each cell, after the egg is deposited, is stored with small spiders, and when the larva has finished up the supply it spins a stout silken cocoon. This wasp is remarkable for its reckless habit of making its nest in any hole or cranny it comes across, frequently coming into houses and making its cells in a keyhole, empty rung hole in a chair, or any other aperture that takes its fancy, which slipshod choice of a home often causes the untimely destruction of its establishment.

About two months ago, while waiting for a train at the Oatley platform, I saw the stationmaster pull down a notice board, at the back of which there was a grooved hollow, which had been recently adapted by a *Pison* to form its nest; it consisted of six cells, from which I took forty torpid spiders.

This species is found in Tasmania, Victoria, S. Australia, and most parts of New South Wales. I am indebted to Miss King of Homebush for several nests, from which I have bred specimens.

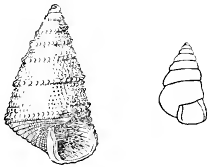
DESCRIPTION OF *CALLIOSTOMA PURPUREOCINCTUM*, A NEW MARINE AUSTRALIAN SHELL.

By C. Hedley, F.L.S.

(Communicated by permission of the Trustees of the Australian Museum.)

Calliostoma purpureocinctum, n.sp.

Shell small, turreted, solid, thick. Colour orange-yellow, with a pale lilac band ascending the spire on the peripheral bead-row; some specimens show on the periphery brown flames succeeded by lighter dashes, both vanishing at the centre of the whorl. Surface glossy. Whorls eight. First whorl and a half smooth, on the next whorl a peripheral and two minor bead-rows may be discerned. Throughout the spire the peripheral bead-row is distinguished by its lilac colour and by its larger grains, of which the last whorl bears about 40; beneath this row and margining the suture of the following whorl there runs a simple unbeaded thread. On the fourth whorl a third minor bead-row appears. By the same process of growth as the latter arose, a thread, intercalated between the bead-rows of the antepenultimate whorl, enlarges, produces small, then larger, beads, and finally equals, on the last whorl, the original series. Behind the aperture these minor bead-rows amount to six. Within the row these beads are separated by the space of their diameters, and are "strung" on a fine thread; the interval between each row is finely obliquely striated. The base is encircled by a dozen spiral threads of



C.H., *del.*

unequal size, which show an inclination latterly to produce beads; they are separated by interstices equivalent to each preceding thread. Aperture oblique, rhomboidal, peristome simple; columella continuing in the direction of the shell's axis, slightly broadening anteriorly; within nacre white, lustreless (in the beach-worn examples before me), a callous deposit within the insertion of the outer lip does not extend across the roof of the aperture to the insertion of the pillar.

Alt. 13, diam. 8 mm.

Hab.—Port Stephens, N.S.W. (Cox), and Botany Heads, N.S.W. (Hargraves).

Type in the Australian Museum.

This pretty little shell is described at the wish of, and from examples furnished by, Dr. J. C. Cox, who regarded it as new, an opinion shared by Mr. Brazier and myself. It may be suitably intercalated among the species arranged in Pilsbry's Monograph of the genus next to *C. poupineli*, Montrouzier [Man. Conch. (I.), xi. p. 350].

Dr. Cox has on several occasions received dead but well preserved specimens of this species from his collectors at Port Stephens. Some faded and broken shells in the Hargraves Collection, labelled "Botany Heads," appear to me to represent the same species.

The accompanying figure was drawn by the writer from the specimen described, with the aid of an Abbé camera lucida.

NOTE ON THE HABITAT OF THE NAKED-EYED COCKATOO, *CACATUA GYMNOPIS*, SCLATER.

By Alfred J. North, F.L.S., Assistant in Ornithology, Australian Museum.

This bird was described by Dr. Sclater (P.Z.S. 1871, p. 43) from a single living example at that time in the Gardens of the Zoological Society. As an uncertainty exists about the true habitat of this species, I embraced the opportunity of obtaining all information about two living specimens, the first I have seen, that are at present in one of the bird dealers' shops in the old George Street Markets. I there met the owner, M. Eugene Etable, a well-known collector of Australian birds, who informed me that he had taken one of them from a nesting-place in the hollow branch of a tree, and had captured the other when just able to flutter along the ground, at a place about six miles south of Burketown, in Northern Queensland. Burketown is situated 17° 47′ S. lat. and 139° 34′ E. long., on the left bank of the Albert River, about 21 miles in a direct line from the Gulf of Carpentaria; there this species is very common, and may frequently be seen flying over the town. For the purposes of breeding it resorts to the hollow limbs or trunks of trees, and deposits two pure white eggs on the decaying wood or dust which these cavities contain; usually they are low down and within six feet of the ground. M. Etable informs me it breeds only during the wet season, and is influenced by its being early or late, the normal breeding time commencing in February and continuing till the beginning of May. During the dry season they assemble in large flocks and remain in the neighbourhood of tanks and waterholes. M. Etable has observed these birds, but not in such great numbers, as far east and south in the intervening country over which he has travelled between Croydon, Hughenden and Barcaldine.

One of the specimens referred to is twelve months old, the other ten; both are hardy and live well in confinement, their owner having taken them from Burketown to Antwerp and back before bringing them to Sydney. They are very tame and like to be caressed, climbing on one's finger and gently nibbling it, and already give promise of being good talkers, their enunciation of the words "Halloo!" "Pretty Boy!" &c., fragments of the common acquired stock vocabulary of the family *Cacatuidæ*, being very clear and good, resembling that of *Licmetis nasica*. These birds have the irides very dark brown; bare space around and below the eye leaden-blue; bill whitish tinged with blue; legs and feet mealy-grey, and the younger one has only the lores stained with red, and with no rosy bases to the feathers of the crest, head, hind neck and upper portion of the breast; the naked space too around the eye is more circular in form, agreeing with the original description and figure of *C. sanguinea*, except in the colour of the bare space around the eye, which is leaden-blue instead of white, as figured by Gould in *C. sanguinea*, but to which no reference is made in the description. Dr. Sclater, however, had a living specimen in the Zoological Gardens that had been in confinement several years, and which he identified as *C. sanguinea*, at the time he described *C. gymnopis*, but the exact locality whence it came is not known.

In the British Museum Catalogue of *Psittaci*, Count Salvadori gives the habitat of *C. gymnopis*, as "South Australia (also Northern and North-Western Australia?)." Now the range of this species is known, the note of interrogation may be removed from the latter localities, for in addition to the living examples referred to from Northern Queensland there are four specimens in the Macleayan Museum at the University; two of them from the Gulf of Carpentaria and two obtained by Spalding at Port Darwin; there is also a specimen in the Australian Museum Collection, procured by E. J. Cairn, at Cambridge Gulf, N.W. Australia, in 1886.

OOLOGICAL NOTES.

By Alfred J. North, F.L.S., Assistant in Ornithology, Australian Museum.

In a collection of nests and eggs made last season by our fellow-member Mr. J. A. Boyd, of the Herbert River, North-eastern Queensland, are the nests and eggs of a species of Honey-eater and the eggs of a Cuckoo, a description of which may be of interest to members of this Society. That a portion of the avifauna of the rich coastal brushes of tropical North-eastern Queensland is derived from the adjoining Papuan fauna on one hand, and that of the Indo-Malayan fauna on the other, is well exemplified by the two species that are exhibited here this evening; *Ptilotis analoga* representing the Papuan, and *Lamprococcyx malayanus* that of the Indo-Malayan areas.

Ptilotis analoga.

This Honey-eater's being subject to local variation, more especially in size and the length of the bill, will account for the different names under which each phase has been described. It was first figured by MM. Hombron et Jacquinot in the "Voyage au Pôle Sud," as *Ptilotis analogue*, and was described subsequently in the text of the same work by MM. Jacquinot et Pucheran as *Ptilotis similis*, from specimens obtained on the western coast of New Guinea. Before the text of the "Voy. au Pôle Sud" was printed, however, Reichenbach, whose name obtains as the authority for this species, had *described* and figured it in his Handbook of *Meropinæ* under the name of *P. analoga*, originally bestowed on it by Hombron and Jacquinot. Since then varying phases of this species have been characterised from different parts of the same island under the names of *Ptilotis auriculata* and

Ptilotis flavirictus. From a single specimen obtained at Cape York, Gould described a decidedly smaller race with an unusually long bill as *P. gracilis*, of which there are similar specimens in the Macleayan Museum, obtained at Cardwell; and later on characterised another specimen received from Cape York, that had the undersurface of the body slightly streaked, and the ear patch well defined, as *P. notata.* It is worthy of note, however, that specimens collected by members of the Chevert Expedition at Cape York and the islands of Torres Straits, where Mr. Masters states it is common, as well as others obtained from Hall Sound and Katau in New Guinea, and by Goldie at Port Moresby, are precisely similar in colour, size, length of bill and extent of ear patch as the specimen procured on the Herbert River, its farthest southern limit yet recorded, and all of which agree with the original figure and description of *P. analoga.*

Nests of this species taken by Mr. Boyd were suspended by the rim and built in Mango trees at an height of five or six feet from the ground; they are cup-shaped structures, outwardly composed of the hair-like fibre of the Cocoanut Palm, dried skeletons of leaves, and pieces of the paper-like bark of the *Melaleuca*, the interior being beautifully lined with the downy glistening white seeds of the "Cotton Plant"; they measure exteriorly three inches and a half in diameter by two inches and a half in depth; internally, two inches and a half in diameter by two inches in depth. Eggs usually two in number for a sitting; they are ovoid in form, pure white, with small blotches, rounded spots and dots on the thicker end, varying in size, also in shade from a rich reddish-black to a purplish-brown, closely resembling small eggs of *Ptilotis lewinii.* A set taken on the 11th of September, 1893, measure (A) 0·92 × 0·67 inch; (B) 0·93 × 0·67 inch; another set taken the 30th of the following month measure (A) 0·92 × 0·66 inch; (B) 0·9 × 0·65 inch. Mr. Boyd has also from time to time supplied me with the following information respecting a nest of this species he had under close observation from the time it was started until the young ones left the nest. It was a most curious position selected, the nest being built upon the frond of a fern, eighteen inches from the ground, growing in a fernery attached to Mr. Boyd's house, and opposite his office to which people were constantly coming through the day ; a piano also, that was in frequent use by the children, being within fifteen feet of the nest. During the period of incubation the female sat steadily, and did not attempt to fly when looked at by one only three feet away, the nest being so deep that the whole of the bird's body was invisible except the bill. This bird was quite tame and used to fly backwards and forwards through the dining-room where a number of persons were seated at dinner. The nest was commenced on the 7th of December, and contained three eggs on the 15th inst.; two young ones were hatched on the 28th inst., and a third next day ; the period of incubation being fourteen days. The young birds left the nest on the 12th of January.

Lamprococcyx malayanus (Little Bronze Cuckoo).

The habitat of this species is the Malayan Peninsula, extending through the islands of the Indo-Malayan Archipelago to New Guinea, and ranging as far South as Cambridge Gulf on the North-western portion of the Australian Continent, and to the neighbourhood of Port Denison on the North-eastern coast.

Gould's figure of *Chrysococcyx minutillus*, in his Supplement to the folio edition of the Birds of Australia, is a faithful representation of this bird, but being copied from a dried skin lacks the bright vermilion orbital ring which is so marked a characteristic in this species. Captain G. E. Shelley, however, who has recently prepared the *Cuculidæ* for Vol. xix. of the British Museum Catalogue of Birds, pronounces Gould's type specimen of *C. minutillus*, under which name this Cuckoo is more familiarly known in Australia, to be identical with *C. malayanus* of Raffles.

For some years past Mr. Boyd has found a dark bronze-coloured egg of a Cuckoo in the nests of *Gerygone magnirostris*, varying considerably from the well-known egg of *L. plagosus*, and which I referred to when describing the nest and eggs of *G. magnirostris* in "The Ibis" last year. Recently Mr. Boyd has forwarded two spirit specimens of the Cuckoos frequenting the vicinity of where these bronze-coloured eggs were deposited. One is an adult male, *Lamprococcyx malayanus;* the other a young male, *Cacomantis castaneiventris.* Now, judging from analogy, one would reasonably expect to find the egg of the latter species of the same type as those of *Cacomantis flabelliformis* and *C. insperatus*, and I have little hesitation in provisionally referring the Cuckoo's eggs found in the nests of *Gerygone magnirostris* as belonging to *Lamprococcyx malayanus*, until Mr. Boyd has an opportunity of watching one of these Cuckoo's eggs hatched by the foster parent, and conclusively determining to which species the young bird belongs.

The Cuckoo's eggs taken from the nests of *Gerygone magnirostris* are elongate ovals in form and equal in size at each end, of a rich deep olivaceous bronze, some specimens having minute black dots on the larger end, and the surface of the shell smooth and glossy. Specimens taken during 1893 measure as follows:—(A) 0·78 × 0·53 inch; (B) 0·8 × 0·53 inch; (C) 0·83 × 0·55 inch; (D) 0·78 × 53 inch; (E) 0·82 × 0·54 inch.

In conclusion, I may here point out that eggs of a Cuckoo taken near Sydney from nests of *Rhipidura albiscapa*, *Malurus cyaneus* and *Ptilotis chrysops*, and described at different meetings of this Society by Dr. George Hurst and myself, when we both referred to them as belonging to *Cacomantis insperatus*, as it was the only other species of Cuckoo found near Sydney whose egg we were until then acquainted with, have been verified last season by finding similar eggs in the nests of *R. albiscapa*, as well as seeing in the same locality specimens of *Cacomantis insperatus*, and by obtaining a young Square-tailed Cuckoo that was being fed by the foster parents, *R. albiscapa.*

That *C. insperatus* evinces a decided preference for depositing its eggs in the nests of *Rhipidura albiscapa*, is signalised by the fact that all the eggs I know of belonging to this Cuckoo that were taken last season, both near Sydney and two hundred miles inland, were found in the nests of the White-shafted Fantail.

NOTES AND EXHIBITS.

Mr. Hedley exhibited specimens of the land shell *Flammulina rosacea*, Petterd (= ?*Helix tamarensis*, Petterd), found for the first time in N.S.W. by Mr. Cyril Quaife, who procured several living specimens in the coal mine valley, Blackheath. At this point, its northern known limit, Mr. Quaife found it associated with *Cystopelta petterdi*, Tate, and a mollusc doubtfully identified as *Helicarion verreauxi*, Pfeiffer. These southern forms here assume a subalpine position.

Mr. North exhibited specimens of *Ptilotis analoga*, with nest and eggs, and *Lamprococcyx malayanus* and eggs referred to in his paper. Also clutches of the following eggs taken near Sydney last season, each set containing in addition the egg of a different species of Cuckoo, viz., *Ptilotis auricomis*, with the egg of *Cacomantis pallida* ; *Acanthiza pusilla* with egg of *Cacomantis flabelliformis* ; *Rhipidura albiscapa* with egg of *Cacomantis insperatus* ; *Malurus cyaneus*, with egg of *Lamprococcyx basalis*, and *Geobasileus chrysorrhœa* with egg of *Lamprococcyx plagosus*.

Mr. North also drew attention to several species of rare birds at present in the George-street Markets, among which may be pointed out *Poëphila leucotis*, *Donacicola pectoralis*, and *Lophophaps plumifera*, all captured in the neighbourhood of Croydon and Hughenden, Northern Queensland.

Mr. Maiden showed, on behalf of Dr. Bancroft, the following, in illustration of his paper, viz.: Plant of *Blechnum serrulatum*, rhizomes of the same, and the stones used for pounding them ; also photographs showing (*a*) an aborigine preparing the fern-root, (*b*) one of the fern swamps, and (*c*) the mode of collection of the fern. Also stones used by the aborigines for pounding Bunya Bunya nuts for food.

Mr. Hamilton showed specimens of rare or local butterflies (*Casyapa beata*, Hew., ♂♀, and *Heteronympha mirifica*, Butl.)

from Illawarra. *C. beata* is apt to escape notice, being crepuscular in its habits. *H. mirifica* was seen in numbers wherever the brush vegetation occurs, but usually flying too high for capture. He also showed examples of the bees concerned in the fertilisation of *Candollea*, and drawings illustrative of his paper.

Mr. Fred. Turner exhibited (1) a flowering specimen of the Californian Poppy (*Romneya coulteri*), grown near Goulburn by Mr. Gibson—supposed to be the first time this plant has flowered in New South Wales; (2) a flowering specimen of the typical form of the N. American "Stag's-horn Sumach" or "Vinegar Tree" (*Rhus typhina*) grown at Wagga—also supposed to be the first instance in which the plant has been known to flower in this Colony; and (3) a fruiting branch of *Ailanthus glandulosa* from the County of Cumberland.

Mr. Waite exhibited specimens of the various species of *Typhlops* referred to in his paper.

Mr. Froggatt showed a number of wasps with their nests in illustration of his paper.

Professor Wilson read the following Note entitled "Observations upon the Anatomy of the 'dumb-bell-shaped Bone' in *Ornithorhynchus*, with a new view of its Homology":—

"The 'dumb-bell-shaped bone' is not confined to the palatine region, but both dorsally and posteriorly it is in intimate relation to the nasal septum. From the dorsal part of its hinder extremity it sends backwards a distinct vomerine spur, about 3 mm. in length, which is bifurcated posteriorly and grooved along its dorsal border, forming a splint for the ventral edge of the cartilaginous nasal septum. The tips of this bifid spur are connected with those of the anteriorly bifid end of the true vomer by means of a strong 'vomerine ligament,' varying in length from about 2 mm. downwards. In coronal sections this ligament is seen to possess the same sectional shape as the vomerine spurs, and to be structurally and morphologically continuous with the bone at either end. The vomerine spur lies quite dorsal to the palatine plate formed by the maxillæ, and it extends backwards to a plane from 2-3 mm. behind the tip of the anterior median process of the latter, from which it is separated by an interval. This interval forms a wide passage of communication (1 mm. vertically), below the nasal septum, between the nasal cavities of opposite sides, and it is lined by columnar epithelium like the neighbouring parts of these cavities. The 'dumb-bell-shaped bone' is a true 'anterior vomer' formed by the fusion of bilaterally symmetrical halves; and both in its nasal and in its palatine relations it resembles the palatine lobe of the vomer in *Caiman niger*."

WEDNESDAY, APRIL 25th, 1894.

ADJOURNED ANNUAL GENERAL MEETING.

The President, Professor David, B.A., F.G.S., in the Chair.

The Secretary read the report of the Auditors, who, after an examination of the books, vouchers, and securities, certified the accounts for 1893 to be correct.

MONTHLY MEETING.

The President, Professor David, B.A., F.G.S., in the Chair.

Mr. J. H. Gatliff, of Melbourne, was introduced as a visitor.

DONATIONS.

"Comité Géologique, St. Pétersbourg — Bulletin." T. vi. (1887), Nos. 2-3; T. xii. (1893), Nos. 3-7, et Supplement. *From the Committee.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 5-6. *From the Government Secretary.*

"Zoologischer Anzeiger." xvii. Jahrg. Nos. 440-441. *From the Editor.*

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), Nos. 2-3. *From the Editor.*

"American Naturalist." Vol. xxviii. Nos. 326-327 (Feb.-Mar., 1894). *From the Editors.*

"Revista de Sciencias Naturaes e Sociaes." Vol. iii. No. 9 (1894). *From the Society.*

"Hand-List of the Aquatic Mollusca inhabiting South Australia." By D. J. Adcock (1893). *From O. B. Lower, Esq.*

"Société Belge de Microscopie—Bulletin." T. xx. (1893-94), No. 4. *From the Society.*

"Johns Hopkins University Circulars." Vol. xiii. No. 109. *From the University.*

"American Museum of Natural History—Bulletin." Vol. vi. (1894) Sheets 2-5, pp. 17-80. *From the Museum.*

"Société Zoologique de France—Bulletin." T. xviii. (1893): "Mémoires." T. vi. (1893). *From the Society.*

"Royal Microscopical Society—Journal, 1894." Part 1. *From the Society.*

"Zoological Society of London—Abstracts," 20th Feb. and 6th March, 1894. *From the Society.*

"Scottish Microscopical Society—Proceedings." Sessions 1889-90, 1891-92, 1892-93. *From the Society.*

"Victorian Naturalist." Vol. x. No. 12 (March, 1894). *From the Field Naturalists' Club of Victoria.*

"United States National Museum—Proceedings." Vol. xv. (1892): "Bulletin," Nos. 44-46 (1893). *From the Museum.*

"United States Department of Agriculture—Division of Entomology—Insect Life." Vol. vi. No. 3 (1894). *From the Secretary of Agriculture.*

"Californian Academy of Sciences—Memoirs." Vol. ii. No. 3 (1894). *From the Academy.*

"Natural History Society of New Brunswick—Bulletin." No. xi. (1893). *From the Society.*

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Bd. xxi. (1894), No. 1. *From the Society.*

"Russisch-Kaiserliche Mineralogische Gesellschaft zu St. Petersbourg—Verhandlungen." Zweite Serie. xxx. Bd. (1893). *From the Society.*

"University of Melbourne — Examination Papers — Final Honour, Degrees, &c." Feb., 1894. *From the University.*

"Geological Survey of India—A Manual of the Geology of India" (2nd edition) [1893]: "Memoirs—Palæontologia Indica." Series ix. Vol. ii. Part 1 (1893). *From the Director.*

"Australasian Journal of Pharmacy." Vol. ix. No. 100 (April, 1894). *From the Editor.*

"Sciencias Naturaes—Annaes." Primeiro Anno. No. 1 (Jan., 1894). *From the Editor.*

"Department of Agriculture, Victoria—Course of Lectures delivered by Officers of the Department during 1891": "Illustrated Description of Thistles": "Report on Rust in Wheat Experiments": "Revised List of Fruit Trees, &c.": "Report by Mr. D. Wilson, Dairy Expert, of Visit to Europe." *From the Secretary of Agriculture.*

"Free Public Library, Sydney—Annual Report of Trustees for 1893. *From the Trustees.*"

"Radcliffe Library, Oxford University Museum—Catalogue of Books added during 1893." *From the Trustees.*

PAPERS READ.

A CONTRIBUTION TO A FURTHER KNOWLEDGE OF THE CYSTIC CESTODES.

By Jas. P. Hill, F.L.S., Demonstrator of Biology, Sydney University.

(Plates III.-V.)

The following paper may for convenience be divided into three parts.

Part i. includes the descriptions of two new species of the genus *Piestocystis*, Diesing,—the first from the copper-head snake, *Hoplocephalus superbus*: the second, a somewhat remarkable proliferating form from the lizard *Lialis*—and the general considerations following therefrom.

Part ii. is a description of a new species of *Monocercus* from the earthworm *Didymogaster sylvatica*, Fl.

Part iii. contains an account of the development of the scolex of *Synbothrium*, a genus of *Tetrarhynchidæ*.

I must here express my great indebtedness to Prof. Haswell for his ever ready advice, and for much valuable assistance during the course of my work; and also my best thanks are due to Mr. Masters, Curator of the Macleay Museum, and to Mr. H. Throsby for the material in which the cysts described in Part i. were found; also I have to thank Herr W. Musmann for much assistance with the literature.

PART I.

1. On a new Species of *Piestocystis* from *Hoplocephalus superbus*.

The cysts on which the following account is based were found imbedded in the peritoneum surrounding the intestine of a single specimen of the "copper-head" snake, *Hoplocephalus superbus*, common in certain parts of New South Wales. The cysts when fresh appeared as opaque oval bodies, the largest of which measured 5 mm. in length and 4 mm. in breadth. Each cyst encloses a single Cysticercus, which fills up almost completely the cavity of the cyst, in this respect contrasting strongly with the Lialis cyst, in which, as will be seen in the following, the cyst cavity is very large and the one or more Cysticerci lie perfectly free within it.

Structure of the cyst wall.—In section (Fig. 1) the cyst wall is found to be of considerable thickness and to differ in structure in its inner and outer regions. The inner part, which immediately encloses the Cysticercus, is composed of a homogeneous layer (Fig. 1, *h. l.*) very similar in appearance and mode of staining to the cuticle of the Cysticercus. External to this homogeneous layer and occupying the central part of the cyst wall is a region (*l. l.*) having an irregularly laminated appearance and containing large spaces, probably lymph spaces. External to this and forming the outer layer of the wall is a feebly staining region of a fibrous nature (*f. l.*) and with numerous spaces. In the fresh cyst the outermost layers of the wall can be easily removed with needles, leaving the inner layer as a clear membrane closely surrounding the Cysticercus.

Seeing that the cyst wall is marked out by its optical characters and its histological structure into these two regions, I am inclined to attribute to each a distinct origin. The outer region, consisting of the laminated zone and the fibrous zone, is, I believe, derived from the peritoneum of the host by pathological change, while the inner homogeneous layer probably represents a direct derivative of the six-hooked embryo, and corresponds to the lining of the cyst in Lialis, to the so-called cyst of *Monocerci*—in a word, to what Villot* terms the blastogen or blastogenic vesicle.

Structure of the Cysticercus.—When the Cysticerci are liberated from the cyst, they are found to be somewhat pear-shaped bodies

* "Mémoire sur les cystiques des Ténias." Ann. des Sci. Nat. Zool. 6me série, Tome xv. (1883).

broader at the anterior end, in which the head lies inverted, and tapering to a blunt rounded posterior end. They varied somewhat in size, the largest measuring 3 mm. in length and 2 mm. in thickness at the broader anterior end, while the smallest were 1·5 mm. in length and 1 mm. in thickness, exactly half the size of the largest. When examined under compression the Cysticercus is seen to possess numerous close-set calcareous corpuscles, uniformly distributed over the body. They are mostly in the form of short rods with rounded ends, measuring in greatest length ·04 mm.; others have a more oval or rounded outline. At the broad end the head lies invaginated. It is provided with four large suckers whose cavities communicate with the cavity of invagination of the head. Hooks are altogether absent, but at the bottom of the invagination cavity of the head, situated centrally in what will in the everted condition form the apex of the head, is a small rounded body, representing a rudimentary frontal sucker (Fig. 2, *f. s.*). As the head was not readily everted in water, I have not been able to examine a completely everted Cysticercus. This is the more to be regretted, for in the everted condition the relations of the frontal sucker could have been more easily made out. It appears from the examination of preserved specimens that the suckers can be protruded separately. Fig. 2 represents a nearly median longitudinal section through such a Cysticercus with partially evaginated head, the knob-like mass projecting at the anterior end being one of the protruded suckers in section. In this section the invagination cavity appears as a wide opening, but transverse sections of a Cysticercus with the head fully inverted show that it is comparatively narrow and lined by cuticle continuous with the external cuticle of the body. It is filled up with a granular deeply staining material which is apparently derived from the coagulated fluid which surrounds the Cysticercus. Fig. 3 represents a section through the inverted head of a Cysticercus at the level of the suckers. Their walls are composed of numerous small radially elongated cells and their cavities open into the invagination cavity. The ground tissue immediately surrounding the suckers is seen to be disposed in a circular manner, giving rise to a definite sheath (Fig. 3, *r. c.*) which surrounds the inverted head. This sheath represents the "receptaculum capitis" of Leuckart, concerning which he says,* "The receptacle has least independence in the bladder worms with parenchymatous bodies such as we have seen in *Cysticercus (Piestocystis) variabilis* and its allies, for there it is not only connected with the mass of the head, but, like the ordinary body muscles, bound up with the tissue of the bladder." Along with the receptacle, mention must be made of the numerous muscular or elastic fibres which run through the body tissue. They are composed of a homogeneous substance which stains uniformly and shows no trace of cellular structure. In Fig. 3 in the receptacle they are seen to be more or less radially arranged, while in Fig. 2 some of the fibres are seen to take a longitudinal course, passing forwards like the similar fibres in the Lialis Cysticercus, to be inserted into the head.

The bladder cavity in this form is represented by an irregular cavity occupying the centre of what represents the caudal bladder of ordinary Cysticerci, and not distinctly marked off from the surrounding ground tissue. The cavity is filled by a granular material consisting of a homogeneous matrix with granules which stain deeply with cochineal, and which represent the products of degeneration of the original central tissue, which in the Cysticercus from Lialis (*seq.*) persists unaltered.

Frontal sucker.—The frontal sucker is situated medianly in the inner part of the invaginated head, in what will in the evaginated condition be its apex. In sections (Figs. 2 and 4), both by its structure and staining properties, it can readily be distinguished from the surrounding tissue. At its narrower anterior end is a slit-like aperture which places the cavity of the sucker in communication with the cavity of invagination of the head. The sucker cavity (Fig. 4, *s. c.*) is much wider than its opening, but is very shallow, so shallow, indeed, that the aperture and the cavity only

* "Parasites of Man," English Edition, p. 347.

extend through three thin sections, of which the middle one is represented in Fig. 4. The cavity is lined by a delicate layer of cuticle just as Monticelli describes* for the terminal sucker of *Scolex polymorphus.* The wall of the sucker he describes as consisting of radial fibres similar to those of the suckers of Trematodes. In the form under consideration, nuclei are readily visible in the wall, but the cell boundaries could not be made out, nor were the radial fibres distinguishable.

In the tissue surrounding the sucker are numerous radially and circularly running fibres. The radial fibres correspond to what Monticelli calls† the retractors of the terminal sucker. Like the latter the radial fibres pass out from the central sucker and some of them can be traced to the inner sides of the lateral suckers. According to Monticelli, the retractors of the terminal sucker in *Scolex polymorphus* are inserted into the dorsal side of the four suckers. That the structure here termed the frontal sucker represents the similarly named structure in *Scolex polymorphus*, though in a somewhat reduced condition, is evident from the foregoing.

The morphological value of the frontal sucker of *Scolex polymorphus* is considered at some length by Monticelli in the paper already referred to.‡ He regards the frontal sucker and its retractors as homologous with the frontal sucker and its musculature in *Amphilina*, and as homologous with the buccal sucker of Trematodes, as representing in fact the lost digestive tract of Cestodes.

I quote his conclusions in full :—"In breve, saremno per tutti i fatti esposti indotti ad ammettere una forma ancestrale primitiva trematodiforme di Cestode fornita di bocca ed intestino, il quale, è a poco a poco scomparso per effetto del parassitismo. E ad attestare

* "Contribuzioni allo studio della fauna elmintologica del Golfo di Napoli,' Mitt. Zool. Stat. Neap. B. viii. 1888, p. 114.

† *Loc. cit.* p. 118.

‡ *Loc. cit.* pp. 118 and 121.

la presenza di questo intestino scomparso, vi è in alcuni Cestodi adulti, molto semplici, una ventosa boccale con le sue glandole salivari e la sua muscolatura, come condizione permanente *(Amphilina)* ed in altri Cestodi : (1) allo stato larvale, in Cestodi meno differenziati, evvi una ventosa anteriore per struttura e funzione paragonabile alla ventosa dei Trematodi, con una muscolatura propria (scolici di Tetrabothridæ : Call., Tetrab., Phyll.) ed in quelli più differenziati (Tetrarhynchidæ) un rudimento di ventosa sotto forma di fossetta *(Anthocephalus elongatus)* nel quale sboccano le glandole salivari, e rudimenti muscolari alla estremità dello scolice *(Anth. elongatus* et *Ant. reptans)* ; (2) allo stato adulto poi vi sono ora dei rudimenti di ventosa anteriore *(C. corollatum, C. filicolle, Rhynchob. corollatum)*, ora delle glandole salivari *(Tetrabothrium longicolle)*, Zschokke, ora dei rudimenti muscolari *(Calliobothrium* e *Tenie)*."* In view of these observations of Monticelli, it is interesting to find Grassi and Rovelli,† from a totally different standpoint, viz., that of the development of the Cysticercus of *Tænia elliptica*, instituting a comparison between the rostellum of certain Cestodes and the pharynx of Trematodes.

That the rostellum and frontal sucker are homologous structures is strikingly borne out by Leuckart's description‡ of the rudimentary rostellum of *Tænia saginata*. He says :—"So far then the rostellum of *Tænia saginata*, in spite of its comparatively weak development, possesses essentially the structure seen in the hook-bearing cystic tapeworms. But, while in the latter the rostellum is covered by a prominent layer of parenchyma in which the anterior processes of the hooks are embedded, this coating is represented in *T. saginata* only by an annular diaphragm, which lies as a lip on the outer wall of the above-mentioned lenticular mass. This is more or less markedly arched according to the curvature of the

* *Loc. cit.* pp. 122-123.

† Embryologische Forschungen an Cestoden, Centralb. f. Bact. u. Parasit. B v. 1889, p. 376.

‡ *Loc. cit.* p. 434.

latter, and has in its centre an opening which is expanded below and appears sometimes rather deep, since the lenticular body has not unfrequently a depression in its anterior surface. This is the opening long since observed by Bremser and occasionally by other observers, and the appearance of which has given rise to the formerly prevalent idea that the tapeworms possessed a mouth opening between the suckers," and further he regards "this pore (frontal sucker), along with the muscular apparatus lying below it (the rostellum or bulbus), as the morphological equivalent of that sucker which is found between the lateral suckers, not only in Rudolphi's Scolex and the associated Phyllobothria, but also in some Tæniadæ."

Admitting then that the structure under consideration in *T. saginata* is the homologue of the frontal sucker, found in a more highly developed condition in other forms, and accepting Leuckart's further observation, viz., that the rostellum in the hook-bearing cystic worms passes through a developmental stage similar to that which is retained as the permanent condition in *Tænia saginata*, we have clear proof of the homology of the two structures. The disappearance of the hook-fundaments which surround the pore of the sucker in *T. saginata* is certainly due to degeneration, but in the sucker itself we have clearly the persistence in the adult of a developmental stage, early lost in the other hook-bearing Tæniadæ. These facts tend clearly to show that phylogenetically the frontal sucker is the older of the two structures, and that as specialisation has proceeded it has been replaced by the rostellum.

If this be so, then we must regard the condition in *Polycercus Didymogastris*, where, as we have shown,* the head, with the rostellum, arises in the centre of a cellular mass, as an example of the most highly specialised condition in the series.

Excretory System.—In the living Cysticercus examined under compression, the longitudinal trunks of the excretory system were

* "On *Polycercus*," P.L.S.N.S.W. (2), Vol. viii. p. 373.

readily visible. Two large vessels are present on either side and extend throughout the whole length of the body. Numerous smaller canals were also visible, which seemed to communicate with one of the main trunks on either side. The canals contained a liquid in which were suspended bright refractive granules, rounded or oval in form, in rapid circulation. The direction of the currents in the compressed Cysticercus was of an inconstant character ; at one moment the liquid with the granules might be seen flowing towards the head, then the direction of the current would be reversed and the granules flow towards the posterior end.

These observations, taken from my rough notes made at the time of examination, do not agree with Monticelli's account* in *Scolex polymorphus.* Whether this reversal of the direction of the current is a normal feature in our Cysticercus or abnormal and due to the great compression to which it must be subjected before any of the internal details can be made out, I am unable to say. But Monticelli's observation that by an undulatory movement of the walls of the descending trunks the contained liquid transports the calcareous corpuscles to the head, inclines me to the latter belief.

The refractive granules, referred to above, represent calcareous corpuscles similar to those Monticelli has described as existing in the descending trunks of *Scolex polymorphus*, and which he regards as similar to those described by Fraipont in the accessory branches of the great trunks of the excretory system of *Diplostomum.*

Fraipont† in *Scolex trygonis pastinacæ* describes two longitudinal vessels on either side, of which one is smaller than its neighbour. The two larger vessels open posteriorly into the pulsatile vesicle, while anteriorly they curve back to form the smaller vessels which at the posterior end resolve themselves into

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* *Loc. cit.* p. 126.

† "Recherches sur l' appareil excréteur des Trématodes et des Cestodes," Archives de Biologie, T. ii. 1881, p. 5.

a network around the pulsatile vesicle. The larger vessels he terms the descending trunks, and the smaller the ascending. Monticelli confirms* Fraipont's description as to the difference in size of the vessels and also as to the mode of termination of the vessels.† Pintner,‡ on the other hand, maintains that all the four canals in the young forms terminate in the contractile caudal vesicle, and such is the condition in the Cysticercus under consideration. In sections, the larger descending (Fig. 3, *d. v.*) and the smaller ascending canals (*a.v.*) can be readily distinguished, two on each side. They differ not only in size but in the thickness of their walls. Both are lined by a cuticular membrane, which, however, is thicker and much more distinct in the case of the smaller ascending canal. Posteriorly the two vessels on each side unite with each other, then pass inwards and backwards to open into a short terminal canal which communicates with the exterior. The terminal canal is lined by a very definite cuticle, which when traced back is found to grow thicker and to become continuous with the external cuticle of the Cysticercus.

Structure of the cuticle and the subcuticular layer.—The cuticle (Figs. 5 and 6) consists of a thick layer of uniform depth, which with cochineal shows a differentiation into an outer thicker layer and an inner thinner more deeply staining layer. The external surface is smooth, no hair-like appendages being present, as Monticelli§ describes for *Scolex polymorphus.*

As Leuckart describes‖ for Cestodes generally, there is, immediately below the cuticle and in close contact with it, a thin layer of circularly disposed elastic fibres (Figs. 5 and 6, *c. f.*); internal to this circular layer is, in transverse sections, a layer of bright refractive bodies (Fig. 5, *l. f.*), separated from each other by interspaces. They represent the transverse sections of a layer of

* *Loc. cit.* p. 124.

† *Loc. cit.* p. 127.

‡ As quoted by Monticelli.

§ *Loc. cit.* p. 133.

‖ "Parasites of Man," p. 290.

longitudinally running elastic fibres. The outer circular layer and the inner longitudinal together constitute the "musculo-dermal" layer of Leuckart, but which is perhaps here better termed a "dermo-elastic layer." Griesbach describes* in *Solenophorus megalocephalus*, below the cuticle, a similar layer of circular elastic fibres, while the longitudinal fibres correspond to his sub-cuticular "Langsmuskeln."

Internal to the "dermo-elastic" layer is the layer termed by various authors subcuticula, subcuticular or hypoderm layer, or the layer of matrix cells.

The subcuticula of the Hoplocephalus Cysticercus is composed of a layer of radially elongated cells, which appear somewhat triangular in transverse section (Fig. 5, *s. c.*), with their broad ends directed outwards and their narrow ends inwards ; in longitudinal section (Fig. 6, *s. c.*) they appear more spindle-shaped and their narrow ends are prolonged for some distance into the body tissue. They possess deeply staining nuclei, which, as Steudener has noted generally for Cestodes, may be situated in any part of the cell, sometimes near the middle, at other times nearer the base or apex, "so that they appear not in a line but alternating in a somewhat broad zone."†

As Roboz‡ finds in *Solenophorus megalocephalus*, the cells composing the subcuticula do not abut directly on one another or on the "dermo-elastic" layer, but are separated from each other and from the dermo-elastic layer by a finely granular matrix (Fig. 5, *m.*). Monticelli,§ apparently not recognising the existence of this intercellular matrix, inclines to the belief that the spaces between the cells are due to the effect of the reagents used, and very probably also, as Pintner says, to the state of contraction or extension

* "Beiträge sur Kenntniss der Anatomie der Cestoden," Archiv f. Mik. Anat., Band xxii. 1883, p. 571.

† Leuckart, "Parasites of Man," p. 288.

‡ Zeit. f. wiss. Zool. xxxvii. ; Abstract Journ. Roy. Micr. Soc. Vol. ii. Ser. 2nd, 1882, p. 785.

§ *Loc. cit.* p. 136.

of the body. No doubt the latter factor does, to some extent, influence the closeness or remoteness of the subcuticular cells, but that it does so in only a very slight degree is shown by the fact that in invaginated Cysticerci (*i.e.*, in the most contracted condidion) these spaces are always recognisable between the cells.

Ground tissue.—The ground tissue (the ground parenchyma, ground substance, body parenchyma, of various authors) consists, as Griesbach describes* for *Solenophorus* and Hamann† for *Tænia lineata*, of a granular matrix, in the outermost part of which the subcuticular cells lie embedded. It contains, internal to the subcuticula, numerous rounded, fusiform or stellate cells, the nuclei and cell bodies of which are clearly distinguishable.

Certain of these cells lying nearer the subcuticula have an oval nucleated cell body, which is produced on opposite sides into two narrow processes, the outer of which can be traced into the space between two adjacent subcuticular cells and is probably inserted into the "dermo-elastic" layer; the inner process passes for some distance into the ground tissue. These cells probably function as muscular cells. Zograf,‡ in *Solenophorus megacephalus* and *Triænophorus nodulosus*, describes and figures cells "de forme etoilée, avec leurs longues excroissances en forme de rayons qui, d'un côte, s'élèvent entre les cellules de la matrice jusqu' à la cuticle, et, de l'autre, s'enfoncent dans le parenchyme du ver et s'y rattachent aux cellules semblables du tissu conjonctif du parenchyme." These star-shaped cells closely agree in their relationships with the cells described above. With the exception of the elastic fibres already described as occurring in the ground tissue, no distinct bundles of longitudinal muscle fibres were recognisable.

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* *Loc. cit.* p. 527.

† Zeit. f. wiss. Zool. xlii. 1885; *vide* Rolleston's "Forms of Animal Life," 2nd ed. p. 226.

‡ "Les Cestodes, offrent-ils des Tissus ectodermiques?" Archives Zool. Exp. et Gen. 2nd Ser. T. x. 1892, No. 3, p. 339.

The inner region of the matrix contains scattered nuclei, the cell bodies of which were not distinct. Ill-defined spaces occur here and there in the matrix, but the definite lacunæ figured by Griesbach* for *Solenophorus* do not exist in this form.

Calcareous corpuscles occur throughout the whole thickness of the body tissue, but are specially aggregated in a zone situated some distance below the subcuticula.

In Cysticerci which have been stained by an acid fluid, such as Ehrlich's acid hæmatoxylin, and afterwards treated with acid alcohol, these bodies are dissolved and for the most part disappear. Their position is, however, indicated by circular spaces (Fig. 5, *r. c. c.*) surrounded by a wall and clearly marked off from the surrounding matrix.

Prof. Haswell,† in reference to the calcareous corpuscles in the parasitic flat-worm from the frog, says:—"From their appearance when acted on by dilute acid, it would appear that the two parts of the corpuscle are of different composition, the inner part becoming, before it is entirely dissolved, converted into a cluster of granules, while the outer part never becomes granular, but only gradually becomes less and less distinct till a fine outline alone remains." In sections treated with acid reagents, the cluster of granules representing the inner part of the corpuscle can in many cases be distinguished lying in a cavity which is bounded by a wall representing the wall of the cell in which the corpuscle is formed. At one point on the wall the original cell nucleus can be recognised.

Immediately external to the zone containing the calcareous corpuscles, in sections from Cysticerci which have been stained with a neutral fluid such as cochineal, numerous round spaces can be seen, containing a number of rounded or oval granules (Fig. 6, *c. n. c.*), similar in optical characters and staining properties to

* *Loc. cit.* Taf. XXI. figs. 1 and 2.

† P.L.S.N.S.W. Vol. v. (2), p. 664.

the ordinary calcareous corpuscles. In some cases the spaces contain one or more large granules with a number of small ones, in others the small granules are alone present. Their very definite form goes against the belief that they are due to the action of the fixing fluid (corrosive sublimate) or the staining fluid (cochineal). It may be that they represent cells which produce instead of one large corpuscle, a number which lie free in their cavities.

2. On a proliferating Species of *Piestocystis* from *Lialis*.

A living specimen of the widely distributed but somewhat rare lizard *Lialis Burtonii*, Gray, for which I am indebted to Mr. Masters of the Macleay Museum, was found on dissection to be infected with cysts of a somewhat remarkable character. Each cyst contained from one to three Cysticerci, which lay quite free in the cavity of the cyst. In the fresh condition the cysts appeared as vesicular elevations of the wall of the small intestine, along the whole length of which they were found, usually placed singly, but in some cases two occurred in close apposition, with a common wall between them. The largest cyst observed measured 1·75 mm. in diameter. Through the kindness of Mr. R. Etheridge, Junr., Acting Curator of the Australian Museum, and of Mr. Masters, I had the opportunity of examining six spirit specimens of *Lialis*, and in two of these the cysts were again encountered, occupying the same position as described for the living form. When the living cysts are removed from the wall of the intestine and the cyst wall ruptured with needles, the cyst collapses owing to the escape of the Cysticerci and the fluid which surrounds them. In the fresh specimen examined, two Cysticercoids were found in the greater number of the cysts, one usually larger than the other; in a few one Cysticercus only was found, but seeing that in cysts containing two Cysticerci one was larger than the other, and also judging from certain appearances seen in entire cysts mounted in glycerine and in a series of sections, I am inclined to believe that the cysts with only one Cysticercus had not advanced so far in development as the cysts containing two. In one of the spirit specimens examined, a cyst was found containing three equally and fully developed Cysticerci (Fig. 7).

Structure of the cyst wall.—The outer wall of the cyst is composed of a fibrous layer (Fig. 8, *f. l.*) continuous with the muscular layer of the wall of the intestine and doubtless formed from it by the replacement of its muscular elements by fibrous tissue. It contains scattered cells, blood vessels, and lymph spaces and is covered externally by peritoneum. Internal to this fibrous outer wall and lining the cavity of the cyst is a thin layer of slightly staining homogeneous substance, with flattened nuclei on its inner face (*h. l.*). As in the case of the cyst wall of the Cysticercus from Hoplocephalus, I attribute to these two well-defined parts of the wall a distinct origin. The outer wall is a product of the tissues of the host, while the thin inner lining of the cyst cavity, together with the cellular network in its interior (*seq.*), are the direct derivatives of the six-hooked embryo, representing the proscolex or blastogen of Villot.

The cavity of the cyst is occupied by a branching network of cells, the nucleated cells from which the anastomosing processes arise being situated irregularly in the angles between the meshes. Round the periphery of the cavity of the cyst the processes of these branching cells become continuous with the inner lining of the cyst wall, a fact which supports the view expressed above, that the inner lining of the cyst is an integral part of the parasite and not derived from the host.

Structure of the Cysticerci.—The Cysticerci lie embedded in this network, and, as they occur naturally in the cyst, are small rounded or oval bodies, about ·75 mm. in diameter, and with the head invaginated at the broader anterior end (Fig. 9). When the cyst wall is ruptured and the Cysticerci allowed to escape in a drop of water, the head is immediately evaginated and they begin to creep about actively; the change of shape is so remarkable that the movement might almost be described as amœboid.

The evaginate Cysticerci (Fig. 10) measure from 1·25 to 2 mm. in length. In each can be distinguished an anterior or head end, conical in form and provided with four large well-marked protrusible suckers, which passes gradually, by way of a narrow neck region, into the posterior much wider and longer region, which Leuckart considers as the homologue of the caudal bladder of the ordinary bladder worms.

The whole body is invested in a layer of cuticle which in the head region is covered by numerous very minute backwardly directed spinules ·002 mm. in length. Hooks are altogether absent. Numerous minute black points are visible all over the cuticle. These may be the external openings of pore canals, but sections did not reveal their existence in the cuticle. The posterior part of the Cysticercoid contains very numerous uniformly distributed calcareous corpuscles, which are most abundant in the superficial layers of the body tissue, but occur in the more centra tissue as well. They vary in shape from round to angular and are almost entirely confined to the posterior region, only a few being found between the suckers of the head.

The excretory system opens at the posterior end of the Cysticercus by a short tube, which in the living form is seen to be pulsatile. It is lined by a continuation of the outer cuticle and in sections is visible as a minute tube with a cuticular wall passing forwards for a short distance.

In the inverted Cysticercus the head lies inverted in the central tissue of the body, and, as in the typical bladder worm, the cavity of invagination is in free communication with the exterior, and into it the cavities of the four suckers open. Fig. 11 represents a transverse section at the level of the suckers. Just as in the case of the Hoplocephalus Cysticercus, the invaginated head is surrounded by a thick envelope of circularly arranged tissue representing the receptacle of the head. In the superficial region of the body tissue in the posterior part of the Cysticercus, and especially clear in Cysticerci preserved in Flemming's Fluid, are bundles of elastic fibres which run towards the head, and as they do so widen out to become inserted into it. They, like the similar longitudinal fibres in the Cysticercus from Hoplocephalus, probably have to do with the invagination of the head.

In histological structure the Cysticercus under consideration agrees closely with the Cysticercus from Hoplocephalus, in which I have gone into detail more fully. Below the cuticle the outer circular and inner longitudinal layers of elastic fibres can be recognised, and internal to these the subcuticula, consisting of a richly nucleated layer of radially elongated cells, whose outlines, however, owing to the small size of the Cysticercus, are difficult to make out.

The ground tissue is composed of a matrix with scattered nuclei, but here, as distinguished from the Hoplocephalus Cysticercus, the posterior part is solid, there being no indication of a central cavity. In this respect it agrees with two forms mentioned by Leuckart,* "one from the sub-epidermal tissue of the nightingale and another from the body cavity of *Lacerta vivipara (Piestocystis Dithyridium*, Diesing)," in which no bladder cavity is present.

As to the development of the Cysticerci, the material at my disposal did not offer any certain developmental stages, but it seems probable that the Cysticerci arise by a process of proliferation from the thin inner lining of the cyst cavity, which, together with the cellular network in the interior of the cyst, I interpret as the direct derivative of the six-hooked embryo, representing the blastogen of Villot. The small mass of cells attached to the lining of the cyst in Fig. 8 probably represents the first stage in development of one of the Cysticerci. This bud probably increases in size, becomes separated from the wall, and comes to lie free in the cavity of the cyst, forming a mass of cells such as are seen in the right hand corner of the cyst cavity in Fig. 8. Later, round this mass the cuticle is differentiated, and finally by an invagination at one end the head is developed, the suckers developing on the interior of the invagination cavity.

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* "Parasites of Man," p. 343.

General Considerations.

Diesing* divides the cystic forms into four genera :—(1) *Echinococcus*, (2) *Cœnurus*, (3) *Cysticercus*, (4) *Piestocystis*. With the two latter we are for the present alone concerned.

According to Diesing the presence or absence of hooks serves to distinguish the genus *Cysticercus* from the genus *Piestocystis;* the Cysticerci are armed forms, the Piestocystes unarmed, and it is clearly among the unarmed Piestocystes that we must look for the relationships of the two forms described in the foregoing; they are both the cystic forms of hookless Tæniæ.

Villot,† basing his classification on the mode of formation of the caudal bladder, has divided the cystic forms into two groups. His first group includes cystic forms whose caudal vesicle arises from the proscolex by simple growth and modification of structure, without, strictly speaking, the production of any new part. His second group includes cystic forms in which the caudal vesicle arises from the proscolex by a process of budding, *i.e.*, by the addition of a new part. In the first group he includes the three genera, *Cysticercus*, *Echinococcus*, and *Cœnurus*, and it is with the first of these genera, with the Cysticerci properly so-called, that he classes the forms included in Diesing's genus *Piestocystis*. He says‡ :—"L'état inerme, pas plus que l'état armé, ne peut caractériser une coupe générique parmi les Cystiques; et il est bien évident que le groupe des *Piestocystis* doit disparaître de la nomenclature." In support of this view he instances the case of *Tænia saginata*, a form which in the adult has no hooks and only a rudimentary (persistently embryonic) rostellum, but whose affinities structurally are with the armed Tæniæ.

Leuckart,§ however, has shown that the Cysticerci of this form, "although the descendants and young forms of a hookless tape-

* Systema Helminthum, Vol. i. p. 478.

† *Loc. cit.* "Cystiques des Ténias."

‡ *Loc. cit.* p. 5.

§ *Loc. cit.* p. 463.

worm, are furnished with a distinct though small rostellum and with the rudiments of hooks"; and further Nitsche, according to Leuckart,* has occasionally observed, in the adult form, these rudimentary hooks. In view of these facts, Villot's opinion, in so far as it rests on the case of *T. saginata*, loses its value.

It may now be well to institute some comparison between the Cysticerci properly so-called and the two forms described in the foregoing as representing the genus *Piestocystis.*

The unarmed Piestocystes are not only sharply marked off from the Cysticerci properly so-called by the absence of hooks, but also by their general structure. The retractile more or less conical head, destitute of hooks and provided with four large and well-marked suckers, is characteristic, as also is the elongated posterior portion usually interpreted as representing the caudal vesicle.

According to Villot, four parts can be distinguished in an ordinary Cysticercus: (1) the cyst, (2) the head, (3) the body, (4) the caudal vesicle. The cyst is in the Cysticerci properly so-called an adventitious structure derived from the host, and having no genetic connection with the enclosed Cysticercus, and so may be left out of consideration in the present connection. The Cysticercus itself consists of the three parts—head, body, and caudal vesicle. If we, with Leuckart and other observers, consider the posterior part, in which the head is invaginated, in these unarmed forms, as representing the caudal vesicle, what corresponds to the body of the ordinary Cysticercus? It seems to be represented by the muscular sheath which immediately surrounds the invaginated head and which has in the foregoing been regarded as comparable to the "receptaculum capitis" of Leuckart. The "receptaculum capitis" of Leuckart is, as Villot has shown,† formed by the internal of the two layers into which the somato-cephalic bud of the developing Cysticercus separates. From the internal layer (the receptaculum capitis) the inner wall of the body is derived, while from the external are derived the outer wall of the body

* *Loc. cit.* p. 435.

† *Loc. cit.* p. 14.

and the head of the Cysticercus. In the forms under consideration, these two layers enclosing an interparietal cavity do not appear to be represented, and further, as Leuckart states,* the sheath or so-called receptacle is in these forms "not only connected with the mass of the head, but, like the ordinary body muscles, bound up with the tissue of the bladder." Hence, if this sheath be taken as representing the body of the Cysticerci properly so called, we may take it as characteristic of the genus *Piestocystis* that the body, unlike that of the Cysticerci properly so-called, is not represented by a part distinct from the caudal vesicle.

The absence of a well-marked bladder cavity containing fluid is also a noteworthy feature and one which has given rise to the name parenchymatous bladder worms for these forms. The cavity may be entirely absent or it may be represented by an irregular space bounded by thick walls. With reference to this feature Leuckart says† :—"With the loss of the bladder cavity most of the characteristic peculiarities of the bladder worms have been also lost, so that it is hardly possible to distinguish these forms from developed bladder worms with evaginated heads. In fact, even in spite of the attached caudal bladder, such a form as that represented on Fig. 185c looks exactly like a young still unsegmented tapeworm."

The Cysticercus which most closely approaches these parenchymatous forms in the absence of a distinct bladder cavity is that of *Tænia elliptica (cucumerina)*, but it is at once distinguished from them by the possession of hooks, and further, as Grassi and Rovelli have shown,‡ the fully formed Cysticercus represents only the anterior part of the six-hooked embryo, the posterior part which forms the tail being lost on the Cysticercus reaching maturity.

As one of the characters of the genus *Piestocystis*, Diesing gives the absence of a rostellum, but its homologue, the frontal

* *Loc. cit.* p. 347.

† *Loc. cit.* p. 343.

‡ "Embryologische Forschungen an Cestoden," Centralb. f. Bakt. u. Parasit., Band v. 1889.

sucker, is found in the form from Hoplocephalus, and Van Beneden* in a form, *Milina grisea*, from the intestine of *Vespertilio murinus* and *serotinus*, and which evidently belongs to the genus *Piestocystis*, describes an unarmed bulb as existing between the four suckers, and also Bellingham,† in a Cysticercus from *Cobitis barbatula*, has observed a similar unarmed proboscis, so that this character of Diesing no longer holds. The presence of a posterior pulsatile excretory tube and of numerous calcareous corpuscles in the caudal vesicle are features of lesser importance.

Thus, in the absence of hooks, of a distinctly differentiated body, and of a proper bladder cavity, these forms are sharply marked off from the Cysticerci properly so-called.

Returning now to the consideration of the cyst, in Cysticerci properly so-called it is, as already remarked, a wholly adventitious structure, being derived from the tissues of the host and having no genetic connection with the enclosed Cysticercus. In the unarmed forms considered in the preceding, the inner lining of the cyst in that from Hoplocephalus and the inner lining of the cyst, together with the cellular network in the interior of the cyst from Lialis, are, in our opinion, the direct derivatives of the six-hooked embryo, and correspond to the so-called cyst of *Monocercus arionis* and of *M. glomeridis*, and to the cellular cyst of *Monocercus Didymogastris* (*cf.* Part ii.), representing in fact the proscolex or "blastogen" of Villot.

This consideration, viz., that, in the unarmed forms under consideration, we have, surrounding the Cysticerci and forming part of the cyst wall, a part which is the direct derivative of the six-hooked embryo, and which is not found in any Cysticercus properly so-called, is alone sufficient justification for removing them from Villot's genus *Cysticercus*, and they certainly have no genetic connection either with *Echinococcus* or *Cœnurus*.

* "Les Parasites des Chauves-souris de Belgique," Mém. de l' Acad. Roy. de Belgique, T. xl. 1873, as quoted by Moniez, "Essai Monographique sur les Cystiques," p. 144.

† "On Irish Entozoa," Ann. Mag. N.H. Vol. xiv. p. 398.

Superficially there is a slight similarity between an isolated *Echinococcus* head and, say, the Cysticercus from Lialis, but detailed comparison shows they have little in common. Leuckart,* after referring to the similarity in disposition between the enclosing portion of the *Echinococcus*-head and the caudal bladder of a Cysticercus, says:—"Nevertheless it is impossible to regard the capsular envelope of the retracted *Echinococcus*-head as a caudal bladder, and that not only because it forms an integral part of the head, and is included in the body of the future tapeworm, but more especially because of its entirely different origin." In the foregoing we have considered the part in which the head is invaginated in these forms as representing the caudal vesicle and body, and that it does not become part of the future tapeworm, Von Linstow's† observation of the commencement of segmentation in the part immediately succeeding the head in *Cysticercus (Piestocystis) Dithyridium* strikingly bears out.

Multiplication in the genus *Piestocystis* takes place, according to Diesing, by a process of external proliferation from the caudal vesicle. This method of multiplication certainly does not hold good for the forms under consideration, and Villot‡ agrees with Leuckart § in believing that the so-called buds are malformations due to purely mechanical causes; still it is possible that certain species do multiply by external proliferation. In the two forms under consideration internal proliferation undoubtedly takes place, in the first one Cysticercus only is formed, in the second three may be thus formed. Here the caudal vesicle does not proceed from the proscolex by simple growth and modification of structure as in Villot's genus *Cysticercus*, but it represents a secondarily formed structure derived by internal proliferation from the proscolex, which remains persistent in the form from Hoplocephalus as the inner lining of the cyst cavity, and in the form from Lialis

* *Loc. cit.* p. 604.

† "Neue Beobachtungen an Helminthen," Archiv f. Naturgesch., B. i. 1878, p. 222.

‡ *Loc. cit.* p. 22.

§ *Loc. cit.* p. 356.

as the inner lining of the cyst cavity together with the cellular network in the interior of the cyst.

The two forms under consideration are thus brought into close relationship with certain forms included in Villot's second group, but they agree so closely with one another and differ so widely in other respects from the Cysticercoids that it seems advisable to associate them together in Diesing's old genus *Piestocystis.*

Leuckart* regards these parenchymatous forms as in many ways connecting the Cysticercoids with the ordinary bladder worms, and this is the view we here adopt. In their general structure they are certainly more nearly related to the Cysticerci properly so-called than to the Cysticercoids, while at the same time the presence of the surrounding blastogen is a character they share in common with certain of the latter.

Finally, then, we hold the genus *Piestocystis* to include unarmed forms, intermediate between the Cysticerci properly so-called and the Cysticercoids; and which are produced, one or more in number, by proliferation of the blastogen (proscolex).

The Lialis Cysticercus may be termed *Piestocystis Lialis*, and the Hoplocephalus Cysticercus *Piestocystis Hoplocephali.*

PART II.

On a *Monocercus* from *Didymogaster.*

While examining specimens of the earthworm *Didymogaster sylvatica*, Fl., for the *Polycercus* described by Prof. Haswell and myself in a previous part of these Proceedings,† one individual was found to be infected by a Cysticercoid belonging to the allied genus *Monocercus*, for which I propose the name of *Monocercus Didymogastris.* The generic name *Monocercus* was proposed by Villot‡ for cystic forms of the type of *Cysticercus arionis*, in

* *Loc. cit.* p. 655.

† P.L.S.N.S.W. Vol. viii. p. 365.

‡ "Mémoire sur les Cystiques des Ténias," Ann. des Sci. Nat. (6), T. xv. 1883, p. 35.

which the blastogen (proscolex) gives rise by endogenous budding to a single caudal bladder, as distinguished from the genus *Polycercus*, in which, according to Villot, a number of caudal bladders are similarly produced.

Structure of Monocercus Didymogastris.—The *Monocerci* lie embedded in the wall of the intestine, generally in the superficial layers. They appear to the naked eye as small rounded elevations of a whitish colour, which vary considerably in size, the largest observed measuring ·5 mm. in diameter and the smallest ·18 mm. Each (Fig. 12) consists of two very distinct parts: (1) An outer clear cellular portion which we may provisionally term the cyst, and which surrounds (2) a central more opaque portion, the Cysticercoid proper. Considering these two parts separately, and first as to the outer portion. In section it is found externally to consist of a homogeneous membrane apparently of a cuticular nature and which stains more deeply than the cuticle of the Cysticercoid. Internal to this cuticular membrane is a single layer of large cells, each containing protoplasm with refractive granules and a nucleus; their walls are continuous with the outer membrane and stain similarly to it. In the possession of this well-defined surrounding layer of cells, in the fully developed Cysticercoid, *Monocercus Didymogastris* appears to differ from all previously described forms belonging to this type. In *Cysticercus arionis*, Leuckart* describes the Cysticercoid as surrounded by a true connective tissue cyst derived from the host. But Moniez† says:—"Le kyste dans lequel est enfermé le Cysticerque de l'*Arion* est pour nous, un produit du parasite lui-même et non une sécrétion de l'hôte." He, however, describes the cyst as consisting of concentric layers, an observation which Villot shows,‡ from the study of *C. arionis* and *C. glomeridis*, to be incorrect. According to him—"Le soi-disant kyste des Monocerques est, en réalitié, une

* "The Parasites of Man," English Edition, p. 361.

† "Essai Monographique sur les Cysticerques," Travaux de l'Institut Zoologique de Lille, T. iii. fasc. 1, p. 74.

‡ *Loc. cit.* p. 38.

enveloppe très fragile, composée d'une mince cuticule et d'une couche sous-jacente de nature cellulaire." This subcuticular layer he describes as consisting of small groups of fine granules, separated from each other by a hyaline border and evidently representing a layer of cells in process of degeneration. Villot's observations receive ample confirmation from the form under consideration. There is here, just as in *C. arionis*, a layer of cuticle externally, and an underlying cellular layer, which, however, in the case of our *Monocercus*, shows no signs of degeneration. Accepting Moniez's view that the cyst belongs to the Cysticercoid itself, what does it represent? With Villot I agree in regarding it as the blastogen or blastogenic vesicle (proscolex), which by internal differentiation, either by budding or some process of separation, gives rise to the Cysticercoid proper. The Cysticercoid, then, together with the outer cellular layer, the blastogen, represent the entire product of the six-hooked embryo.

We pass now to the consideration of the second part of our *Monocercus*, the Cysticercoid proper.

Each is an ovoid body measuring from ·15-·3 mm. in diameter. It lies perfectly free in the centre of the surrounding layer of cells. There is no connection nor any sign of connection between the outer wall and the Cysticercoid. Villot* believes that in *Cysticercus arionis* he has seen, at the posterior part of the caudal vesicle of the Cysticercoid and the cyst, traces of an original connection in the form of "une sorte d'ombilic ou de dépression infundibuliforme." No such indication of an original connection is to be seen in the case of *Monocercus Didymogastris;* if it ever existed no trace of it remains in the fully-formed Cysticercoid. This fact suggests that the Cysticercoid, instead of arising from the proscolex by a process of budding, arises by the separation of the more central cells from a peripheral layer. The latter forms the outer layer of cells, while the central mass gives rise to the Cysticercoid by differentiation, probably in a manner similar to

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* *Loc. cit.* p. 38.

what we have described* in the development of an individual Cysticercoid in *Polycercus*. And I may here add that our observations on the development of the Cysticercoid in *Polycercus Didymogastris* strikingly confirm Villot's view that the position of the head in Cysticercoids of the type of *Cysticercus arionis* is the primitive one and not secondary as Leuckart† believes.

When the Cysticercoid is examined in the fresh condition, it is seen to possess numerous uniformly diffused calcareous corpuscles ·01-·012 mm. in diameter. At one end, the anterior, is a slight depression indicating the aperture of evagination of the head.

In sections the three parts found in all Cysticercoids of this type can be readily distinguished.‡ These parts are: (1) the head, (2) the body, (3) the caudal vesicle. The head forms a somewhat conical mass lying invaginated in the body, and with the blunt apex of the cone pointing to the aperture of evagination of the head. It bears on its sides four large and well-marked suckers, and in its centre lies the retracted rostellum, the anterior end of the latter forming the blunt apex of the head.

The head is covered by a definite cuticle and is composed of a dense mass of small-celled tissue. The suckers are composed of rounded cells, radial and circular fibres not being recognisable.

The rostellum is stout, thickest in its middle region, and with blunt anterior and posterior ends. It extends to near the posterior end of the head, terminating on a level with the posterior border of the suckers. It is composed of rounded cells larger and clearer than those of the rest of the head. Surrounding it is a thin sheath of a cellular nature, apparently corresponding to the muscular receptacle of other forms (*cf. Polycercus Didymogastris*), but distinct muscular fibres were not recognisable in it. At the anterior end of the rostellum are the small hooks, sixteen to

* P.L.S.N.S.W. 2nd Series, Vol. viii. p. 365.

† *Loc. cit.* p. 362.

‡ Villot, "Metamorphoses des Ténias des Musaraignes," Ann. des Sci. Nat. (6), T. viii. 1878, p. 5.

twenty in number, and arranged in a single row. Each hook (Fig. 13) has a total length of ·03 mm. and is provided with an internal root ("dent," "Hypomochlion," or "talon") and an anterior root (Leuckart's "posterior process," Villot's "manche"). The anterior root, which is inserted into the tissue of the rostellum, runs forwards in a line with the free part of the hook (Villot's "lame"), while the internal root runs backwards almost parallel with the free part. The free part of the hook is ·018 mm. long, the internal root ·0125 mm., and the anterior root ·012 mm.

The great development of the internal roots of the hooks of *Monocercus Didymogastris* may be taken as their most striking characteristic, and that they differ most markedly in form from those of *Monocercus arionis* and *M. glomeridis* a comparison of Fig. 13 with Villot's figures* will clearly show.

The posterior part of the head, behind the posterior end of the rostellum and the suckers, may be taken to represent the neck. This neck region becomes continuous with a thin layer of deeply staining small-celled tissue, which passes forwards, completely enclosing the head. This represents the second part of the Cysticercoid—the body. Anteriorly it becomes continuous at the aperture of evagination with the outer wall of the Cysticercoid. The outer wall represents the third part of the Cysticercoid—the caudal bladder. In sections it is to be clearly distinguished from the layer forming the body. It is composed of a larger-celled tissue and does not stain so deeply with hæmatoxylin, and to it the calcareous bodies, distributed throughout its thickness, are almost entirely confined. Externally it is covered by cuticle, which, at the aperture of evagination, turns in, becoming continuous with what will, in the evaginated Cysticercoid, be the external cuticle of the body. Both in its histological structure and in its relations to the other parts of the Cysticercoid, this outer wall clearly corresponds to the caudal bladder of the ordinary Cysticerci.

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* *Loc. cit.* pl. XII. figs. 10 and 11.

Grassi and Rovelli* regard the outer wall as formed by the tail, the part on which in the Cysticercus of *Tænia elliptica* they find the hooks of the embryo are borne. "In ihnen *(C. arionis)* ist die äussere Wand, unserer Meinung nach, vorzugsweise von dem Schwanze gebildet, da sich die Haken auf der äusseren Wand oder auch auf dem Grenzpunkte zwischen der äusseren Wand und inneren Wand befinden (Meissener, Leuckart, Moniez)." They base their belief on the observations of Meissener, Leuckart,† and Moniez,‡ who assert that they have seen the hooks of the embryo lying on the caudal vesicle or on the body. With reference to these statements, however, Villot remarks § :—"Nous sommes persuadé qu' on a pris pour les crochets de l'hexacanthe quelque portion des fibres élastiques, très réfringentes, que l'on observe sous la cuticle de la vésicule caudale."

If we regard the so-called cyst (blastogenic vesicle) as the direct derivative of the six-hooked embryo, then, as Villot further says,‖ "Les véritables crochets du Proscolex doivent être cherchés sur le kyste." In view of these considerations, Grassi and Rovelli's interpretation falls to the ground.

Finally, it may be added that the hosts of Cysticercoids of this type have now been found among the Mollusca, the Myriapoda, and the Chætopoda.

PART III.

On the Development of a Tetrarhynch Scolex belonging to the Genus *Synbothrium*.

The cysts on which the following account is based were taken from the peritoneum surrounding the intestine of the jew-fish, *Sciæna aquila*. The form under consideration closely agrees with

* "Embryologische Forschungen an Cestoden," Centralb. f. Bact. und Parasit., Band v. 1889, p. 404.

† *Loc. cit.* p. 361.

‡ *Loc. cit.* p. 74.

§ *Loc. cit.* p. 39.

a cyst from the liver of *Cybium regale*, described by Linton* under the name of an embryo *Tetrarhynchobothrium*, and is probably identical with an immature *Synbothrium* from the spiral valve of *Trygon centrura*, which the same author describes† as a new species under the name of *Syndesmobothrium filicolle*. In view of Linton's descriptions and figures I have not thought it necessary to describe the structure of the fully-formed scolex, but proceed at once to the description of the developmental stages I have been able to examine.

Fig. 14 represents a median longitudinal section of the youngest blastocyst observed. It had an elongated form of uniform thickness, except for a slight constriction near its middle, and measured 7·5 mm. in length by 1 mm. in breadth. The blastocyst in its natural position is surrounded by an outer fibrous layer derived from the peritoneum, and representing the cyst of the Cysticerci properly so-called. The part enclosed by the cyst, and here, after Linton termed the blastocyst, really represents the caudal vesicle of these forms, and is, without doubt, the direct derivative of the embryo. The blastocyst is in the fresh condition of an opaque whitish colour and contains scattered calcareous corpuscles.

The structure of the blastocyst is comparatively simple. It is invested by a thin layer of cuticle ; below this is a thin granular layer with scattered nuclei. Internal to this is a vacuolated tissue, with here and there scattered nuclei, calcareous corpuscles, and a series of longitudinally running fibres, by means of which the contractile movements of the living blastocyst are probably performed. The central mid-portion of the blastocyst is occupied by a somewhat irregular cavity. Two well-marked excretory vessels with thin cuticular walls run along, one on either side of the blastocyst, to its posterior end, where they unite to open to the exterior by a short terminal canal.

* "Notes on two Forms of Cestode Embryos," American Naturalist, 1887, p. 199.

† "Notes on Entozoa of Marine Fishes," United States Commission of sh and Fisheries, 1891, p. 861, pl. xv. figs. 2-4.

The first stage in the development of the scolex is the appearance, at what will become the anterior end of the blastocyst, of a narrow involution. It is lined by a thin cuticle continuous with the outer cuticle, while the granular layer below it is likewise continuous with the similar layer below the external cuticle, only here it is somewhat thicker and contains a large number of small deeply staining nuclei. The first stage in the development of the *Synbothrium* scolex is thus identical with the corresponding stage in the development of the Cysticerci properly so-called.

Fig. 15 shows a further stage in the development of the involution. It is now considerably larger, and the granular layer surrounding it is thicker and contains far more numerous small nuclei. The internal tissue of the blastocyst now forms a more compact mass around the involution, while the central cells have for the most part disappeared. At the bottom of the involution cavity, which now communicates with the exterior by a narrow opening, is seen a small elevation, probably the first indication of the scolex.

Fig. 16 is a longitudinal section of an older cyst, about 5·5 mm. in length by 1 mm. in breadth at its anterior end. This anterior or scolex-containing end is broader than the posterior end of the blastocyst, and is now marked off from it by a well-marked constriction. The involution cavity is now very much larger than in the preceding stage and communicates with the exterior by a well-marked though narrow canal. The involution cavity is lined by a very thin cuticle, and arising from its bottom is a knob-shaped mass, the rudiment of the scolex. That this knob-shaped mass gives rise to the whole of the scolex is evident when we compare the mode of attachment of the fully-formed scolex (Fig. 5) with that of the scolex bud. In both cases they are attached to the centre of a saucer-shaped area of tissue, which thins out at the edges and has the concavity directed towards the aperture of invagination. The *Synbothrium* scolex does not then arise directly from the invagination sac, but by the differentiation of a bud which arises from its floor, thus confirming Hoek's* view that "Der Scolex ensteht dan bei *Tetrarhynchus* auf dem Boden dieser Einstülpung aus knopfförmiger Anlage," and also Wagener as quoted by Leuckart†—"If we imagine the thimble-like projection from the base of the sac broadened out above like a mushroom, we have the head of a *Dibothrium*, which might become a 'dibothrian' *Tetrarhynchus* by the addition of proboscides."

Leuckart,‡ on the other hand, considers "that it is the sac-like invagination of the bladder itself which produces the head. The elevation always appears only as a secondary structure of subordinate morphological importance, and is, moreover, by no means so widely distributed as the statements of some investigators would lead one to suppose." He bases this view on an examination of young *Tetrarhynchus* bladders from *Lophius piscatorius*, in which he finds, "that the elevation only takes place at a time when the suctorial cups and proboscides are already formed and when the head, with its different parts, is thus essentially mature." If this be so in the case he examined, then we must admit that in the *Tetrarhynchidæ*, as among the *Tæniadæ*, the head may arise in two distinct ways. It may arise directly from the invagination sac or it may arise as a bud from the bottom of the invagination sac. The occurrence of the latter of these two methods is denied by Leuckart, but Moniez,§ from the examination of *Cysticercus pisiformis*, is convinced "que la tête du Cysticerque bourgeonne au fond de l'invagination comme l'avait indiqué Wagener," and Hamann‖ has also described and figured (*cf.* especially his fig. 5, taf. I.), in the development of the Cysticercoid of *Tænia sinuosa* from *Gammarus pulex*, a plug-shaped structure which arises by

* "Ueber den encystirten Scolex von Tetrarhynchus," Niederländisches Archiv für Zoologie, B. v. p. 3.

† *Loc. cit.* p. 374.

‡ *Loc. cit.* p. 375.

§ "Essai Monographique sur les Cysticerques," p. 36

‖ "In Gammarus pulex lebende Cysticerkoiden mit Schwanzanhängen," Jenaische Zeitschrift, Bd. xxiv. p. 2-3, taf. I. figs. 4-8.

the inturning of a cushion-like thickening of the bottom of the invagination sac into its interior. Concerning the further development of the plug he says: "An diesem Zapfen spielen sich die weiteren Veränderungen ab, an ihm bilden sich die Saugnäpfe und der Hakenkranz."

The matter is well summed up by Villot*: "La vérité est que la tête des Cystiques peut se développer de deux manières bien différentes," and we can now extend Villot's view to the *Tetrarhynchidæ*.

Returning now to the scolex-forming bud in *Synbothrium*, at the stage under consideration the bud is typically knob-shaped, being attached to the bottom of the involution sac by a narrow stalk, which widens out into an expanded and rounded head. It consists of a fairly compact mass of small rounded cells, such a tissue among the Cestodes having, according to Moniez,† all the characters of cells in process of reproduction. In the anterior broader portion of the bud there are large clear spaces, and the small cells are not so numerous; in the stalk the tissue is of a denser character, the cells being more numerous and larger. In the anterior region are seen two denser areas radiating outwards. These are in all probability the fundaments of the proboscides. Below the cuticle of the blastocyst at this stage an external layer of circular fibres and an internal layer of longitudinal fibres can be recognised; then internal to these is the granular layer containing nuclei lying at some distance from each other; the cell boundaries are not distinct.

Fig. 17 is a longitudinal section of the next stage I have been able to obtain. It is separated by a somewhat wide interval from the preceding stage, for the knob-shaped process has not only given rise by elongation to the external form of the adult scolex, but internal differentiation has advanced to a considerable extent. The cyst, of which Fig. 17 is a longitudinal section, had a length of only 3·5 mm., so that the size of the cyst is evidently not

* Cystiques des Ténias, p. 20.

† *Loc. cit.* p. 37.

indicative of the stage of development of the scolex. In this stage the three parts into which, after Lang,* the adult scolex can be divided can readily be distinguished. These parts are: (1) The anterior or head region, which carries the bothridia; (2) The middle or neck region, through which run the proboscis sheaths; (3) The posterior region, in which the proboscis bulbs are situated. The internal parts, however, are still in process of differentiation, and the cuticle investing the scolex is still a comparatively thin layer.

In the posterior part of the scolex the proboscis bulbs are represented by non-staining tracts apparently of a fibrous nature and surrounded by deeply staining cells. Such cells occur along the whole course of the proboscides and sharply mark them off from the surrounding cells. In the middle region of the scolex occur longitudinally running cellular strands surrounded by deeply staining cells similar to those round the bulbs. These cellular strands probably give rise to the retractor muscles of the proboscides, while the deeply staining cells form the sheaths of the proboscides. Anteriorly the proboscides themselves (Fig. 17, *prb.*) are seen to be hollow structures with well-defined cuticular walls and surrounded by deeply staining cells. On the interior of the hollow proboscis the hooks appear as small inwardly-projecting conical processes of its cuticular wall.

In sections of a cyst slightly older than the preceding, the proboscis bulbs are now found to possess very definite fibrous walls, enclosing a cellular strand, from which the retractor muscle will be developed. The wall of the bulb is very much thicker on its inner face than externally and closely surrounds the cellular strand, the large cavity found in the bulb of the fully-formed scolex being not yet formed. The proboscis, surrounded by a layer of deeply staining rounded cells, is now found to lie in a definite cavity, the cuticular wall of which forms the proboscis sheath. Posteriorly the sheath becomes continuous with one of

* MT. Zool. Stat. Neap. ii. 1881, pp. 372-400; see résumé, Journal of the Royal Microscopical Soc. 2nd Ser. Vol. ii. part 1, 1882, 51.

the bulbs, while anteriorly it opens to the exterior beside one of the bothridia. The hook fundaments have now become separated off from the cuticular wall of the proboscis and appear as short inwardly-projecting processes with rounded ends. These by subsequent elongation give rise to the long and slender hooks of the adult scolex. The cellular strands in the bulbs are continuous with similar strands which run through the hinder parts of the proboscis sheaths and become continuous with the proboscides themselves. As development advances, well-marked obliquely-crossing fibres are developed in the walls of the bulbs, which now enclose large cavities. From the cellular strand the retractor muscle is developed; anteriorly it is continuous with the proboscis, while posteriorly it passes back to become inserted into the posterior end of the cavity of the proboscis bulb.

The blastocyst, when the scolex has reached the fully-formed state, has an elongated club-shaped form, the largest found measuring 14 mm. in length. The anterior club-shaped end contains the scolex, attached by its posterior end to the bottom of the invagination sac. Round its point of attachment a number of minute hair-like processes of the cuticle are developed. The scolex is surrounded by a fluid containing granules and probably nutritive in function. As the scolex lies naturally in the invagination cavity, its parts have the following disposition: the posterior part lies in a line with the long axis of the blastocyst; the neck curves round, forming a loop lying on the straight posterior portion, while the head lies on one side.

I append some notes from Linton's* description of the scolex as explanatory of fig. 19, which is a drawing of the adult scolex freed by mechanical means from the blastocyst:—The head is tetragonal, transverse, cruciform. Bothria four, subcircular, convex, cup-shaped, each the termination of a short cylindrical pedicel. They are arranged in a cruciform manner, but also somewhat in pairs, and capable of being directed either forwards or backwards in pairs. Proboscides very long and slender, each one running

* *Loc. cit.*, "Notes on Entozoa of Marine Fishes," p. 861.

through a pedicel and emerging at the apex, apparently beside the bothrium proper; neck very long and slender, cylindrical, enlarging slightly at the contractile bulbs and rounded at the base, tapering to a point where it is connected with the body (blastocyst); proboscis sheaths spiral, contractile bulbs linear, oblong: hooklets long and slender, falcate. Size of scolex 4·60 mm. Hooks near the middle ·06 mm. long.

RÉSUMÉ.

(1) The so-called blastocyst or endocyst is the serial homologue of the caudal vesicle of the Cysticerci.

(2) The wall of the invagination sac represents the body of these forms.

(3) The scolex, consisting of head and neck, arises from the bottom of the invagination sac as a knob-shaped process, which, by subsequent elongation and internal differentiation, gives rise to the fully-formed scolex.

EXPLANATION OF PLATES.

Plate III.

Figs. 1-6.—*Piestocystis Hoplocephali.*

Fig. 1.—Transverse section of the wall of Hoplocephalus cyst. Zeiss. D., oc. 1, cam. luc. *h. l.*, homogeneous inner layer of wall ("blastogen"); *l. l.*, middle laminated zone; *f. l.*, outer fibrous layer.

Fig. 2.—Longitudinal section (nearly median) of Cysticercus from Hoplocephalus, with partially evaginated head. From a specimen preserved in corr. subl. and stained with cochineal. Zeiss. A., oc. 1, cam. luc. *f. s.*, frontal sucker; *b. c.*, bladder cavity; *l. f.*, longitudinal elastic fibres; *t. c.*, terminal canal of excretory system.

Fig. 3.—Transverse section of a Cysticercus with invaginated head, at the level of the suckers. Corrosive sublimate and Ehrlich's Hæmatoxylin. Zeiss. A., oc. 1, cam. luc.; details with Zeiss. D. *c.*, cuticle; *s. c.*, subcuticula; *r. c.*, "receptaculum capitis"; *e. f.*, elastic fibres; *a. v.*, ascending vessel of excretory system; *d. v.*, descending vessel; *i. v.*, invagination cavity of head.

Fig. 4.—Portion of a transverse section (slightly oblique) of a Cysticercus with invaginated head, passing through frontal sucker. Chromosmic acid and Ehrlich's Hæmatoxylin. Zeiss. C. and oc. 1, cam. luc. *f. s.*, frontal sucker; *c. s.*, cavity of sucker; *c. f.*, circular fibres; *r. f.*, radial fibres; *l. s.*, lateral sucker.

Fig. 5.—Outer portion of a transverse section of a Cysticercus about its middle region. Corrosive sublimate and Ehrlich's Hæmatoxylin. Zeiss. D., oc. 1, cam. luc.; details with Zeiss. F. *c.*, cuticle; *c. f.* and *l. f.*, circular and longitudinal fibres of dermo-elastic layer; *s. c.*, subcuticula; *r. c. c.*, cavity with remains of calcareous corpuscle; *g. t. c.*, cells of ground tissue; *m*, matrix; *e. f.*, elastic fibres.

Fig. 6.—Outer portion of a longitudinal section. Corrosive sublimate and cochineal. Zeiss. F., oc. 1, cam. luc. *c.′ c.″*, outer and inner layers of cuticle; *c. n. c.*, cavities containing a number of small calcareous corpuscles.

Plate IV.

Figs. 7-11.—*Piestocystis Lialis.*

Fig. 7.—Cyst from Lialis containing three Cysticerci (× 50).

Fig. 8.—Longitudinal section of cyst (× 100). *f. l.*, fibrous outer layer of wall; *h. l.*, homogeneous inner wall; *c. n.*, connective tissue network; *ct.*, Cysticercus cut obliquely; *c. ct.*, cells attached to inner lining of cyst and probably representing the first stage in the development of a Cysticercus; *c. ep.*, columnar epithelium of intestine.

Fig. 9.—Invaginate Cysticercus, from a specimen preserved in Flemming's Fluid (× 80).

Fig. 10.—*Piestocystis Lialis* with evaginated head; partly from living specimen (× 50).

Fig. 11.—Transverse section of invaginate Cysticercus at level of suckers (× 260). *c.*, cuticle; *s. c.*, subcuticula; *l. f.* longitudinal fibres of dermo-elastic layer; *g. t.*, ground tissue; *i. c.*, invagination cavity of head.

Plate V.

Figs. 12-13.—*Monocercus Didymogastris.*

Fig. 12.—*Monocercus Didymogastris* in optical longitudinal section (× 250). *bl.*, "blastogen"; *c. v.*, caudal vesicle; *b.*, body; *r.*, rostellum; *s. r.*, sheath of rostellum; *s.*, sucker.

Fig. 13.—Isolated hook of *M. Didymogastris* Zeiss. F., oc. 3, cam. luc. (× 900). *a. r.*, anterior root; *i. r.*, internal root; *f. p.*, free part of hook.

Figs. 14-19.—Development of Scolex of *Synbothrium*.

Figs. 14-18 are longitudinal sections of the anterior ends of blastocysts of different ages. Drawn with Zeiss. A., oc. 1, cam. luc.; details with Zeiss. D., oc. 4.

Fig. 14.—Longitudinal section of youngest blastocyst observed, with developing invagination cavity.

Fig. 15.—Further stage in development of same.

Fig. 16.—Longitudinal section of blastocyst, with the knob-shaped process arising from bottom of invagination cavity.

Fig. 17.—Longitudinal section of blastocyst, with developing scolex. *prb.*, proboscis with developing hooks.

Fig. 18.—Longitudinal section of blastocyst, with fully-formed scolex in invagination cavity. *br.*, bothridium; *pr.*, proboscis lying in cavity of proboscis sheath; *pr. b.*, proboscis bulb; *r. msc.*, retractor muscle; *i. v.*, invagination cavity; *w. i. v.*, wall of invagination cavity.

Fig. 19.—Fully-formed scolex of *Synbothrium*. separated mechanically from the blastocyst (× about 30).

NOTES ON AUSTRALIAN COLEOPTERA WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem.

Part XV.

CARABIDÆ.

Taromorpha (gen.nov. *Lebiidarum*).

Corpus glabrum; caput minus elongatum, orbitu post-oculari parvo, collo distincto; palpi labiales subcylindrici acuminati; mentum medium haud dentatum; antennarum articulus 3^{us} glaber; prothorax postice vix lobatus; elytra elongata apice valde obtusa vix truncata, interstitiis sparsim punctulatis, tertio 3-punctato; tarsi graciles, supra glabri, articulo 4° simplici, unguibus simplicibus.

In general facies the species for which I propose this name is remarkably like *Anomotarus olivaceus*, Chaud., though its structural characters are different in some important respects.

Taromorpha alternata, sp.nov.

Nitida; piceo-nigra, subviride-micans, palpis antennis pedibus et corpore subtus ferrugineis; capite fere lævi; prothorace leviter transverso, canaliculato, transversim rugato, basi quam margo anticus vix angustiori, lateribus antice modice rotundatis postice sinuatis, angulis posticis vix acutis extrorsum vix prominentibus; elytris striatis, interstitiis alternis magis angustis magis convexis. [Long. $3\frac{1}{2}$, lat. $1\frac{3}{10}$ lines.

N. Queensland; taken by Mr. Cowell near Cairns.

Scopodes rugatus, sp.nov.

Aureo-æneus, certo adspectu plus minusve viridi- vel cupreo-tinctus; capite prothoraceque confertim fortiter (quam *S.*

sigillati, Germ. multo magis grosse) rugatis; hoc pone angulos posticos minutos (quam *S. sigillati* multo minus productus) quam *S. sigillati* retrorsum magis fortiter lobato; elytris fere ut *S. sigillati* sed minus distincte striatis interstitio 3° interrupte sat fortiter costato. [Long. 2, lat. $\frac{4}{5}$ line.

Very like *S. sigillatus*, Germ., but of a more coppery or golden tone of colour (this may be an unreliable character), with dark legs, the head and prothorax much more coarsely wrinkled, the prothorax more strongly produced hindwards behind the posterior angles, which are much less conspicuous, and the subsutural foveæ of the elytra less marked and connected *inter se* by an interrupted costa, while the elytral striæ (especially the external ones) are scarcely indicated.

Oodnadatta; Central Australia.

Silphomorpha cordifer, sp.nov.

Nitida; atra, palpis antennis femoribus et subtus corpore medio testaceo-brunneis, elytris macula communi cordiformi testacea ornatis, hac a parte paullo ante medium suturæ fere ad apicem extensa; corpore supra fere lævi; prothorace quam in medio longiori fere triplo latiori.

[Long. 4, lat. 2 lines.

This species is not unlike *S. marginata*, Cast., but besides considerable differences in markings and size, its prothorax is very much more strongly transverse. The common spot on the elytra has its point near the apex and is somewhat heart-shaped, or might be described as a triangle with its base (which crosses the suture a little in front of the middle) strongly concave.

N. Queensland; taken by Mr. Cowell near Cairns.

Clivina oodnadattæ, sp.nov.

C. angustulæ, Putz., affinis. Brunneo-testacea, capite prothorace et macula magna communi ovali in elytris posita infuscatis; clypeo antice sat angusto leviter emarginato (angulis anticis acute rectis) ab alis distincto, his ut clypeus ipse vix tam productis; elevatione antica vix distincta; vertice medio sparsim sat fortiter punctulato, et foveola impresso; prothorace quam longiori vix latiori, antrorsum leviter angustato, canaliculato, utrinque ante basin foveola elongata impresso; elytris sat elongatis, punctulato-striatis, stria quarta antice extrorsum flexa, interstitiis (præsertim basin versus) convexis; tibiis anticis extus supra digitationem terminalem tridentatis, dentibus 2 inferioribus validis; prosterno ad latera transversim strigato. [Long. 3, lat. $\frac{7}{10}$ line.

It will be noticed that in the above diagnosis I have used the names (*ala*, *digitatio*, &c.) adopted by M. Putzeys for the several parts in which he considered the important characters in this genus to lie. This species belongs to M. Putzeys' 30th "groupe" of *Clivina*. Its colours and markings are almost identical with those of *C. sellata*, Putz., but the underside is of a testaceous red colour; *C. sellata*, however, is a notably smaller insect and belongs to the 28th "groupe," which is distinguished from the 30th *inter alia* by the front margin of its clypeus forming a continuous curve, not interrupted by any distinction between the clypeus itself and its "alæ." In *C. sellata*, moreover, the part of the head which M. Putzeys calls the *elevatio antica* is extremely well developed as a short curved carina, while in the present insect it is scarcely indicated at all. From the other described members of the 30th "groupe," the colours and markings of this species are different enough to probably form a sufficient distinction. If it and *C. heterogena*, Putz., are both variable in markings, they may possibly approximate each other, but if so it may be noted that the latter is a smaller species with the "*elevatio antica*" of the head strongly developed, and the prothorax not narrower in front than behind, and with its surface "sprinkled with very distinct punctures" (in the present insect the prothoracic puncturation is as fine as in *C. sellata*).

Oodnadatta; Central Australia.

Clivina eremicola, sp.nov.

C. obliquatæ, Putz., affinis. Tota ferruginea; clypeo antice vix emarginato (angulis anticis acutis prominentibus) ab alis distincto, his quam clypei anguli minus productis; elevatione antica ut carina fere recta sat distincta; vertice medio sat fortiter sat crebre punctulato et foveola elongata impresso; prothorace quam latiori sublongiori, antrorsum leviter angustato, canaliculato, utrinque ante basin foveola elongata leviter impresso; elytris elongatis, punctulato-striatis, stria quinta antice extrorsum flexa, interstitiis antice leviter postice vix convexis; tibiis anticis extus supra digitationem terminalem tridentatis, dentibus 2 inferioribus sat robustis; prosterno ad latera transversim strigato. [Long. 3, lat. $\frac{4}{5}$ line.

This species pertains to M. Putzeys' 29th "groupe" of *Clivina*, which is distinguished from the other "groupes" found in Australia by the 5th stria (not the 4th) of the elytra being connected on the base of the elytra with the 8th stria. Of this "groupe," the described species except *melanopyga*, Putz., and *obliquata*, Putz., are much smaller than the present one (and otherwise very different from it); *melanopyga* is differently coloured, has the striæ of its elytra much more strongly punctured, &c.; in *obliquata* (which I have not to my knowledge seen) *inter alia* the subbasal impressions of the prothorax are stated to be wanting.

Oodnadatta; Central Australia.

Mirosarus insularis, Bates.

Mr. Simson, the captor of the specimens on which Mr. Bates founded this name, has sent me two examples of the insect taken in Tasmania. I can find no character to distinguish it from the species that de Castelnau described under several names,—*Harpalus Adelaidæ*, *H. marginicollis*, &c.; Mr. Simson tells me that M. Putzeys considered it identical with de Castelnau's insect.

Trechus baldiensis, sp.nov.

Sat elongatus; minus depressus; nitidus; nigro-piceus, palpis pedibus antennarum basi et elytrorum apice rufescentibus; prothorace sat fortiter transverso, antice quam postice parum angustiori, lateribus ante medium sat fortiter rotundatis hinc ad basin leviter nec sinuatim convergentibus, angulis posticis rectis, foveis basalibus magnis obliquis lævibus; elytris ovalibus, leviter striatis, striis valde perspicue punctulatis, 1ª vix distincte recurva, interstitiis sat planis, 3° 3-foveolato. [Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line.

Remarkable for there being no recurved stria well defined on its elytra; nevertheless I see no reason to separate it from *Trechus* of which it has the facies, palpi, anterior male tarsi, &c. It is a smaller and narrower insect than *T. diemenensis*, Bates (of which I have an example from Mr. Simson, the original captor), with much more distinct punctures in the elytral striæ, the striæ themselves being much feebler; indeed the elytral striæ are almost as feebly impressed and their punctures about as conspicuous as in some species of *Cyclothorax* (*e.g.*, *lophoides*, Chaud.).

Victoria; near the summit of Mount Baldi.

T. VICTORIÆ, sp.nov.

Minus elongatus; minus depressus; nitidus; pallide brunneo-testaceus, antennis (basi excepta) capite postice prothorace medio elytrorum disco postice striisque tibiis et tarsis plus minusve infuscatis; prothorace fortiter transverso, antice quam postice vix angustiori, lateribus antice sat fortiter rotundatis postice vix sinuatis, angulis posticis obtusis angulo summo minute subdentiformi, foveis basalibus magnis lævibus; elytris obovatis, fortiter striatis, disco utrinque fortiter bifoveolato, interstitiis convexis, stria suturali sat manifeste recurva. [Long. $2\frac{1}{2}$, lat. 1 line.

An easily recognisable species owing to its peculiar colouration. It is of a pale brownish-yellow colour, with the hinder part of the head, the middle of the prothorax, the hinder part of the disc of the elytra and all the elytral striæ very conspicuously infuscate (the elytra thus bear a number of fine blackish stripes). The antennæ, tibiæ, and tarsi are of a darker colour than the general surface. The prothorax is very strongly transverse, and its hind angles are peculiar, the side and base meeting in a slightly obtuse angle, the extreme point of which, however, is minutely but abruptly sharpened and turned outward. The anterior tarsi of the male (as usual in *Trechus*) have their basal two joints (only) dilated and spongiose beneath. The apex of the hind body is a little protruded beyond the elytra as in many other species of *Trechus*, especially in the females. The facies of this species is of *Bembidium* rather than *Trechus*, but the structure of its palpi will of course at once distinguish it from *Bembidium*.

Victoria; Sassafras Creek; sent to me by Mr. French, of Melbourne.

T. Simsoni, sp.nov.

Minus elongatus; minus depressus; nitidus; luride brunneus, capite prothorace et pone medium elytris inæqualiter submaculatim infuscatis, elytrorum striis nigricantibus, tibiarum parte inferiori et tarsis quam femora magis obscuris, antennis basi excepta brunneo-piceis; prothorace vix transverso, postice fortiter angustato, lateribus antice sat fortiter rotundatis postice sinuatis, angulis posticis rectis, foveis basalibus elongatis lævibus; elytris breviter ovalibus, fortiter striatis, disco utrinque fortiter bifoveolato, interstitiis convexis, stria suturali sat manifeste recurva. [Long. $1\frac{3}{5}$, lat. $\frac{7}{10}$ line (vix).

In colour and markings very like *T. Victoriæ* (though the general colour being considerably darker the markings are much less conspicuous), but at once distinguishable from it by the much smaller size and very differently shaped prothorax, which is almost as long as wide and is much narrower across the base than across the front margin.

Tasmania; taken by Mr. A. Simson.

Tachys Flindersi, Blackb.

This species seems scarcely distinguishable from *Tachys (Bembidium) rubicundus*, Macl., which latter, however, is a *nom. præocc.*, having been used by Chaudoir for an Asiatic sp. (1850).

HYDROPHILIDÆ.

CYCLONOTUM ABDOMINALE, Fab.

Mr. De Vis, of Brisbane, has recently sent me examples of this widely distributed species which were taken by Mr. Wild in rotten aloes at Brisbane. I believe the insect has not previously been recorded as occurring in Australia.

STAPHYLINIDÆ.

QUEDIUS DIEMENENSIS, sp.nov.

Minus robustus; sat nitidus; niger, prothorace abdomineque piceo-rufescentibus, antennis (articulis basalibus 3 exceptis) tarsisque rufo-testaceis; capite sat lato, punctura magna utrinque in oculi margine et 3 aliis postice triangulariter dispositis instructo; oculis modicis; prothorace leviter transverso, antice parum angustato, angulis posticis rotundatis; elytris quam prothorax vix longioribus, sparsim fortius punctulatis; abdomine fere ut elytra punctulato.

[Long. $3\frac{1}{2}$, lat. $\frac{3}{5}$ line.

The prothorax has the usual two discal punctures near the front and no others except a moderately numerous series running along the front and lateral margins. The antennæ are moderately elongate, joint 1 the longest, 2 and 3 about equally long (longer than any of the following joints), the rest moniliform (6-10 gently transverse). The general form of this species together with the colour of its prothorax and hind-body give it a notable resemblance to the European *Q. xanthopus*, Er.; but the elytra are much less closely punctulate than in that species. The reddish tone of colour is much less noticeable on the prothorax than on the hind-body. More or less resembles *Q. ruficollis*, Grav., and *nigricollis*, Fauv., but differs, *inter alia*, from the former by its very different colouration, from the latter by the dark basal joints of its antennæ. The reddish colour of the hind-body is most conspicuous on the hinder part of each segment.

Tasmania; sent by A. Simson, Esq.

PÆDERUS SIMSONI, sp.nov.

Apterus; subparallelus; niger, prothorace rufo, elytris cyaneis, antennarum articulis basalibus 3 subtus testaceis; oculis modicis; prothorace anguste elongato; elytris basin versus angustatis quam prothorax subbrevioribus, sparsim punctulatis; abdomine sparsim sat grosse punctulato.

[Long. 3 lines.

In general build resembles *P. australis*, Guér., but apterous and with much shorter elytra and the elytra (and still more the abdomen) more sparsely punctured. Coloured like a very dark example of *P. cruenticollis*, Germ., but differing from that species as from *australis* in respect of its elytra and abdomen, and also in its much narrower prothorax less rounded laterally, its antennæ much less dilated towards the apex, &c. From *P. Meyricki*, Blackb., the present insect differs by its smaller size and much more parallel and slender build, its much smaller and more sparsely punctured elytra, narrower prothorax, evidently larger eyes, &c.

Tasmania; sent by A. Simson, Esq.

BYRRHIDÆ (?).

ASPIDIPHORUS HUMERALIS, sp.nov.

A. orbiculato, Gyll., valde affinis; differt colore elytrorum subænescenti, humeris læte pallide testaceis, his valde callosis, antennis paullo magis elongatis, elytrorum striis magis fortiter impressis, harum interstitiis manifeste convexis.

[Long. 1, lat. $\frac{3}{5}$ line.

The general colour is a shining pitchy, inclined towards reddish, more particularly on the elytra, which have a slightly metallic appearance. The humeral calli are extremely prominent and of a pale testaceous colour, the legs and antennæ (except the club of the latter which is darker) reddish-testaceous. The antennæ are of 10 joints, the basal large and pyriform, 2nd much smaller and subglobulous, 3rd slender and as long as the 1st, 4th nearly half as long as 3rd, 5-7 very short, 8-10 forming an elongate club as long as 2-7. The elytra are rather strongly punctulate-striate with evidently convex interstices. The upper surface is clothed with very short semi-erect pubescence.

The position of this remarkable genus seems to be very doubtful. It has been referred to the *Ptinidæ*, the *Dermestidæ* and the *Byrrhidæ* by various authors. To me it seems least out of place in the last-named family.

Tasmania; taken by A. Simson, Esq.

DERMESTIDÆ.

CRYPTORHOPALUM QUORNENSE, sp.nov.

Ovale, pilis crebris (his in elytris nonnullis nigris nonnullis albis fasciatim et plagiatim dispositis) vestitum; nigrum, antennis flavo-testaceis; sat crebre asperatim minus subtiliter punctulatum; antennarum clava valde compresso-dilatata, articulo apicali quam præcedentia 2 conjuncta multo majori.

[Long. 1, lat. $\frac{3}{5}$ line.

Entirely black except the antennæ, but much clothed with long adpressed white hairs, with short black hairs so intermingled as to present the appearance of a whitish surface bearing a pattern of black markings. The head and prothorax are entirely but not very closely clothed with white hairs, while on the elytra the black hairs form the following markings:—A round spot on each elytron behind the base, another just before the apex, and a common moderately wide zig-zagged fascia just behind the middle. The black pubescence is short and not very noticeable, so that the portions of the elytra bearing it appear to a casual glance to be denuded spaces. The entirely black derm distinguishes this species from all its described Australian congeners except *confertum*, Reitt. I am not sure that I know that insect, and therefore will distinguish it from the present one only by characters mentioned in Reitter's description; in *confertum* the antennæ and legs are said to be "obscurely ferruginous," and the elytra to be "confertissime punctata," while in the present species the legs are black and the antennæ bright yellowish, and the elytra (compared with those of others of the genus) not particularly closely punctulate. Moreover, the pattern formed by the black and white hairs on the elytra as described are very different in *confertum* from that formed by them in the present insect.

S. Australia ; on Eucalyptus blossom, near Quorn.

PARNIDÆ.

Elmis tasmanicus, sp.nov.

Modice elongatus ; piceo-niger, antennis palpis tarsisque rufescentibus, elytris ad basin et pone medium transversim rufo-maculatis ; prothorace inæquali sed haud latera versus plicato, sat crebre sat fortiter punctulato ; elytris punctulato-striatis, puncturis in striis antice magnis retrorsum minoribus, interstitiis sat planis coriaceis. [Long. $2\frac{1}{4}$, lat. $\frac{4}{5}$ line.

Tasmania ; taken by Mr. Simson.

PECTINICORNES.

Ceratognathus Froggatti, sp.nov.

♂. Oblongus ; convexus ; crebre rugulose punctulatus ; niger, squamis adpressis læte aurantiacis sparsim vestitus ; capite supra tuberculis 2 parvis instructo ; mandibulis quam caput longioribus, extus late fortiter auriculatis ; prothorace antice sat angustato.

♀. Mandibulis quam caput brevioribus nec auriculatis.

[Long. (mands. incl.) 5-$5\frac{1}{2}$, lat. $2\frac{1}{5}$ lines.

In size, build and sculpture much like *C. niger*, Westw., but differing from that species by the presence of thinly scattered bright orange scales, by the prothorax less transverse and quite strongly narrowed in front, by the median erect lateral process of the mandibles in the male being (not pointed and, at the apex, spine-like, but) a broad almost quadrate lamina, and by the decidedly greater convexity of the general form. The two well defined tubercles on the head distinguish this species from all its other known congeners (they having a single, either conical or bifid, tubercle). The lateral erect process of the mandibles in the male is scarcely less elevated than in *C. niger*, though it is of quite different shape.

N. S. Wales; bred by Mr. Froggatt from *Eucalyptus robusta* at Botany Bay.

LAMELLICORNES.

ATÆNIUS DESERTI, sp.nov.

Sat angustus; minus parallelus; nitidus; niger, clypei lateribus antennis pedibusque rufescentibus; clypeo rotundato-emarginato; capite longitudinaliter sat crebre strigato-punctulato; prothorace æquali, dupliciter (subtiliter et subfortiter) nec rugulose punctulato, puncturis in disco minus crebre vix æqualiter (ad latera confertissime confluenter) dispositis; elytris sulcatis, sulcis in fundo anguste subtiliter catenulatis, interstitiis modice convexis nec anguste carinatis, humeris dentatis. [Long. $1\frac{4}{5}$, lat. $\frac{4}{5}$ line (vix).

Differs from *A. australis*, Har., chiefly in the following respects: puncturation of the head finer and running much more evidently in strigæ, prothorax without any trace of a median sulcus, elytral sulci traversed (not by rows of large punctures giving an uneven crenulated appearance to the interstices, but) by fine catenulated lines occupying the extreme bottom of the sulci and leaving the interstices free from any appearance of crenulation, elytral interstices (though decidedly and somewhat angularly convex) not nearly so narrowly or sharply carinate.

Oodnadatta; Central Australia.

MÆCHIDIUS CLYPEALIS, sp.nov.

Minus elongatus; supra sat opacus; fusco-piceus; capite antice leviter emarginato, lateribus sat fortiter sinuatis; prothorace fortiter transverso, antice minus angustato, confertim rugulose nec grosse punctulato, lateribus crenulatis leviter sat æqualiter arcuatis, angulis anticis obtusis minus productis, posticis subacutis vix retrorsum directis, basi fortiter lobata sicut prothorax certo adspectu utrinque pone angulos posticos profunde excisus videtur; elytris striatis, interstitiis puncturis seriebus binis impressis, puncturis singulis setas fuscas singulas (his vix exsertis) ferentibus; tibiis anticis extus dentibus 3 acutis sat æqualibus (inferioribus 2 approximatis, a 3° sat remotis) armatis; tibiis posterioribus 4 extus crenulatis, ad apicem sat leviter dilatatis; unguiculis simplicibus.

[Long. $3\frac{1}{2}$, lat. $1\frac{4}{5}$ lines.

This species may be at once distinguished from all its congeners known to me (*M. hopeanus*, Westw., however, comes near it in this respect) by the peculiar form of the front of its clypeus which is only moderately emarginate (and that almost vertically), so that when the head is looked at obliquely from behind, there is a point of view from which the front of the clypeus does not appear to be emarginate at all, but to be formed by a horizontal trisinuate line. The form of the prothorax is as in *M. excisus*, Waterh., in respect of the emargination behind the hind-angles, these, however, being less sharply defined than in that species and the emargination behind them less deeply excised. There are about twenty rows of punctures on each elytron (each puncture filled with a seta) and each pair of rows is divided from the next pair by a narrow smooth stria-like space.

The present insect resembles *M. hopeanus*, Westw., in many respects, but may be at once distinguished from it by the front extremity of the basal emargination (on either side of the prothorax) being a well defined angle.

Oodnadatta; Central Australia.

Heteronyx Cowelli, sp.nov.

Modice elongatus; postice minus dilatatus; minus nitidus; testaceo-fuscus; sat pubescens; capite sat grosse, prothorace sat fortiter minus crebre, elytris fere ut prothorax, pygidio (hoc pilis erectis sparsim vestito) leviter sparsim nec subtiliter, punctulatis; labro clypeum vix manifeste, sat late superanti; antennis 9-articulatis; unguiculis bifidis; coxis posticis quam metasternum parum brevioribus, quam segmentum ventrale secundum sat longioribus.

[Long. 3, lat. $1\frac{3}{5}$ line.

The following characters in combination place this species in Section iii., Group vi. of the genus (tabulated P.L.S.N.S.W., 1889, pp. 426-8) : labrum overtopping the clypeus and causing its outline from a certain point of view to appear trilobed, antennæ 9-jointed, claws furnished with a projection close to the apex, almost perpendicular to the line of the claw. In that group it is associated with *H. borealis*, Blackb., by the following characters in combination : external margin of hind coxæ evidently shorter than the metasternum, antennæ entirely of pallid colour ; middle lobe of "trilobed outline" of clypeus widely rounded and not much narrower than the lateral lobes, prothorax moderately closely punctulate (intervals between the punctures somewhere about $\frac{1}{20}$ the length of the prothorax), joint 2 of hind tarsi evidently longer than joint 1. From *H. borealis* it differs *inter alia* by the prothorax being narrower in front, with more rounded hind angles, and by the middle lobe of the "trilobed outline" of the clypeus being wider than in *borealis* and not more prominent than the lateral lobes. The sides of the prothorax are somewhat strongly rounded.

N. Queensland ; taken near Cairns by Mr. Cowell.

HETERONYX SEQUENS, sp.nov.

Modice elongatus ; postice minus dilatatus ; minus nitidus ; testaceo- vel brunneo-fuscus ; sat pubescens ; capite sat grosse, prothorace sat fortiter minus crebre, elytris fere ut prothorax, pygidio (hoc pilis erectis sparsim vestito) obsolete, punctulatis ; labro clypeum sat fortiter sat anguste superanti ; antennis 9-articulatis ; unguiculis bifidis ; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale secundum multo longioribus. [Long. $3\frac{1}{5}$-4, lat. 2-$2\frac{2}{5}$ lines.

This species falls in the same group as the preceding, which it resembles somewhat closely in respect of colour and puncturation, differing from it, however, widely in respect of some important structural characters. Its labrum is considerably narrower and more elevated, so that the "trilobed outline" of the head has quite a different appearance, the middle lobe being less than half as wide as, and more prominent than, the lateral lobes ; its prothorax is of very dissimilar form, being only feebly rounded on the sides and having much better defined hind angles (especially when viewed from above) ; the hind coxæ are considerably longer and have their external hind angles much more defined ; and the produced apex of the basal piece of the hind claws is much larger, nearly equalling the apical piece in size. In the tabulation of this group (see preceding species) this species falls beside *H. Darwini*, Blackb., but differs from it *inter alia* by very much less coarse prothoracic puncturation.

N. Queensland ; taken by Mr. Cowell near Cairns.

BUPRESTIDÆ.

Chalcophora exilis, sp.nov.

Obscure ænea, hic illic viridi- vel cupreo-micans ; capite sat fortiter punctulato et inter oculos excavatione magna subrotunda albo-pulverulenta impresso ; prothorace transversim subquadrato, longitudinaliter 3-canaliculato, canalibus albo-pulverulentis, mediano crebre punctulato quam ceteri crebre granulati angustiori, inter canales interspatiis nitidis sparsim punctulatis, nihilominus interspatiorum dorsalium parte mediana antice longitudinaliter fere ut canales punctulata ; elytris postice extus denticulatis, supra interrupte inæqualiter costatis, partibus depressis crebre sat subtiliter (elevatis sparsim minus subtiliter) punctulatis, pube albida ita dispersa ut vittam dorsalem a basi ad elytrorum medium et alteram sublateralem ab elytrorum medio ad apicem extensas præbet ; antennis brevibus haud prothoracis basin attingentibus, corpore subtus albo-squamoso, abdomine vittis denudatis macularibus 3 ornato.

♂. Segmento ventrali apicali postice profunde triangulariter emarginato.

♀. Segmento ventrali apicali postice sinuato.

[Long. $5\frac{1}{2}$-7, lat. $1\frac{4}{5}$-$2\frac{1}{5}$ lines.

This species, notwithstanding its diminutive size, appears to be certainly a genuine member of *Chalcophora* in the Lacordairean sense. I find it difficult, however, to place it in any of the genera that have been formed at the expense of *Chalcophora*. The shortness of its antennæ prevents its admission to *Chalcotænia* in which most of the previously described Australian *Chalcophorites* find a place, and the scarcely emarginate front of its prosternum forbids its reference to *Paracupta* or *Cyphogastra* in which the rest of them have been located. According to the characters specified by M. Kerremans in his recent work on the classification of the *Buprestidæ* (Ann. Soc. Ent. Belg. xxxvii.) this species would appear to be a true *Chalcophora*, but as no true *Chalcophora* (in the strict sense) has hitherto been reported from the Southern hemisphere there is every probability that it may eventually have to receive a new generic name; I am not able to refer to a sufficient series of true *Chalcophoræ* to justify me in forming a definite conclusion on this point, and therefore for the present call it a *Chalcophora*.

In general appearance this insect looks fairly at home among the previously described Australian *Chalcophorites* although it is more convex and cylindrical than most of them. The whitish powder-like scales form the following markings: a broad vitta near (but not reaching) the lateral margin of the prothorax on either side which is continued hindward on the elytra to near the middle of their length (the elytral portion of this vitta is very indistinct in its middle); and another vitta skirting the lateral margin of the elytra on either side, commencing level with the hind apex of the anterior vitta (but nearer the lateral margin) and continuing almost to the apex of the elytra. The elytral costæ are wide and but feebly elevated; one of them runs close to the suture and reaches the apex, a second runs near it and parallel with it to behind the middle of the elytra where it coalesces with the third costa (which commences immediately behind the apex of the anterior powdery vitta) to form a single costa which reaches the apex; the fourth costa is very obscure and runs from the shoulder obliquely to near the middle of the elytra; the fifth costa also commences on the shoulder and runs (close to the lateral margin) to the apex. There is no elevated plate like that of *C. pistor*, L. and G., on the abdomen. The basal joint of the hind tarsi is distinctly longer than the second. The prosternal process is deeply sulcate. The joints of the antennæ beyond the fourth are not longer than wide.

Central Australia; near Oodnadatta.

CHALCOPHORA BELTANÆ, sp.nov.

Supra viridis (hic illic aureo-viridis), apice cæruleo, partibus elevatis obscure cuprascentibus; subtus obscure aureo-viridis; capite longitudinaliter concavo, sat grosse nec crebre punctulato; prothorace leviter transverso, antice subito sat fortiter angustato, canaliculato, latera versus inæquali et irregulariter obscure longitudinaliter impresso, in partibus depressis crebre minus fortiter (in convexis grosse paullo minus crebre) punctulato, basi trisinuata; elytris postice extus denticulatis, supra interrupte inæqualiter costatis, partibus depressis crebre minus fortiter (maculis binis quam partes depressæ ceteræ magis crebre magis subtiliter) costis sparsim fortiter punctulatis; antennis sat brevibus haud prothoracis basin attingentibus; corpore subtus ut *C. australasiæ*, Saund., sculpturato. [Long. $8\frac{3}{4}$, lat. 3 lines.

This species seems certainly congeneric with the preceding. It has a similar form, more convex and cylindrical than that of most of the Australian *Chalcophorites*, and has short antennæ not reaching the base of the prothorax; but nevertheless its antennæ are a little longer than those of *C. exilis* and its antennal joints are all more or less longer than wide.

The example before me is devoid of the patches of dust-like scales usually ornamenting the Australian *Chalcophorites,* but they are represented on each elytron by two patches on which the colour is a little more brightly golden-green and the puncturation a little finer and closer than elsewhere. The anterior of these patches extends from the 2nd to the 4th costa and interrupts the 3rd costa at about the hind extremity of the front $\frac{1}{3}$ part of the elytra; the posterior of them extends from the 2nd to the 5th costa and interrupts the 3rd and 4th costæ immediately behind the middle of the elytra. The costæ (as in *C. exilis*) are wider and less elevated than in most of the Australian *Chalcophorites (e.g., C. australasiæ)*; the 1st costa is sutural and entire, the 2nd parallel with the 1st and entire, the 3rd twice interrupted and joining the 2nd close to the apex, the 3rd once interrupted and scarcely reaching into the apical $\frac{1}{3}$ of the elytra, the 5th near the lateral margin and entire. It is just possible that the absence of dust-like scales may be due to abrasion, but I think more probably not. The hind tarsi and prosternum are as in *C. exilis.* There is no trace of an abdominal plate like that of *C. pistor*.

This insect is not, I think, very near any previously described; perhaps it comes nearest to *C. Martini*, Saund., and *C. cerata*, Kerremans, both of which, however, differ from it, *inter alia multa*, by their testaceous antennæ.

S. Australia; near Beltana (on the Southern border of the Central Desert).

ASTRÆUS TEPPERI, Blackb.

This species appears to be identical with *A. Jansoni*, v. de Poll. The "Monographical Essay" in which it received the latter name is dated 1889; my description was read to the Linnean Society of N.S. Wales in December, 1889, but was not published till early in 1890. My name therefore becomes a synonym.

TENEBRIONIDÆ.

HYOCIS NIGRA, sp.nov.

Opaca; nigra, pedibus plus minusve rufescentibus; prothorace fortiter transverso, canaliculato, lateribus minus arcuatis postice haud sinuatis, angulis anticis prominulis posticis rectis, basi late fortiter lobata; elytris punctulato-striatis, puncturis in striis minoribus crebre positis, interstitiis vix convexis. [Long. 1, lat. $\frac{2}{5}$ line.

Smaller and more parallel than *H. Bakewelli*, Pasc., and differently coloured; its prothorax is much less rounded laterally, with the sides not at all sinuate behind, the front angles more prominent and the hind angles less acute; its elytral striæ are much more closely and less coarsely punctulate and their interstices are almost flat.

S. Australia; also in Victoria.

HYOCIS VARIEGATA, sp.nov.

Opaca; piceo-ferruginea, prothoracis lateribus elytrorum plagis et pedibus dilutioribus; prothorace fortiter transverso, leviter canaliculato, lateribus minus arcuatis postice haud sinuatis, angulis anticis prominulis posticis rectis, basi sat late lobata; elytris punctulato-striatis, puncturis in striis magnis quadratis (subclathratis), interstitiis angustis subelevatis. [Long. $1\frac{2}{5}$, lat. $\frac{3}{5}$ line.

The markings on the elytra consist of a bright testaceous spot on either side of the suture; behind the middle a less conspicuous mark a little nearer the apex (the part of the elytra bearing these pale marks being darker than the rest of the surface), and an irregular inconspicuous patch commencing about the shoulder somewhat paler than the general colour. The prothorax scarcely differs from that of *H. nigra*, but the elytral sculpture is almost as in *H. Bakewelli*, Pasc.

S. Australia; also in Victoria.

HYOCIS OCCIDENTALIS, sp.nov.

Sat opaca; piceo-rufa, antennis pedibus elytrisque brunneo-flavis, his piceo-notatis; prothorace fortiter transverso, canaliculato, lateribus rotundatis postice fortiter sinuatis (mox ante basin rectis inter se parallelis), angulis anticis vix productis posticis rectis, basi late lobata; elytris punctulato-striatis, puncturis in striis magnis quadratis (subclathratis), interstitiis angustis subelevatis. [Long. $1\frac{1}{5}$, lat. $\frac{1}{2}$ line.

The punctures in the elytral striæ appear under a lens of a golden colour. The markings on the elytra consist of a dark spot on either side of the suture about its middle, and a smaller one on either side of the suture close to the apex. Apart from colour, this species differs from *H. Bakewelli*, Pasc., chiefly by the sides of the prothorax being perfectly straight in their hinder part (immediately in front of the hind angles), and by the humeral angles being much less rounded off. The former of these characters distinguishes it still more strongly from the two species described above.

W. Australia.

NYCTOZOILUS, SLOANEI, sp.nov.

Convexus; late ovatus; niger, supra opacus sparsim subtilissime (nisi sub lente forti haud manifeste) punctulatus; prothorace quam longiori fere duplo (postice quam antice circiter dimidia parte) latiori, *Hypocilibis* prothoracem simulanti, latera versus sat depresso et in margine ipso sat incrassato, latitudine majori pone medium posita; elytris ad latera distincte anguste explanatis et margine reflexo instructis (parum aliter ac *Pterohelæi bullati*, Pasc.), costis obsoletis 3 (sutura exclusa) et inter has nonnullis intermediis magis etiam obsoletis ornatis, strigis transversis (nec costis) sat manifeste certo adspectu impressis. [Long. 9-10, lat. $5\frac{1}{2}$-6 lines.

This species must certainly, I think, be attributed to *Nyctozoilus*, although in some of its characters (notably the shape and sculpture of its prothorax) it agrees better with *Hypocilibe*. The absence of a defined gular sulcus and of a defined tooth on the submentum are quite inconsistent with a place in the latter genus, but on the other hand the front margin of the submentum is considerably thickened, and the strong tooth on the submentum of *Hypocilibe* is represented by a distinctly prominent angulation. Mr. Bates mentions as a generic character of *Hypocilibe* that the prosternal process is bilobed behind; in this present insect the process is not bilobed, but I do not regard that as a reliable character, inasmuch as I have seen several species that certainly could not be separated from *Hypocilibe* in which the process has no indication of bilobation. Perhaps Mr. Bates would have made a new genus of this species, but if that course be pursued with every form presenting slight structural peculiarities a new generic name would be required for almost every species of this group.

The description of *N. Dameli*, Haag-R., points to a considerable resemblance of this insect to it, but I do not think the two can be identical, as Haag-Rutenberg says that the prothorax of *Dameli* is at its widest at the middle, whereas in *N. Sloanei* the greatest width is distinctly *behind* the middle; also the description of the sculpture of the elytra in *Dameli* does not at all accurately fit *N. Sloanei*, in which there is scarcely any trace of transverse lines connecting the costæ, nor do I find any "minute rust-coloured setæ" in the depressed parts of the upper surface.

N. S. Wales; taken by Mr. Sloane at Urana.

Hypocilibe vittata, sp.nov.

Late ovata; modice convexa; sat opaca; piceo-nigra, elytris vittis 5 testaceis ornatis; fere impunctulata, abdomine subtilissime punctulato et longitudinaliter strigato; prothorace quam longiori quatuor partibus (postice quam antice fere dimidia parte) latiori, antice sat profunde arcuatim emarginato, latitudine majori paullo pone medium posita, lateribus sat arcuatis postice manifeste sinuatis, angulis omnibus acutis; elytris quam prothorax fere 3ª parte latioribus, postice minus abrupte declivibus; tibiis intus haud tomentosis.

[Long. $9\frac{1}{2}$, lat. 5 lines.

The whole upper surface of this species is absolutely devoid of sculpture except the row of punctures close to the margin of the elytra, and even that does not extend so far as the middle of their length. The 5 testaceous vittæ on each elytron render the insect easy to recognise.

Queensland; presented to me by Mr. French.

Platyphanes superbus, sp.nov.

Latissime ovalis; nitidus; subtus niger; supra læte æneo-viridis aureo-micans, capite cæruleo aureo-micanti, prothoracis elytrorumque lateribus (et horum epipleuris) scutelloque splendide cæruleis purpureo-micantibus; capite crebre fortiter punctulato; prothorace quam longiori duplo (postice quam antice fere duplo) latiori, subtiliter sparsius punctulato, a basi ad apicem (vix arcuatim) angustato, angulis omnibus subacutis; elytris antice gibbosis (fere ut *P. gibbosi*, Westw.), striis punctulatis 14 instructis, interstitiis convexis, lateribus pone humeros angulatis. [Long. $11\frac{1}{2}$, lat. $7\frac{1}{2}$ lines.

This magnificent insect is allied to *P. gibbosus*, Westw., from which it differs, *inter alia*, by its colouration and by the close and somewhat strong puncturation of its head.

N. Queensland; in the collection of C. French, Esq.

Chariotheca Besti, sp.nov.

Nitidissima; capite versicolori (antice cyaneo, postice nigro aureo-micanti), prothorace læte cæruleo, elytris igneo-cupreis, corpore subtus pedibusque versicoloribus (cyaneo violaceo et aureo micantibus), antennis tarsisque piceis; clypeo subtilissime, capite postice crebre subfortiter, punctulatis; prothorace (leviter transversim) quadrato, subtilissime punctulato, antice leviter angustato, angulis posticis acutis; elytris leviter striatis, striis (vix crebre) punctulatis, interstitiis subtilissime punctulatis fere planis. [Long. 5, lat. $2\frac{2}{5}$ lines.

This brilliantly coloured little *Helopid* has been inspected by my friend Mr. G. C. Champion, of London (the well-known specialist in the *Heteromera*), who has obligingly reported to me that it is near *Chariotheca amaroides*, Pasc. Mr. Pascoe's species (besides being very differently coloured) differs from the present one *inter alia* by the sculpture of its head, which is said to have "a few coarse punctures between the eyes," whereas the head of *C. Besti* (except on the clypeus) is evenly, somewhat closely and not at all coarsely (scarcely even *strongly*) punctulate. Mr. Pascoe's brief description of *C. amaroides* implies moreover that the elytra are not striate, but the elytra of the present species are very distinctly (though not very *strongly*) striate.

I have named it, at the suggestion of Mr. French, after Mr. Best, of Melbourne, who is an energetic coleopterist.

N. Queensland; presented to me by Mr. French.

LONGICORNES.

Uracanthus Froggatti, sp.nov.

Angustus, valde elongatus; piceus, palpis pedibusque (præsertim anticis) plus minusve rufescentibus; pube grisea (nihilominus maculis denudatis confuse variegata) sat dense vestitus; prothorace manifeste (præsertim pone medium) sat crasse transversim rugato; elytris apice truncatis, supra vix costatis, leviter nec subtiliter nec crebre punctulatis.

[Long. 8-9½, lat. 1½ line.

This species seems very distinct from all previously described on account of its being clothed with whitish-grey pilosity which is rather evenly distributed over the whole surface, except that on the upper surface there are a certain number of small denuded spots, and that in places on the under surface (especially on the prosternum and mesosternum) the pilosity is longer and denser than elsewhere. Comparing this insect with the familiar *U. triangularis*, I note the following differences:—size much smaller, colour and markings (such as they are) quite unlike, general facies much narrower and more slender, transverse wrinkling of prothorax obsolete in front half of that segment, apical margin of elytra truncate and devoid of spines.

N. S. Wales; bred by Mr. Froggatt from *Lasiopetalum ferrugineum*.

Rhytiphora fasciata, sp.nov.

Picea, pube densa tecta (hac albido et fulvo variegata et nigro maculata, maculis nigris in parte mediana majoribus ita dispositis ut fasciam obscuram efficiunt); prothorace inæquali et tuberculato et transversim plicato; elytris in tertia parte basali granulis sat magnis nigris nitidis ornatis, ad apicem sat fortiter emarginatis et biapiculatis.

[Long. 13, lat. $4\frac{1}{2}$ lines.

This species is near *R. Argus*, Pasc. Compared with that insect it is of somewhat broader and more robust build with the elytra quite strongly emarginate at the apex, the extremities of the emargination of each elytron distinctly pointed,—almost spiniform. The eyes are less approximate than in *Argus*, and the pubescence of the upper surface is considerably different ; taking the whitish pubescence as the ground the fulvous pubescence is laid on in such fashion as to form a sharply defined pattern which on the elytra has a sinuous and mostly transverse linear arrangement; while the black granulations and spots are much like those of *Argus*, except that the black patches are much larger about the middle part of the elytra than elsewhere, where some of them are transversely elongate, and they are so placed on a wide space extending across both elytra as to look like a conspicuous band of spots. The underside, legs, and antennæ are much like those of *R. Argus*. The elytra present no indication whatever of costæ. The shoulders are black as in *Argus*.

N. Queensland ; presented to me by Mr. French.

PHYTOPHAGA.

NISOTRA SUBMETALLICA, sp.nov.

Ovata ; convexa ; nitida ; subtus (prosterno testaceo excepto) nigra ; supra testacea, elytris pallide viridi-micantibus, antennis nigris (articulis basalibus 4 testaceis), pedibus testaceis (femoribus posticis antice nigricantibus) ; subtiliter (in elytris vix seriatim) punctulatis. [Long. $1\frac{4}{5}$, lat. 1 line.

The prothorax is (by measurement) just twice as wide as long ; its puncturation is very lightly impressed and by no means close ; its sides are gently and somewhat sinuately arched, its front angles decidedly its hind angles scarcely directed outwards ; its anterior discal furrows are elongate and extremely deep, and it has two basal foveæ on either side, the outer ones much feebler than the inner. The puncturation of the elytra is evidently stronger than of the prothorax, and is at its strongest in the front of the outer part of the disc; it can scarcely be called distinctly seriate in any part except near the lateral margins where there are several abbreviated striæ with ill-defined raised interstices. The black colour of the undersurface (except the undersurface of the prothorax) distinguishes this species from its previously described allies. An example taken in S. Australia is without metallic gloss on the elytra and has entirely testaceous legs, but does not seem to differ otherwise. I have seen numerous Victorian specimens, among which I find no variation.

Victoria; taken by Mr. French.

MONOLEPTA ALPINA, sp.nov.

Elongato-ovalis; sat nitida; nigra, elytrorum dimidio basali (macula magna communi basali excepta) sanguineo, antennarum basi tibiis tarsisque plus minusve ferrugineis; antennarum articulo basali quam 2^{us} 3^{us} que conjuncti (his inter se sat æqualibus) vix breviori, ceteris basali et inter se sat æqualibus; prothorace obsolete punctulato transversim leviter impresso; elytris subfortiter minus crebre punctulatis.

[Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line.

Variat prothorace femoribusque plus minusve rufescentibus.

Regarding black as the ground colour of the elytra the red marking consists of a wide fascia, the hind margin of which crosses the middle of the elytra, and which runs forward along the lateral margin to the base on either side, leaving a large common black spot on and around the scutellum.

Victoria; Alpine district.

ON AN ABORIGINAL IMPLEMENT, BELIEVED TO BE UNDESCRIBED, AND SUPPOSED TO BE A HOE.

By R. Etheridge, Junr.,

(Palæontologist to the Australian Museum, and Geological Survey of New South Wales).

(Plate vi.)

This remarkable object, that at first sight would be pronounced as coming from one or other of the Pacific Islands, rather than the Australian Continent, I am assured by Mr. Harry Stockdale, whose name I have had occasion to mention in former communications to this Society, was obtained by Mr. Alexander Gilchrist, F.R.G.S., "on the head waters of the Endeavour River, Northern Queensland, about one hundred and fifty miles inland."*

The Endeavour River is in Cape York Peninsula, about S. Lat. 15°, at Cooktown.

Mr. Gilchrist continues—"The tribe was small in numbers, about seventy, but possessed a lot of weapons; they were Myalls,† although friendly to me."

But one use can be assigned to this implement, that of digging, and for the sake of brevity will be referred to hereafter as a "hoe." It consists of a stick with a diameter of three and a-half inches, that has been chopped off short above, and with an iron tool fashioned into a handle below, and the clean chops of the cuts show that the operator was no novice in the practice of the

* In a letter to Mr. Stockdale.

† *i.e.*, wild blacks.

instrument used. At about the centre of the unexcised part, or head as it may be termed, a hole has been bored, one and a-half inches in diameter. This head is six inches long, and the excised portion or handle about nine inches. Introduced into the hole, is the columellar portion of the body whorl of the large Melon shell, probably *Melo diadema*, Lamk., the outer edge of the fragment, or what would be the anterior end of the whorl, being ground to a cutting edge, by friction from the outside, producing a slight bevel. As the shell portion is too small for the hole, the former has been wedged in by four pieces of circular stick, soft wood, which project on the outside, and the shell blade is thus held in position. It is six inches in length.

I can only imagine this to have been meant for a hoe, and, although of the roughest description, it was, no doubt, tolerably well adapted to the use for which it was meant, the roughest description of husbandry.

It has been asserted on more than one occasion that the Australian Aborigines were collectively quite devoid of any knowledge of husbandry, even in its most elementary form. This generalisation is, however, a mistake, similar to many other mistakes that have been made by writers with the view of bolstering up the old preconceived and erroneous idea that the Australian Aborigine represents one of the most, if not the most degraded variety of the human race.

Sir George Grey has described* the method of yam digging employed by the natives generally with the yam-stick. The stick is driven firmly into the ground with the right hand and shaken, so as to loosen the earth, "which is scooped up and thrown out with the fingers of the left hand, and in this manner they dig with great rapidity."

Sir Thomas Mitchell also, in his account of tropical Australia, describes "ground tilled by the natives." He states: † "We

* N.-West and Western Australia, 1841, ii. p. 293.

† Tropical Australia, 1848, p. 274.

crossed some patches of dry swamp where the clods had been very extensively turned up by the natives. . . . The whole resembled ground broken up by the hoe."

With regard to the West Australians, we are informed by Mr. A. C. Gregory* that "the natives of the west coast of Australia are in the habit, amongst other things, of digging up yams as a portion of their means of subsistence. . . . In digging up these yams they invariably re-insert the head of the yams so as to be sure of a future crop, but beyond this they do absolutely nothing which may be regarded as a tentative in the direction of cultivating plants for their use."

I am of opinion that this hoe is not of Australian Aboriginal manufacture, but simply an adoption by the tribe from whom it was obtained of an implement imported from one of the Torres Straits islands in the ordinary way of barter—a well-known practice held by the northern coastal tribes, in common, in fact, with those of the whole Continent. Mr. E. Beardmore speaks of a hoe, almost identical in construction to the present implement, from Mowat, Daudai, New Guinea. He says† "It is made from a piece of melon shell *(Cymbium)* inserted into a hole in a rough wooden handle, the shell being wedged in by one or two pieces of wood. . . . This rude hoe is only used on soft ground." D'Albertis also figures‡ a very similar implement, as a "shell spade," from the interior of New Guinea, as then known, but no definite locality is given. The blade is mounted in a precisely similar manner to our example through a hole in the handle, D'Albertis also figures§ two unmounted blades, also identical in character to the present implement, from Moatta, N. Guinea.

That the present implement is not of Aboriginal manufacture, is, I think, conclusively proved by the drilling of the hole for the

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* Journ. Anthrop. Inst. Gt. Brit. and Ireland, 1887, xvi. p. 131.

† Journ. Anthrop. Inst. Gt. Brit. and Ireland, 1890, xix. p. 468.

‡ New Guinea, 1880, ii. pl. opp. p. 378, f. 11.

§ *Loc. cit.* i. pl. opp. p. 266, f. 12 and 13.

reception of the blade. The Australian Blacks were quite unacquainted with the art of hafting by drilling, union between any two parts of their weapons or implements being always effected by grasping or tying and cementing. A very excellent illustration of this is on record. General Pitt-Rivers (Col. A. Lane-Fox) states* that at an old native camping place, a European axe-head was found, the hole of which the natives, unable to comprehend its object, had carefully filled with their cementing medium, and hafted by means of a withy, bent round the *outside* of the axe-head, in accordance with their traditional custom.

* Report Brit. Assoc. Adv. Sci. for 1872 [1873], p. 160.

ON THE LIFE-HISTORIES OF AUSTRALIAN COLEOPTERA.

Part II.

By Walter W. Froggatt.

This paper contains my notes and observations on beetles bred out during the season 1892-93. Nearly all my specimens, with the exception of a few obtained during a visit to Victoria, have been obtained from material collected in the neighbourhood of Sydney; among those noted in my former paper I described *Stigmodera rufipennis*, Kirby, bred from the twigs of *Acacia juniperina* from Victoria; this season I have bred a great number from the twigs of *A. discolor* in November and December from about Sydney. Among the more remarkable ones now described is another gall-producing Buprestid belonging to the genus *Paracephala* recently described by the Rev. Thos. Blackburn from specimens I sent to him. The life-history of several weevils belonging to the genus *Oxyps* is very remarkable. Their larvæ might very easily be taken for those of lepidoptera. Another Cetonia has been added to our list; while I have made a slight departure in this part in noting several small longicorns which I have bred from infested branches, but the larvæ of which I have been unable to determine, as very frequently one twig will contain several larvæ belonging to different species.

As before, I am indebted to the Rev. Thos. Blackburn for determining a number of my insects, and to Mr. R. T. Baker for the identification of some of their food plants.

Scolecobrotus Westwoodi, Hope, Trans. Zool. Soc. i. 1835, p. 109, t. 15, f. 5.

Larva pale yellow, cylindrical, with broad head, small conical legs, and a slight fringe of reddish hairs round the head and margins of segments; mouth parts and jaws black, head rounded in front, broad behind, base of forehead with a broad ferruginous band extending backwards round the sides, a short furrow in centre, with a deeper furrow on either side, the summit broad, projecting, bluish-white, finely transversely striated; thoracic segments wide but short, the last with warty markings on the upper sides, first six abdominal segments deeply and widely constricted, the summit with a depression in centre surmounted on either side with an oval warty excrescence; 7th short, cylindrical, smooth; 8th twice as long as 7th; anal segment small, conical, depressed at the tip, with five short stout spines on the upper side forming a triangle pointing downwards; corresponding warty patches on the underside of segments.

The larva feeds upon the stems of *Eucalyptus corymbosa*, attacking them about a foot above the ground; it bores upward, hollowing out the branches; it then turns downward and gnaws right round the top of the stem where it first entered, thus killing the branch. It is a common sight on the sandhills in the neighbourhood of Botany, about August and September, to see a dead bush standing out in every patch of this Eucalypt, and which when pulled readily snaps off short at the gnawed ring. The larva feeds downwards towards the roots just before pupating, and will generally be found in the stem a few inches above the ground when in the pupal stage.

The beetle is 16 lines in length, of a rich reddish-brown colour; the head long and slender; thorax long, cylindrical, finely and deeply striated with transverse corrugations, but covered with fine pale buff hairs almost obscuring them; the whole of the elytra, legs and underside covered with a fine close pale buff pubescence, the fore part of elytra from the shoulders to the fore legs broad, deeply punctured with irregular coarse striæ, the edges of which are fringed with a pale buff pubescence giving it a handsome wavy pattern; the rest of elytra densely covered with pubescence, and tapering towards the tip of the abdomen, the tips arcuate forming a double tooth on either side. It is a long slender beetle resembling *Uracanthus triangularis* in form and habits; nor is it easy to find any difference between the larvæ of these beetles, both having the same constricted segments, and spines on the anal segment.

This beetle is not common in the bush, and is generally found upon *Leptospermum* in November.

Since breeding them from Botany, I have also bred them from some stems of the Whipstick-scrub gum *(Eucalyptus gracilis)*, infested branches of which I collected near Bendigo, Victoria, in August, and which I found to contain this beetle early in last March.

SYMPHYLETES SOLANDRI, Fab. Ent. Syst. Vol. i. p. 292.

Larva legless, white, short and stout; jaws black, thick, mouth parts deep reddish-brown, labrum pale yellow, thickly fringed with bright golden hairs; forehead broad, slightly punctured in centre, ferruginous at base, lightly clothed with long golden hairs, with a few scattered along the sides of abdominal segments; thoracic and abdominal segments, with the exception of the last two, with an elongate warty patch occupying the central portion of each, both on the upper and under sides, a transverse line very slightly impressed passing from behind the head and dividing each segment in the centre; anal segment smooth, shining, rounded at the tip, fringed with a few scattered hairs.

This larva attacks the flower stalks of the grass trees *(Xanthorrhœa)*, feeding upon the dry woody pith, and forming straight irregular tunnels down the centre, and then gnawing round the stem close up to the outer bark about a foot above where the flower stalk springs from the stem. This causes the upper portion of the stalk to fall off, whereupon the larva, after plugging the hole, retreats downwards, forming a straight chamber down the remaining length of the stem, at the bottom of which it pupates. In the month of September, between Botany and La Perouse, I have seen the flower stalks of every grass tree on a hill side thus cut off, and found living pupæ and larvæ in most of them.

The perfect beetle appears in the latter part of October, and can be found in a favourab e season feeding upon the bark of the living flower stalks of the grass trees up to the end of December. On these they gnaw little patches, and deposit their eggs in the hole made for the next season's crop.

The beetle is 11 lines to an inch in length, dark chocolate-brown; antennæ fringed on the inner margin with short black hairs; thorax very rugose, deeply punctured, and irregularly marbled with patches of buff hairs; the femora and tibiæ and the whole of the underside mottled with fine creamy hairs, a patch of bright golden hairs on the tibiæ just above the tarsi; elytra deeply and coarsely punctured, clothed with irregular patches of fine buff and creamy hairs giving it a marbled appearance, the outer edges of elytra fringed with creamy hairs, arcuate at the extreme tip of each elytron forming a double toothed tip.

Common about Sydney in early summer.

URACANTHUS FROGGATTI, Blackburn, P.L.S.N.S.W. ix., (2), 1894, p. 106.

Larva long, slender, reddish-yellow, with very short pointed legs, and a slight fringe of scattered hairs round the head and sides of segments; mouth parts ferruginous; jaws small, black; head longer than broad, forehead excavated in centre, a slightly punctured projecting summit marked with fine parallel striæ; thoracic and first five abdominal segments deeply and broadly constricted, with a faint transverse furrow dividing each in the centre, on either side of which is an oval rugose patch; 6th abdominal segment much longer than preceding ones; 7th cylindrical, telescopic towards the 8th, the latter longer than the anal segment, which is conical at the tip.

The larva feeds upon the stems of *Lasiopetalum ferrugineum*, a low shrub common about Sydney, completely hollowing them for a considerable length, and usually cutting the branch off before pupating, and forming a chamber at the end of its burrow.

Larvæ were obtained, well grown, in infested twigs, in August, at Rose Bay, and in the following April I found the beetles emerging; previously I had never found this fine longicorn.

The beetle is 9 lines in length, light brown, covered with grey pubescence, with a long slender head and antennæ; thorax long, cylindrical, the anterior portion with irregular transverse corrugations, the posterior portion smooth; legs long, pubescent, thighs swollen; elytra long, slender, very finely ribbed, truncate at tips, the pubescence at the extremity forming a white fringe, with a fine tooth on either side, the basal portion chocolate-brown, with a shining square patch below each shoulder, the rest of elytra lightly covered with grey pubescence, densest on the sides, with a row of irregular bare spots along the outer margins.

I have never taken this beetle at large, but have bred a number of them; they doubtless live on the twigs of the shrub in their perfect state.

BETHELIUM SIGNIFERUM, Newman, Entomologist, 1840, p. 10.

Several specimens of this longicorn were bred from twigs taken from a dead tree of *Acacia decurrens* at Carlingford, all the branches of which were swarming with beetle larvæ. The earliest to appear bred out towards the end of October, and the last in the middle of November.

It is 3 lines long, reddish-brown in colour, eyes very prominent, head broad in front, the thorax rounded behind, the legs long, the apical portion of femora swollen and thickened into an oval lump; the elytra reddish-brown, mottled with dull yellow, giving it a zig-zag pattern, and covered with scattered yellow hairs.

NEISSA INCONSPICUA, Pascoe, Journ. Linn. Soc. Vol. ix. 1866, p. 82, t. 3, f. 6.

A number of specimens of this pretty little longicorn came out of twigs of *Acacia longifolia*, collected at Rose Bay; the first was found in the breeding box on the 10th of July, but the bulk of them appeared towards the end of October and early in November.

This is one of our smallest longicorns, being only 2 lines long, of a chocolate-brown colour, with the antennæ stout and hairy, the base of each joint paler than the apex; a grey silvery line down the centre of the thorax, and a broad shield-like patch of a similar colour from the shoulders down to the centre of the elytra, giving it a handsome marbled appearance.

LYGESIS MENDICA, Pascoe, Ann. Mag. Nat. Hist. (4) 1875, Vol. xv. p. 62.

A good number of specimens of this longicorn were bred from infested twigs taken from a dead tree of *Acacia decurrens* at Carlingford; the first appeared about the end of August, others following until the middle of November. The larva feeds upon the young branchlets.

The beetle is 5½ lines long, of a uniform reddish-brown, jaws long and curved, head slender, thorax long and cylindrical, elytra shining, rounded at the tip, the whole insect covered with a coat of stout white hairs.

STEPHANOPS NASUTA, Newman, Entomological Mag. Vol. v. p. 510.

This is a very long slender longicorn, with the fore part of the head greatly produced, the eyes very prominent, and the antennæ light reddish-brown, long and slender. It is 7 lines in length, but not much more than a line across the widest part of the shoulders; head and thorax dark ferruginous-brown, the apex rounded and cylindrical; legs reddish-brown, long and slender, the apical portion of the femora thickened; the elytra reddish-brown, covered with a fine grey pubescence, with the outer edges bare and shining, forming a narrow line round the margins.

Two specimens were bred from stems of *Acacia longifolia* obtained at Rose Bay in the end of November.

PENTACOSMIA SCOPARIA, Newman, Entomologist, 1842, p. 361.

The larva of this beetle, which feeds under the bark, is hardly noticeable in a large twig; several came out in a show-case from mounted specimens of *Acacia longifolia* some months after they had been placed therein.

The beetle is 3 lines in length, dark brown, clothed with greyish-buff pubescence; the head, thorax, elytra, and legs fringed with fine long hairs ; the antennæ having the first joint very stout, all the joints fringed on both sides with long black hairs, the third joint being further ornamented at its apex with a little black ball composed of fine hairs.

Bred out early in October from branches obtained at Rose Bay.

SYBRA ACUTA, Pascoe, Trans. Ent. Soc. (3), Vol. iii. p. 199.

Two specimens of this beetle emerged in the middle of December from twigs of *Acacia longifolia* obtained at Rose Bay.

Length $2\frac{1}{2}$ lines, greyish-brown, antennæ rather short and stout, head and thorax short ; elytra finely and closely punctured, produced into a sharp arcuate tooth on either side.

SYLLITUS GRAMMICUS, Newman, Ann. Mag. Nat. Hist. 1840, Vol. v. p. 21.

The larva bores narrow irregular chambers along the centre of the smaller branches of the dead wood of *Acacia decurrens*. Two specimens bred out from infested twigs in the middle of December.

The beetle is $4\frac{1}{2}$ lines in length, very slender ; antennæ, head, legs, and thorax ferruginous-brown ; the head long, eyes very prominent ; thorax cylindrical, rather narrow at base, swelling out and slightly ribbed above the apex, which is constricted at the junction with abdomen ; elytra long, slender, of a uniform thickness, rounded at the tip, pale ferruginous-brown, with six pale white parallel ribbed lines running from the shoulders to the tips of the wing covers.

SKELTODES TETROPS, Newman, Zool. App. 1850, p. 113.

Though I have not yet been able to determine the larva of this handsome longicorn, such a number have bred out of a log in the Technological Museum, obtained by the collector (Mr. W. Bäuerlen) in the Richmond River District, that a few notes may be of interest.

For some weeks, during the months of July and August, I captured specimens nearly every morning on the roof of the timber court of the Museum. When at rest they spread their long slender legs out, with the antennæ pointing out straight in front, looking very like a large "daddy-long-legs" *(Tipula)*.

The beetle is 6 lines long, pale brown, slender, with the posterior portion of the tibiæ black and swollen out into a club; the antennæ long and slender, the first joint swollen, black in front, but brown behind, while the apical portion of all the following joints is black, becoming lighter towards the extremity, a very long truncate spine standing out from the apex of the 3rd joint; the thorax marked with a double black line in the centre, with a similar line on either side, all coming into a transverse black band behind the head; elytra deeply punctured, and marked on the sides and centre with wavy curved reddish-brown lines forming a distinct pattern. Mr. A. Lea, late of the Agricultural Department, informs me that he on one occasion found a large number of these beetles, which had evidently bred out from a single tree.

CERATOGNATHUS FROGGATTI, Blackburn, P.L.S.N.S.W. (2), Vol. ix. p. 94, 1894.

Larva white, shining, semi-transparent; abdomen more slender than the thorax; head round, slightly elongate, pale brownish-yellow, eye spots black, mandibles stout, 3-toothed, black; antennæ four-jointed; legs long, slender, closely covered with rather long ferruginous hairs, tarsal claws small and very pointed; dorsal side of both thoracic and abdominal segments rounded, covered with fine ferruginous spines, more plentiful on the thoracic segments, interspersed with fine hairs.

The larva lives in the bark of *Eucalyptus robusta*, the trunk of which when the trees are large is covered with a thick felty fibrous outer bark, which shelters numbers of small insects and their larvæ. It excavates oval chambers about half an inch below the outer surface, where it lies lightly curled round. At Botany I found the beetles and pupæ in these cavities early in November.

The beetle is 5 lines long, black, with the outer edges of the thorax ferruginous, the whole insect closely and finely punctured; the dorsal side of head, thorax and elytra covered with scattered reddish-yellow scales which form a slightly ocellated pattern upon the thorax, becoming more undefined on the elytra.

In the male the jaws are large, curved inwards, broad, and toothed at the tip, with a square wing or flange on the outer side in front of the eyes.

Though this pretty little staghorn is plentiful in the bark of the Eucalypt referred to, Mr. Blackburn says it is new; I have never found it at large.

DIAPHONIA DORSALIS, Don., Insects of New Holland, t. L. f. 1.

Larva a large bluish-white grub about 19 lines in length and 6 lines in diameter, rounded on the dorsal side, with the marginal fold, and spiracles very prominent; jaws three-toothed, stout and black; the antennæ five-jointed, basal ones pale, apical ferruginous; the forehead rugose, bisected in centre forming a broad triangle towards the jaws, with an angular ferruginous patch on either side of the first thoracic segment; legs long, covered with fine reddish hairs; all the thoracic and abdominal segments transversely ridged with three deep furrows which all converge and merge into the centre of the marginal fold, anal segment obtusely rounded; the whole insect covered with fine short reddish hairs, interspersed with a few longer ones on the sides of the head and thorax.

The larvæ were very plentiful towards the end of last March under large logs between Carlingford and Eastwood; they are usually just covered with earth mould.

I kept some thirty specimens in a large tin full of damp earth, and though several formed cocoons, with one exception they were all infested with dipterous larvæ which after a time broke holes through the sides of the earthy cocoons and came out.

On the 1st December I examined the remaining cocoons and found the only perfect one contained a dead but perfect beetle.

The beetle is one of the largest Cetonias found near Sydney, and though not as common on the flowers of *Angophora cordifolia* as some of the other species, it is often found flying about in the street, or buzzing in at open windows during the summer months.

It measures 13 lines in length ; underside, legs, head, centre of thorax, a spot on either side above the eyes, the scutellum and the marginal division of the wing cases black, the rest of thorax and elytra ochreous-yellow.

PARACEPHALA CYANEIPENNIS, Blackb., Trans. Roy. Soc. S.A. Vol. xvii. pt. 1, p. 130.

Larva slender, cylindrical ; mouth-parts black, head small, thoracic segments broadest; abdominal ones smooth, regularly rounded, tapering towards the anal segment which terminates in a small tubercle.

In a short paper communicated to this Society in July, 1892, I described three species of the genus *Ethon* whose larvæ form galls on native plants. The larva of this beetle belonging to an allied genus also has the same remarkable habit.

In June of last year I found a large number of the low shrubby bushes of *Casuarina distyla* at the head of Rose Bay with the branches covered with rounded gall-like excrescences about 7 lines in diameter and 5 lines in height. On cutting some of them open I found the larvæ placed at the base of the gall in a similar manner to those of *Ethon affine* on *Pultenæa stipularis* previously described.

The beetle is 4 lines in length ; head and thorax metallic dull bronze, the latter irregularly corrugated ; elytra deep metallic green, very finely and closely rugose ; legs and all the underside dull metallic copper colour. I have never taken this beetle at large, but have cut a great number out of mature galls, dozens of galls being sometimes found upon one bush.

APATE COLLARIS, Boh.

Larva white, showing a red line on the dorsal side bisecting the lower abdominal segments ; broad and stout, with the apex of the abdomen rounded ; jaws black, rather broad at the base, palpi short, jointed, apical one large, oblong ; head small, thoracic segments broad, legs small with very slender tarsi, fringed with long reddish hairs ; abdominal segments slightly rounded on the sides, smaller and more rounded towards the apex.

The larvæ feed upon the dead wood of various species of Eucalypts, living chiefly on the sapwood, which is completely riddled with irregular parallel channels which often cross and run into each other, and are all filled in behind as the insect moves along. When full grown it pupates in a small oval chamber at the end of its bore. The beetles as soon as they emerge bore circular shafts straight through the bark into the sapwood, laying an egg at the bottom. The bark of a large dead Eucalypt (probably *E. hæmastoma*) was covered with these little pits, out of which streams of fine dust were falling; beneath was the sapwood containing larvæ and pupæ in all stages of development.

The perfect beetle is $2\frac{3}{4}$ lines long; head ferruginous, very rugose, slightly furrowed on the sides, jaws black ; thorax pale ochreous-yellow, projecting on either side of the head ; a small curved hook standing out in front above the forehead ; the frontal portion of thorax covered with short warty black spines, the apical part finely punctured, shining ; legs ferruginous ; elytra black, slightly rugose, covered with small punctures, apex truncate, sloping down to the anal tip, the elytron produced into two short spines at the apex, the tips of which are split into two fine points.

Hab.—Hornsby. In the log from which I obtained these beetles I found a number of long slender larvæ which appeared to be parasitic upon the beetle larvæ, but I was unable to breed them.

OXYOPS CONCRETA, Pascoe, Journ. Linn. Soc. x. 1870, p. 479.

Larva a short, stout, dull brownish-green grub, the mouth parts small, and hidden by the folds of the first thoracic segment, which is produced on the dorsal side into four stout tubercles ; the following nine segments, each forming a double fold, the first small, wedge-shaped, with a projecting point at either side, the second fold carrying a row of eight finger-like points, the four central ones longest, the last segment overlapping the anal tip ; legless, and smooth on the ventral surface. The larva exudes a slimy secretion, with which it is covered on the upper surface, while its excreta are drawn all over it by the aid of the slime, and the contraction and expansion of its prickly back; on the leaves it looks like a slimy slug covered with dirt.

It feeds upon the leaves of *Eucalyptus longifolia*, only eating the outer surface, and often completely skeletonising each leaf; it is plentiful about the neighbourhood of Flemington and Rookwood, where in January it is common, and many trees may be noticed with a patch of leaves, white or mottled, that have been attacked by these grubs.

When full grown it crawls down to the earth and buries itself some inches under the soil, where it remains from two and a half to three months before it emerges and re-ascends the tree, on the twigs of which it is to be found clinging later in the year.

The beetle is 6 lines long and 3 lines in width across the shoulders; black and shining, the thorax furcate, covered with fine white or brownish scales in the furrows; legs covered with similar greyish scales, while the elytra which are also distinctly ribbed are granulated with scattered greyish scales which form a round grey patch on the apical portion of the elytra.

OXYOPS HOPEI, Bohem., Schh. Gen. Curc. iii. p. 483.

The larva of this species is similar in form and habits to that of *O. concreta* previously described, but seems to gnaw the leaves in a more patchy manner.

It is common in the neighbourhood of Bendigo, Victoria, feeding upon the leaves of the ironbark, *Eucalyptus leucoxylon*. I obtained a number of the larvæ and several perfect beetles in the latter part of August.

The beetle is about the same size as *O. concreta*; black and shining, the thorax much more rugose, with the elytra more closely ribbed; a row of four rounded tubercles on the shoulder, and two pairs, one above the other towards the apex; the extremity of the elytra at their junction produced into a conical point; the whole of the insect granulate, with scattered reddish-brown scales, densest on the thorax and shoulders.

Orthorrhinus Klugi, Bohem., Schh. Gen. Curc. iii. p. 246.

Larva semitransparent, with a brownish tinge; covered with a few scattered hairs on the dorsal side, and a close growth of much longer ones on the ventral side which is rather flat; mouth parts ferruginous, jaws tipped with black, coming to a sharp point; fore part of head smooth, shining and rounded in front; the segment behind arched over the head, the rest of the thoracic and all the abdominal segments rounded, smooth, shining, of a uniform size; anal segment hairy and rather truncate; larva nearly always curved round and broadest in the centre.

The larva feeds upon the dead branches of *Acacia decurrens*, hollowing out the slender twigs, but filling up the irregular tunnels as it feeds along. I obtained a large number of infested twigs from a dead Acacia near Carlingford containing numbers of perfect insects, and larvæ in all stages of development, in the middle of March. The pupa is of a pale brown colour with black eyes, a small protuberance on either side of the head, and a sharp spine on either side of the anal segment.

The perfect beetle is $3\frac{1}{2}$ lines long; rich reddish-brown, covered with very fine golden bronzy scales which show a faint metallic lustre; two conical projections on the front of the thorax, and a double row of three more rounded protuberances down the elytra with two other pairs towards the apex, and a generally rugose pitted surface on the thorax and elytra, giving it a very warty appearance.

ON SOME NAKED AUSTRALIAN MARINE MOLLUSCA.

Part I.

(Plate vii.).

By C. Hedley, F.L.S.

(Communicated by permission of the Trustees of the Australian Museum).

Partly because they offered no trophies to grace the collector's cabinet and partly because the literature treating of the subject is both meagre and difficult of access, the Australian naked mollusca have been little studied.

A recent donation to the Museum by J. P. Hill, Esq., F.L.S., Demonstrator of Biology of the Sydney University, comprising several species of shell-less mollusca, and which in the course of official duties required determination, brought forcibly to my notice the poverty of published information regarding them.

Commencing my inquiries with a huge *Pleurobranchus* (as understood by Fischer), I found that in Australia two species only are as yet recorded, *P. punctatus*,* Q. and G., Voy. Astrolabe Zool. ii. p. 299, pl. xxii. ff. 15, 19, from Jervis Bay, N.S.W., and *P. angasi*, described and figured by E. A. Smith, "Report on the Zoological Collections made in the Indo-Pacific Ocean during the Voyage of the Alert, 1881-2," p. 88, pl. vi. ff. K, K'; and collected in Sydney Harbour by Dr. Coppinger.

A *Pleurobranchidium maculatum* was collected, figured and described by Quoy and Gaimard in association with *P. punctatus*.

If we extend our survey to New Zealand we find another species *P. ornatus*, Cheeseman (P.Z.S. 1878, p. 275, pl. xv. ff. 1, 2).

* I am indebted to the kindness of Prof. Tate for a reference to this species.

From Polynesia the researches of Garrett and Pease have brought to light *P. grandis, ovalis, delicatulus* and *tessellatus*, Pease (Am. Journ. Conch. iv. pp. 78-80, pls. IX. and X.). The species under consideration resembled none of these, but of all the figures and descriptions within my reach it most approximated to those of *P. testudinarius* on p. 571 of Fischer's Manuel de Conchyliologie.

Most opportunely, whilst still investigating the new species, I received from Prof. Vayssière of Marseilles, France, a welcome gift of a copy of his "Recherches Zoologiques et Anatomiques sur les Mollusques Opistobranches du Golfe de Marseille," "Pt. i.—Tectibranches," forming Tome ii.—Zoologie—of the "Annales du Musée d'histoire naturelle de Marseille." The full account, the best hitherto given, herein contained, of the above mentioned mollusc, confirmed me in recognising in the Mediterranean animal the nearest known relative to our Sydney slug.

For the French species, Prof. Vayssière adopts the name of *Oscanius tuberculatus*, Delle Chiaje; embracing as synonyms *Pleurobranchus forskahli*, Delle Chiaje, *P. mammillatus*, Schultz, and *P. testudinarius*, Cantraine.

My correspondent amends and expands the genus *Oscanius* of Leach on p. 121 of the above quoted work. According full generic rank to this division, he unites with it as an absolute synonym, Gray's genus *Susania* (Guide to the Mollusca of the British Museum, 1857, p. 202). This is the interpretation of *Oscanius* here followed.

Oscanius hilli, n.sp.

Animal elliptical, thick, subglobose; in life, as well as I can recollect, dark plum colour; as contracted in alcohol measuring 140 mm. in length by 120 mm. in width and 50 in height; without a shell. Mantle very large, thick and muscular, overlapping the body so as almost to envelope it; irregularly covered outside by numerous large, warty protuberances; deeply, squarely notched in front, entire throughout the rest of its circumference. Rhinophores appressed to each other, externally split to the base, thick and subcylindrical. Eye not observed. Foot large, somewhat cordate in outline, bearing at the tail, on the sole and in the median line, a gland 30 mm. by 10 mm., distinguished from the rest of the sole by its thick transverse rugosities and black colour. Gill-plume tucked in between the mantle and the foot, a third as long as the animal, bipinnate, folded down the centre so as to expose one side only, the stalk without the pinnæ within, attached to the body as far as the 16th filament; pinnæ 24, rapidly increasing in length from the anterior to the 6th, thence gradually decreasing to the posterior end, each filament attached beneath for more than half its length; midrib beaded at the junction of each plumelet. Anus just within the tip of the gill and behind the membrane upon which it is hung. External genitalia located immediately before the branchia, wrapped within two oblong flaps.

The specimen above described was, with two others, dredged in 8 fathoms, about a mile south of the Sow and Pigs Reef, Port Jackson, by the Marine Excursion of 17/12/92 of the Field Naturalists' Society of N.S.W., and was presented to the Australian Museum by the Society. Another specimen, dredged off Stokes' Point, in Broken Bay, N.S.W., has been presented by Mr. Hill. Mr. Brazier also informs me that specimens of this species from Port Stephens, N.S.W., have come under his notice.

EXPLANATION OF PLATE.

Fig. 1.—Dorsal aspect of *Oscanius hilli*, from spirit specimen.

Fig. 2.—Ventral aspect of ditto, the free edge of the foot bent over to expose the anus, gill-plume and genitalia; on the sole of the foot the tail gland is shown. Both drawings slightly reduced and photo-lithographed from the pen sketches of the writer.

OBSERVATIONS UPON THE ANATOMY AND RELATIONS OF THE "DUMB-BELL-SHAPED" BONE IN *ORNITHORHYNCHUS*, WITH A NEW THEORY OF ITS HOMOLOGY; AND UPON A HITHERTO UNDESCRIBED CHARACTER OF THE NASAL SEPTUM IN THE GENERA *ORNITHORHYNCHUS* AND *ECHIDNA*.

By J. T. Wilson, M.B., Professor of Anatomy in the University of Sydney.

(Plates VIII.-IX.)

(A preliminary note summarising most of the conclusions arrived at in this paper was presented at the Meeting of the Society March 28th, 1894, and published in the Abstract of Proceedings of that date).

The question of the morphological significance of the dumb-bell-shaped bone in *Ornithorhynchus* first attracted the attention of the writer when investigating, with Dr. C. J. Martin, the anatomy of the muzzle of this animal. In the paper in the Macleay Memorial Volume (1) in which we recorded the results of our work, no new opinion upon the subject of the present paper was expressed, though even then our series of coronal sections had gone far to convince me that the usual premaxillary theory of the nature of the dumb-bell bone was an inadequate one. This latter view was that entertained by Rudolphi and Meckel (2, p. 20) and was adopted by Owen in his article on the Monotremes in Todd's Cyclopædia (3).

But in his later work upon the Anatomy of Vertebrates (4, p. 322) Owen apparently forsook this theory in favour of an interpretation of the bone as a 'prenasal ossicle.' This view was adopted by Flower in the earlier editions of the 'Osteology of the Mammalia' (5, p. 219), where the bone is referred to as placed in, or in front of, the anterior extremity of the mesethmoid cartilage, and apparently corresponding to the so-called 'prenasal' of the pig. In 1883 Albrecht (7) again advocated the older (intermaxillary) view of the bone mainly upon reasons derived from a study of the normal and pathological development of the premaxilla in other mammals. The contentions of this author were in 1885 supported by Sir William Turner, who devoted a paper in the Journal of Anatomy and Physiology (8) to a critical examination of the prenasal and intermaxillary theories respectively. His reasons for adhering to the latter are in part founded on his own observations upon the region by means of special dissection. In the edition of the 'Osteology of the Mammalia' published during the same year, 1885, Professor Flower (with Dr. Gadow) explicitly gave up the prenasal theory in favour of the intermaxillary as advocated by Albrecht and Turner. But in the descriptive passage referring to it an extremely misleading description is given of the bone as "placed in front of the anterior extremity of the mesethmoid cartilage in the palatal aspect of the jaw." This statement is indeed quite inconsistent with one of Turner's points of contrast between the dumb-bell bone and a true prenasal, viz., that the latter is (and the former is not) "placed in front of the vomer and mesethmoid cartilage." And in point of fact the dumb-bell bone is entirely ventrad of the cartilaginous septum and far behind the preaxial end of the latter.

The latest contribution to the literature of this subject that I am aware of (apart from the paper in the Macleay Memorial Volume above-mentioned, which only incidentally refers to it) is a paper by Prof. Symington, published in 1891 (9). This author also accepts the view which identifies the dumb-bell bone with an element of the mammalian premaxilla. Both Turner and Symington have recorded important details of the structure and relations of this very interesting ossicle, and the results of their observations we propose first of all briefly to review, as it is chiefly to these authors that we owe our knowledge of the detailed anatomy of the bone. Symington's chief results were obtained by the study of series of coronal sections.

After referring to its shape, Turner *(loc. cit.)* states that the dumb-bell bone "consists of two symmetrical and lateral halves united mesially by a suture, the line of which may be seen on the palatal surface of the bone, though the two halves obviously become fused at a comparatively early period of life." He also states that it is situated "in the hinder part of a fibrous membrane, which is attached behind to the anterior free border of the palate plate of each superior maxilla, on each side to the inner border of the intermaxilla, &c.," and that "the edge of the dumb-bell bone is surrounded by the membrane." He further states that "the upper surface of the dumb-bell bone lies immediately subjacent to the anterior somewhat expanded end of the vomer, which is fused with it along its mesial line." He then proceeds to refer to its relation to the naso-palatine or incisive foramina, which open on each side of and close to the isthmus or intermediate portion of the dumb-bell bone as seen from the palate, and he concludes that in its relation to the incisive foramina, the dumb-bell bone corresponds with "that portion of the intermaxillary in other Mammalia which lies between the incisive foramen and the mesial palatal suture"; and that "the more anterior part of the roof of the mouth does not undergo an ossific change, but remains as fibrous membrane, except in the limited area where the dumb-bell-shaped bone is produced." He then goes on to examine the argument for the theory that the dumb-bell bone is the homologue of the prenasal bone of the pig, as this was expressed by Flower, following Owen's later view, and he sums up in favour of its correspondence to the mesial element of the premaxilla rather than to the prenasal, as follows:—The dumb-bell-shaped bone "is inferior to the vomer and fused with its inferior border; it has no relation to the anterior nares; it enters into the constitution of the hard palate, and it forms the inner boundary of the entrance into the naso-palatine canal. In its position and relations it corresponds with that part of the intermaxilla which lies between the incisive canal and the mesial palatal suture." It would appear from the descriptions thus summarised that Sir Wm. Turner regards the dumb-bell bone as consisting merely of a palatine plate, since he considers it to be fused along its mesial line dorsally with the anterior end of the vomer. We shall see presently that the mesial bone rising dorsally, vomer-like, from the palatine dumb-bell is an integral part of the bone itself, and is quite distinct from the true vomer, which ends quite posteriorly to this region. It may also be noted that what Turner has regarded as fibrous membrane filling up the extensive hiatus in the hard palate is in reality a thin sheet of hyaline cartilage forming the floor of the nose, as was shown by Dr. C. J. Martin and the writer in the paper already referred to (1). It is in this cartilaginous layer, and not in fibrous membrane, that the dumb-bell bone is imbedded. Owen and Meckel both refer to this cartilage forming the floor of the nose, and Meckel (2, p. 40) gives its dimensions and attachments as seen from below.

The additional observations of Professor Symington may now be reviewed. He notes the close relation of the upper surface of the anterior nodule of the dumb-bell "to the cartilages of the nose which contain Jacobson's organ," and he further mentions the fact, to which Martin and I have also drawn attention, that near the posterior extremity of the dumb-bell it is covered, as seen from below, by a thin layer of cartilage. As our figure shows, however (1, Pl. XXIII. fig. 17), this is due to the hinder end being more deeply embedded in the cartilaginous nasal floor and not merely grafted upon its under surface as appears, superficially, to be the case in front. From his study of coronal sections Symington has recognised that the bone projecting from the mesial dorsal surface of the palatine dumb-bell is, as has been said above, an integral part of that bone, and his description and figure (9, Pl. XLIII. 2) of a coronal section through the bone near the middle of the posterior nodule will suffice to carry conviction upon this point. In such a section the bone appears "as composed of two crescents with their convexities directed inwards, and the greater breadth of the bone [in the posterior segment] is due to the elongation of the horns of the crescents which reach about half-way round the organ of Jacobson and are in close contact with its cartilage." This author does not mention the vomer, but quite plainly he does not adopt the view that the vomer is fused with the dumb-bell dorsally.

He concludes by stating that "the dumb-bell bone from its position in relation to the cartilages of the nose is evidently ossified in the membrane investing them," and that "the relation of the bone to the organ of Jacobson corresponds essentially to that of the palatine process of the premaxilla in various mammals" (p. 582).

I may now proceed to state my own observations and conclusions respecting the anatomy of the dumb-bell bone and of the parts related to it.

In studying series of coronal sections one cannot fail to be impressed with the intimate relations between the dumb-bell bone, on the one hand, and Jacobson's organ and the cartilaginous septum nasi, on the other. I have already referred to Symington's account of the relation to the organ of Jacobson, but he has passed over without special remark the relation of the dorsal moiety of the bone to the nasal septum, a relation so marked as to lead Sir Wm. Turner to take that dorsal portion of the bone as part of the vomer.

It may, perhaps, be better to give at once a complete account of the structure and relations of the bone as I have myself determined these both by fresh dissection and by the examination of frontal sections.

In a specially large adult male *Ornithorhynchus* measuring over 50 cm. between the tips of the snout and tail, I find the palatine plate of the "dumb-bell" bone to measure 9·5 mm. in total length. This measurement includes about 2 mm. of the posterior extremity of that plate which is overlapped by the palatine cartilage of the nasal floor (see fig. 1, *b* and *d*) just in front of the anteriorly directed median process of the osseous maxillary palate. The greater portion of the palatine plate of the dumb-bell lying anterior to this appears as if applied to the ventral surface of the cartilage of the nasal floor, and peripherally it is so applied (*cf.* figs. 1-3 for points referred to in this description). This palatine plate consists of an anterior (*a*) and a posterior (*b*) moiety united by a narrow isthmus (*c*). The isthmus is rather nearer to the anterior than to the posterior end of the plate. The naso-palatine foramen lies on each side opposite and close to the isthmus.

The antero-posterior diameter of the anterior segment, measured to a point opposite the anterior margin of the naso-palatine foramen, is 3·5 mm. Its greatest breadth is 4 mm. The antero-posterior diameter of the posterior segment is 4·5 mm. and its greatest width is 7 mm. Its hinder border forms a nearly semi-circular line. The width of the isthmus is 1·5 mm. The palatine plate is comparatively thin, and the term "dumb-bell-shaped" is only applicable to the general contour of the periphery as seen from below, and indeed it only imperfectly describes that contour.

On dissection to expose the dorsal aspect of the thin palatine plate of the bone, there is seen arising from its dorsal median line a vertical plate (*f*) which dorsally sends out diverging alar laminæ (*g*) on either side. These form the dorsal horns of the "crescents" which Symington has described in transverse sections. The spread of the dorsal alar laminæ at its maximum is 3 mm., and they do not form a horizontal plate, but from their upward divergence they form dorsally a deep median groove or gutter which receives the ventral edge of the cartilaginous nasal septum. The maximum height of this vertical portion of the bone is 2 mm., the maximum height of the bone as a whole being 3 mm. The vertical plate does not extend to the anterior extremity of the horizontal or palatine portion of the bone, but begins about 1·5 mm. behind the anterior end of the latter in a gradually ascending crest with an oblique margin. Just opposite the hinder end of the preaxial segment of the bone the height of the crest is about 1·5 mm. Here it rather suddenly develops its dorsal alar laminæ, and from this point backwards it slightly increases in height, though on the whole its height is fairly uniform and not exceeding 2 mm. The height does not diminish until the hinder end of the palatine plate of the bone is reached. Here, however, the vertical portion of the bone is continued backwards dorsally for a considerable distance behind the plane of the posterior end of the horizontal palatine plate, in the form of a thick bony spur (*e*), still grooved dorsally for the septum, and gradually undergoing reduction in height at the expense of its ventral border, which becomes elevated more and more dorsally above the horizontal plane of the palate. This spur finally terminates in a posterior bifurcated extremity. The forks (morphologically continuous with the dorsal alar laminæ of the vertical portion of the bone in front) are in contact with the lips of the ventral border of the cartilaginous nasal septum, and they are in continuity posteriorly with the fibres of strong bilateral "vomerine" ligamentous bands of similar sectional area to themselves which connect them with the corresponding forks of the bifid anterior extremity of the vomer. In the dissected specimen from which this description is chiefly taken, the distance between the extreme tips of the forks of the vomer and those of the spur of the dumb-bell bone is about 2 mm., and the latter projects backwards beyond the plane of the posterior extremity of the palatine plate of the dumb-bell for a distance of 4 mm. Now the posterior extremity of the latter bony plate is only about 0·5 mm. in front of the anterior end of the maxillary palate, to which it is usually regarded as articulated ; and accordingly the postaxially directed spur of the dumb-bell bone lies in a horizontal plane above (dorsad of) the maxillary palate, from which indeed it is separated near its hinder end by a vertical distance of about 1·5–2 mm., as is also the bifid anterior end of the vomer and the "vomerine ligament" aforesaid. This interval, spanned by the series of structures just mentioned, is not filled up by any septal structure whatever, but in the living or recent specimen forms a low antero-posteriorly elongated aperture of communication between the two nasal fossæ which is lined by columnar epithelium similar to that lining the adjacent parts of the nasal fossæ (*cf.* fig. 4 *i*). The maximum height of this *internasal* aperture is about 1 mm., while its length antero-posteriorly is about 5·5 mm.* The plane of the anterior boundary of the internasal passage corresponds pretty accurately with the tip of the median anterior process of the maxillary palate whose upper surface, covered by the nasal mucous membrane, forms the lower boundary of the passage.

When the nasal septum is viewed from the side, the internasal aperture is seen to be overhung and almost concealed by the prominent shelf-like ridge running backwards upon the septum, and forming the posterior continuation of the prominence containing the organ of Jacobson (see figs 4 and 6-8 *gl.*). The roof of the internasal passage may be regarded as considerably widened by the projection of this shelving ridge on either side of the septum (fig. 7 *gl.*).

From what has already been said of the structure of the dumb-bell-shaped bone, it will have become evident that that bone presents on each side a wide and antero-posteriorly elongated sulcus between the lateral portions of its palate plate on the one hand, and the vertical portion of the bone, with its dorsal alæ, on the other (see fig. 3). In this sulcus is lodged the greater part of the organ of Jacobson, enclosed in its incomplete cartilaginous capsule, for which the bone forms a somewhat semi-tubular osseous investment, the tube being incomplete externally (*cf.* figs. 9-11). In transverse sections this gives rise to the appearance of the bone being "composed of two crescents with their convexities directed inwards" (Symington). The hollows of these crescents are, throughout their greater part but not entirely, lined by the investing cartilaginous capsules of the organs of Jacobson. The osseous sulcus on each side is of course deepest where both the width of the palatine plate and the spread of the dorsal alæ are greatest, *i.e.*, in the region of the posterior palatine segment of the bone. It shallows rapidly in front of the naso-palatine foramen through sudden reduction of the alæ, and the more gradual reduction of the vertical plate itself (fig. 12). Posteriorly it is continued

* These measurements are given from the very large specimen chosen for description. In another specimen the length was only about 4·5 mm. It will be understood that all the measurements given are proportionally large.

backwards beyond the posterior segment of the palate plate of the bone as a groove upon the side of the posterior spur, where that lies in the roof of the internasal passage (figs. 7 and 8).

As Symington has shown (*loc. cit. cf.* his pl. XLIII. fig. 1) the organ of Jacobson in *Ornithorhynchus*, with its cartilaginous capsule, is continued forwards for some little distance in front of the naso-palatine foramen into which its duct opens, and in fact it reaches to near the anterior end of the preaxial segment of the dumb-bell ending immediately in front of the anterior commencement of the vertical crest. Posteriorly the organ ends at the plane of the anterior margin of the internasal aperture, *i.e*, that of the anterior limit of the maxillary palate, and only a very short distance behind the plane of the hinder end of the dumb-bell-shaped plate.

The outer wall of its cartilaginous capsule, however, is continued a little further back, closing in externally the continuation, on the posterior spur, of the lateral groove of the bone, in which are lodged the great nerves and the vessels destined for Jacobson's organ. These are contained in the base of the shelving ridge referred to above, but the marginal part of the shelf consists merely of mucous membrane, including an elongated mass of glandular tissue. In sections through the middle of the internasal aperture (fig. 7) the glandular tissue is responsible for about two-thirds of the entire width of the shelf, but at the anterior margin of the passage it forms only about a half of the total width. This definite glandular prominence lies outside the capsule of Jacobson's organ, and may be traced forwards as an extra-capsular prominence on its dorso-lateral wall almost to the anterior end of the organ. A small amount of glandular tissue is, however, to be found within the capsule of the organ.

In the light of these observations I propose now to reconsider the grounds upon which the dumb-bell bone has been so confidently regarded as simply the inner or mesial palatine portion of the intermaxillæ. The criteria which, in Sir Wm. Turner's opinion, were sufficient to establish this judgment, have already been quoted, and we have seen that the first of these depends on an erroneous view of the relation of the dumb-bell bone to the vomer. This is an extremely important point, and I am surprised that Prof. Symington does not explicitly recognise the mistake which his observations were quite sufficient to correct. It is very plain, both from Symington's observations and my own, that the dumb-bell-shaped bone is not inferior but anterior to the vomer, and that it is *not* "fused with the inferior border" of the latter.

The criteria that remain,—viz., that it "has no relation to the anterior nares," that "it enters into the constitution of the hard palate," and that "it forms the inner boundary of the entrance into the naso-palatine canal"—may be sufficient to disprove the homology to the prenasal bone of the pig. A powerful additional argument against the homology to the prenasal bone in the pig is derived from the observations of Dr. Martin and the writer upon the anterior extension of the cartilaginous septum in *Ornithorhynchus* in the form of a flattened 'prenasal plate' lying in front of the dumb-bell bone and continuous behind with the ventral extensions of the alinasal or aliseptal cartilages which form the cartilaginous nasal floor (1, pp. 185-8). But the reasons adduced do not appear to me sufficient to establish the intermaxillary nature of the dumb-bell bone against the contention that that bone is a true "anterior vomer" formed, of course, by the fusion of two bilaterally symmetrical halves, and this is the view which it is one of the objects of this paper to advocate. Whenever it is recognised that the vertical bony lamella dorsad of the palatine dumb-bell is not part of *the* vomer but an integral part of the so-called dumb-bell bone, certain of the relations and connections of that bone at once suggest difficulties in the way of its explanation as premaxillary.

(1) Although the palatine plate of the dumb-bell bone appears at first sight as if it were situated in the same morphological plane with the maxillary palate behind it, this is not really the case, because the hinder end of the palatine dumb-bell is embedded in and covered ventrally by the cartilage of the nasal floor, in front of the maxillary palate. (See figs. 1 & 9; and also Macleay Memorial Vol. [1], Pl. XXIII. fig. 17.)

(2) That this peculiar relation of the postaxial end of the dumb-bell to the cartilage of the nasal floor is no trivial or insignificant fact, is confirmed by the prolongation backwards of the vertical part of the bone some considerable distance dorsad of the maxillary palate and in relation to the cartilaginous septum. It appears to me that a bone which is so prolonged backwards on a higher plane than the maxillary palate cannot be regarded as developed in the same morphological plane with it, even though anteriorly it has come down so as to occupy the same actual plane.

(3) But further, we have seen not only that the dumb-bell bone is prolonged backwards in the form of a bifurcated (vomerine) splint in relation to the ventral edge of the cartilaginous septum nasi, altogether above the plane of the maxillary palate, but also that this vomerine spur is separated from the maxillary palate by a very peculiar hiatus. In what light are we to regard the internasal passage above referred to? A very little consideration will, I believe, suffice to render this somewhat extraordinary feature of an adult mammalian septum nasi quite intelligible. When the palatal plates of the embryonic maxillary processes coalesce to form the floor of the nasal cavity, they very soon unite with the ventral edge of the internasal septum. This coalescence generally proceeds backwards towards the posterior nares, and before the coalescence of the palate with the septum is complete posteriorly there is a single median choanal passage, *i.e.*, the nasal cavities freely communicate. It is plain that here in *Ornithorhynchus* we have a condition of non-coalescence of the palate with a certain extent of the ventral border of the septum nasi.* But it is notable that this non-union does not occur towards the posterior

* Attention may here be called to the instructive similarities in the general relations of parts between transverse sections through the nasal region of Platypus in the region of the internasal aperture, and similar sections through the nasal region of many embryo mammals passing through the embryonic choanal communication between the two cavities. *Cf.* in particular, figures in Parker's monographs on development of Mammalian skull, *e.g.*, *Edentata* and *Insectivora*, pl. III. figs. 9 and 9*a*. Note especially the ventral relations of the cartilaginous septum to the vomer, &c.

nares, but in front of the vomer. The question arises, why should the failure to unite with the septum have taken place precisely in this region? This is an important question, and I think it may easily be answered if we recognise that the anterior end of the osseous maxillary palate indicates the anterior limit of fusion of the palatal plates of the secondary or permanent palate. In other words the secondary palate ceases somewhat abruptly with the anterior margin of the maxillaries, and in front of this the floor of the nasal cavities is constituted, not by a secondary palatal formation at all, but simply by the ventral parts of the cartilaginous walls of the primary nasal capsules which are intimately bound up with the forward extension of the intertrabecular cartilage forming the cartilaginous septum nasi. This, indeed, is demonstrably the case. The wide area between the diverging premaxillo-maxillary crura in the macerated skull is largely filled up in the recent state by a sheet of cartilage whose composition has been described and figured in the paper already referred to (1), and which has nothing to do with the secondary palate. In ordinary adult mammals the area, which is homologous with this interval, is closed in below the nasal cavities by the premaxillaries, which send inwards and backwards palatine plates* which join the maxillary palate, completing the secondary palate in front. And according to the prevalent theory the dumb-bell bone in *Ornithorhynchus* represents these premaxillary palatine plates, at least in part. I am of opinion, however, that the facts I have adduced respecting the dorsal and posterior relations of the dumb-bell bone tend to negative the view that that bone is an ossification in the morphological plane of the secondary palate, and point distinctly to its homology to a bone of the vomerine series. To sum up this portion of the argument: I regard the secondary palate as ceasing altogether at the anterior margin of the osseous maxillary palatine plate. The failure to develop in front, on the part of the premaxillary moiety of the usual secondary palate, results in the exposure from below of the ventral walls of the cartilaginous nasal capsules, and of the intervening cartila-

* See, however, discussion towards the end of this paper.

ginous nasal septum. The latter, however, is clad for a certain distance forward on its ventral border by a bilaterally symmetrical anterior vomerine splint, distinct from, but in series with, the principal vomer; while in front of this the ventral aspect of the septum is bare—covered only by the mucous membrane of the mouth—and here it descends, flattens dorso-ventrally, and spreads out into a "prenasal plate" of cartilage, which is continuous laterally and behind with the aliseptal cartilages, and in front with the marginal cartilage of the upper "lip." [See paper (1) and figures in Macleay Memorial Volume.]

Further, with regard to the internasal aperture, I regard it as situated in a position quite definitely determined by the course of development, viz., above the extreme anterior end of the secondary palate. It seems less difficult to understand non-coalescence of the septum with the secondary palate either posteriorly or anteriorly than it would be to imagine an arbitrary interruption of the coalescence midway. Posteriorly a persistent median choanal passage would be the result of premature cessation of the process of coalescence, while non-union anteriorly such as we have in the case before us may possibly be explained by supposing that the porterior boundary of the internasal aperture really represents the original starting point of palatal coalescence, and that the extension of the secondary palate in front of that point, at a lower level than the septum, is the product of a later development. Of course the point can only be decided by actual embryological investigation, for which, unfortunately, the material has hitherto not been available.

The anterior boundary of the fenestra is in my view due to a rapid ventral descent of the septum into the roof of the mouth in front of the anterior border of the permanent palate, and I conjecture that it is probably formed somewhat late in development, as the septum undergoes the great anterior elongation which it acquires in the snout of this long-nosed animal.

It might detract from the value of the arguments based upon the posterior relations of the dumb-bell bone to the internasal aperture if it could be contended that the latter may be merely an adaptive character in this peculiar animal, and one which may not bear all the significance which I attach to it. But this position can hardly be taken up when I am able to state that the feature appears to be a general character of the *Monotremata* since it is also present in the genus *Echidna* (see fig. 5). I have not yet had time fully to investigate the structural relations of the fenestra in the latter type, though the material is in process of preparation. I fully expect that a study of the same region in *Echidna* along parallel lines will throw a fuller light on the whole anatomy of the region, and will, perhaps, enable us to determine what in that animal is the structural homologue to the dumb-bell bone in *Ornithorhynchus*.

After diligent search I have been unable anywhere to find a reference to this very obvious perforation of the wall between the nasal chambers in *Ornithorhynchus* and *Echidna*, or to the persistence of such an aperture in any other mammalian form. I do not think that its presence can ever have been recorded, else its significance would hardly have been overlooked by comparative anatomists.

The aperture does, however, bear a most interesting resemblance to that which in the duck and certain other water birds (15) perforates the septum opposite the external nostrils. This also is a low and anteriorly elongated aperture in the septum at the nasal floor, and the chief *superficial* difference from the internasal aperture in the Monotremes lies in the more anterior position of the aperture in the duck's nose.

It may yet be contended that the considerations which I have hitherto brought forward are, after all, insufficient to enable us finally to dispose of the argument in favour of the homology,—derived from a comparison between their relations to the organ of Jacobson and the naso-palatine foramen,—between the dumb-bell bone in *Ornithorhynchus* on the one hand, and the palatine plate of the ordinary mammalian premaxilla on the other, or rather that portion of the latter which, in the words of Sir William Turner, "lies between the incisive foramen and the mesial palatal suture."

I fully admit the force of such an objection and recognise that if the view advocated in this paper is to be regarded as valid and satisfactory it must be supported by an explanation of the common relationship just referred to and one in which the admitted facts of that relationship are not left out of account.

In attempting to afford such an explanation, reference may in the first place be made to the condition which is common in reptilian forms. The late Prof. W. K. Parker has shown in his Monograph on the structure and development of the skull in *Tropidonotus natrix* (10) that the vomer occupies a position and relation alike to the cartilaginous nasal septum, to Jacobson's organ, and to the opening of the duct of the latter which corresponds to the site of the naso-palatine foramen, exactly similar to the position and relation which we find the dumb-bell bone to occupy in relation to these structures in *Ornithorhynchus.* And identical relations of the vomer may be recognised in others of those reptilian forms in which the organ of Jacobson reaches so high a degree of development. It is then the vomerine element and not the premaxilla which in lower vertebrates possesses those relations which among the majority of adult mammals seem to be possessed by an inner or mesial osseous element of the premaxilla.

Professor Howes has drawn attention to the significance in *Caiman niger* of the very exceptional arrangement due to the intercalation of the bullous anterior free extremities of the vomers in the premaxillo-maxillary region of the palate. He has shown reason for the belief that this bullous palatine lobe of the vomer is to be regarded as the representative of the osseous investment of Jacobson's organ generally present in other reptiles and in mammals. In other crocodilian forms, in which the palatine lobe of the vomer is absent, he found the anterior truncated extremity of the vomer buried in a powerful 'vomerine' ligament which runs forward to the premaxillary region, where its fibres are attached to the periosteum of the premaxillary region and to the palatine process of the premaxilla when such is present. In a young *Alligator mississippiensis* he found the fibres of this ligament partly in continuity with the walls of two fibro-cartilaginous sacs lying within the embrace of the prepalatine foramina, and he considers it justifiable to assume that these sacs, together with the vomerine ligament, form the vestigial remains of the palatine lobes of the vomers in *Caiman niger* with their associated structures. I have referred to these observations in detail because the descent of the anterior lobes of the vomers into the prepalatine region in *Caiman niger* presents a very fair analogy to the descent of the dumb-bell ossification into the prepalatine region in *Ornithorhynchus*. In the latter case, however, the 'palatine lobe' is not absolutely continuous with the main body of the vomer, the continuity being interrupted by the intervention of the bilateral vomerine ligament which has been described above.*

Turning next to the arrangements in the class Mammalia, we may enquire whether developmental conditions amongst other mammalian orders bear out the objection, founded upon the adult condition of the mammalian skull, to our considering the dumb-bell bone as vomerine rather than premaxillary. And this question may, I think, be answered in the negative. A study of Parker's elaborate monographs, especially those dealing with the development of the skull in *Edentata* and *Insectivora* (12), has tended strongly to confirm the idea I had previously formed of the vomerine nature of the bone in question.

Attention may be specially directed to the following amongst Parker's figures—*Tatusia hybrida*, Pl. II. fig. 6 v.', along with the transverse sections in Pl. III. figs. 7 and 8 v'. A later stage of the same, showing the palatine anterior vomers, is figured on his Pl. V. fig. 5 lettered, by mistake, o'.

In the ripe embryonic condition represented on his Pl. VI., fig. 1 shows the palatine anterior vomers considerably restricted in extent and forming that part of the palate which intervenes between the naso-palatine foramen and the "mesial palatal suture." At this stage, however, they appear to be fused with the palatine plate of the premaxillæ.

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* This bilateral vomerine ligament is actually figured by Meckel (2, Pl. VII. fig. 11), though his description of the bone and its relations is meagre.

Again, in *Erinaceus europaeus*, the anterior vomers are shown in Pl. XIX. figs. 1, 3, 7 and 8 (v'.), where their intimate relation to the "recurrent cartilages" or cartilaginous capsules of Jacobson's organs is most striking. *Cf.* also the transverse sections, figs. 4 and 5 of Pl. XVIII.

In reference to the anatomy of the region under notice in *Tatusia hybrida*, Parker has made the following observation (*loc. cit.* p. 18):—"The cartilages protecting 'Jacobson's organs' are no longer tubular, but form half a tube, open externally, the organ lying in the outer hollow. But the cartilages themselves have an osseous counterpart protecting them on the inner side and having their shape and direction; these are the 'anterior paired vomers,' bones well known for their large development in the *Ophidia* and *Lacertilia*; they do not represent a divided 'vomer,' proper, which in nearly all Mammalia is well developed also." This description could almost stand for one of the actual conditions in the adult *Ornithorhynchus*, the paired "anterior vomers" being of course fused mesially.

Thus, if Parker's splendid work could be taken as final, there could be little hesitation in identifying the dumb-bell bone as the homologue of the "anterior vomers" described and figured by him in so many edentate and insectivorous types of Mammalia, as well as in the *Ophidia* and *Lacertilia*.

The figures illustrative of Herzfeld's paper on the organ of Jacobson (13) are also worthy of study in this relation, but in the text this author states that he has simply adopted from Balogh (14) the identification of the bone lying mesially to the incisive foramen as palatine process of premaxilla. Some of the figures, however, show a dorsal extension of this osseous region which is at least highly suggestive of a true vomerine character.

Professor Howes, however, has stated (*loc. cit.*) the opinion that Parker's views respecting the various elements of the vomerine series in the Mammalia are not entirely devoid of uncertainty, and in particular he holds that Parker has "shown that he was unable to draw a sharp distinction between the palatine processes of the premaxillæ and his anterior paired or lateral vomers." Nevertheless, this inability can only be regarded as manifested in certain cases, and Howes himself accepts from Parker certain conclusions on this subject which he sums up as follows:—"(*a*) That we can no longer regard those structures ordinarily described among mammals as 'palatine' processes of the premaxillæ as throughout homologous; and (*b*) that the latter are, in a number of cases, no parts of the premaxillæ at all, but rather referable to the vomerine category;" and he adds that "in his discovery of the complex nature of the (non-pathological) premaxilla of mammals Parker is at one with Albrecht, who has shown that there is reason for regarding the premaxillæ of the adult *Ornithorhynchus* as a combination of distinct elements." The author then proceeds as follows:—"All those mammals for which Parker has recorded the presence of 'anterior paired vomers' are long-nosed. Comparison of the skulls of adults with those of the young as figured by him, will show that while the bones in question may in some cases pass over to the true vomers they more generally remain exclusively related to Jacobson's organ, which they ensheath in the form of the so-called premaxillary palatine processes, and their products of fusion and metamorphosis lie, for the most part, within the area of the latter as ordinarily described." I have quoted at this length from Professor Howes' valuable paper because it appears to me that the condition in *Ornithorhynchus* may be easily interpreted in the light of the last few sentences. *Ornithorhynchus* is a long-nosed mammal whose 'anterior vomers' have fused together in development *without* uniting with any other osseous element. Posteriorly they preserve an intimate relation to the ventral edge of the septum nasi, while anteriorly they constitute exclusively the osseous investment for the cartilaginous capsules of the organs of Jacobson.

In view of Howes' statements above quoted, and of his further dictum that "the vomers and palatine processes of the premaxillaries have been sufficiently shown to be serial elements of a common category," it is not strictly accurate to regard the vomerine view of the dumb-bell bone as really a novel one. But I am unaware that anyone has ever explicitly applied this interpretation to the "os paradoxum" in *Ornithorhynchus*, and the definition of it as a true premaxillary element certainly holds the field. At the same time, when the significance of the statements of Parker and Howes for the interpretation of the premaxilla of other mammals is borne in mind, it may be necessary to admit that the distinction of the dumb-bell bone as vomerine rather than premaxillary is largely a nominal one. I submit, nevertheless, that this nominal distinction is an important one, and I am inclined to hold that a full recognition that here in *Ornithorhynchus* the bone lying between the incisive or naso-palatine foramen and the mesial palatal suture is truly vomerine and has in its origin nothing to do with the body of the premaxilla, will help us to clearer views upon the constitution of the corresponding region in mammals generally.

[See Appendix, p. 150.]

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EXPLANATION OF FIGURES.

PLATE VIII.

Fig. 1.—View of dumb-bell-shaped bone of *Ornithorhynchus* from below, showing palatine plate and vomerine spur, enlarged four diameters.

Fig. 2.—View of dumb-bell-shaped bone from the left side (× 4).

Fig. 3.—View of dumb-bell-shaped bone from the left and above (× 4).

Fig. 4.—Sagittal section of anterior part of snout of adult *Ornithorhynchus*, parallel with and to the right of the mesial plane. The section

passes through the right nostril and exposes the right side of the septum nasi. The internasal aperture is seen below the level of the longitudinal ridge running backwards from Jacobson's organ. The capsule of the latter has been shaved by the section at its most bulging part. The arrow points up towards the naso-palatine foramen.

Fig. 5.—Sagittal section of snout of *Echidna* to left of mesial plane, passing through left nostril, showing nasal septum with its longitudinal ridge and internasal aperture.

References to figs. 1-5.

a, anterior segment ; *b*, posterior ; *c*, isthmus ; *d*, line on posterior segment indicating anterior limit of plate of cartilage which clothes the inferior surface posteriorly ; *e*, bifurcated vomerine spur ; *f*, vertical part of bone ; *g*, dorsal ala ; *h*, nostril ; *i*, internasal aperture ; *j*, Jacobson's organ ; *k*, marginal cartilage of upper lip.

PLATE IX.

Figs. 6-12.—Coronal sections through snout of *Ornithorhynchus*. These figures have been drawn on a reduced scale of one-half from photomicrographs having a magnification of eleven diameters.

Fig. 6.—T.s. in plane of posterior boundary of internasal aperture. The bone clothing the cartilaginous septum ventrally is the vomer (main vomer), and it is seen just meeting the dorsal crest of the maxillary palate.

Fig. 7.—T.s. through about the middle of the internasal aperture. Ventrad of the septum are the forks of the vomerine spur of the dumb-bell-shaped bone separated by a little fatty tissue.

Fig. 8.—T.s. through plane of anterior boundary of internasal aperture. The vomerine spur of the dumb-bell is becoming more ventrally placed and is connected with the cartilage just in front of apex of the median process of the osseous maxillary palate by means of some fibrous tissue. The posterior extremity of Jacobson's organ is cut through on either side.

Fig. 9. —T.s. in plane of hinder end of posterior segment where that is still covered below by the cartilaginous lamina of the nasal floor.

Fig. 10.—T.s. through snout, cutting postaxial segment of dumb-bell-shaped bone in front of line *d* in fig. 1.

Fig. 11.—T.s. through snout in plane of naso-palatine foramina and isthmus of dumb-bell bone.

Fig. 12.—T.s. snout in plane passing through hinder portion of preaxial segment and commencement of vertical crest of bone. Here the organ of Jacobson is about its widest.

Lettering of figs. 6-12.

mx., maxillary palate; *m. mx.*, median anterior process of maxillary palate; *v.*, vomer; *d. b. v.*, vomerine spur of dumb-bell bone; *d. b. p.*, posterior segment of dumb-bell bone; *d. b. a.*, anterior segment of dumb-bell bone; *d. b. i.*, isthmus of dumb-bell bone; *J. o.*, organ of Jacobson; *gl.*, glandular ridge; *nn.*, nerves; *n. p. f.*, naso-palatine foramen; *n.c.*, nasal cavity; *a. s.*, ali-septal cartilage; *n. f.*, cartilage of nasal floor; *n. s.*, nasal septum; *i. a.*, internasal aperture.

The figures were drawn by Mr. G. H. Barrow, those of the dumb-bell-shaped bone from nature, those of the coronal sections from photo-micrographs.

APPENDIX *(July 23rd, 1894)*:—Just on the eve of the final revision of the proofs of the foregoing pages there came to hand by the English mail, P.Z.S. 1894, Part 1 (June 1st), containing Prof. W. Newton Parker's paper, "On some Points in the Structure of the Young of *Echidna aculeata*," to which the Editor has kindly called my attention. In this paper the author refers to the internasal aperture described above and states that "a communication between the two nasal cavities has been described by Home in *Ornithorhynchus*. Zuckerkandl was unable to observe this; but I have satisfied myself that both Monotremes agree in this respect, and that the left and right nasal chambers communicate by a slit-like passage beneath the septum just behind Jacobson's organ." In view of these observations I can only regret that it is impossible now to withdraw the words "hitherto undescribed" from the title of my paper. It is curious that Home's observation should have been passed over in silence by well nigh every later writer on *Ornithorhynchus*.

The present paper was communicated to the Linnean Society of N.S.W. at its meeting on 25th April, 1894, a preliminary note having been read at the previous meeting on 28th March. Professor Parker's paper, although published only on 1st June, 1894, was received by the Zoological Society of London on 7th Nov., 1893, and read at the Society's meeting on 16th Jan., 1894.

DESCRIPTION OF A NEW *ISOPOGON* OF NEW SOUTH WALES.

BY BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., LL.D., F.R.S.

ISOPOGON FLETCHERI.

Branchlets robust, glabrous; leaves narrow- or elongate-lanceolar, always entire, many times longer than broad, callously sphaceolar-apiculate, gradually narrowed into a hardly petiolar base, flat or at the margin slightly recurved, on both sides dull green, their main venules much longitudinal; headlets of flowers terminal, solitary, sessile, almost concealed among leaves, at first somewhat turbinate, at last globular-ovate; outer bracts glabrous, the lowest sometimes broader than long, always apiculate, the exserted portion of the other bracts almost deltoid, short-acuminate; floral bracts reaching beyond the others, nearly elliptic- or obovate-cuneate, outside white-velutinous, but at and towards the summit glabrous; rachis cylindrically lengthened; flowers rather small, quite glabrous; lobes of the corolla whitish, very narrow, bluntish, about twice as long as the tube; stamens inserted near the base of the corolla-lobes; anthers bright yellow, beyond the cells protracted into a narrow appendicle; filaments flat, partly adnate, hardly shorter than the anthers; style gradually thickened upwards, the incrassated portion angular, truncate, subtle-papillulous, rather longer than the pyramidal-subulate stigmatic termination; ovulary penicillar-villosulous.

Blackheath, Blue Mts., overlooking the Grose Valley; very rare; J. J. Fletcher, Esq.

Aspect that of the South-Western Australian *I. longifolius*, but affinity nearest to *I. anemonifolius*, which occasionally produces similar undivided leaves, as indicated already in the Fragm. Phytogr. Austral. vi. 238.

The naturalist, to whom we owe the unexpected discovery of so conspicuous a plant in a region traversed by searchers of plants during the last eighty years, found only one solitary plant. But last year in a similar way Mr. J. B. Williamson came across a solitary individual of a new *Grevillea*, not closely allied to any recorded species, in the Victorian Grampians, nor was he as yet able through renewed searches to discover any more plants of it.

DESCRIPTIONS OF SOME NEW ARANEIDÆ OF NEW SOUTH WALES. No. 4.

By W. J. Rainbow.

(Plate x.)

Family DRASSIDÆ.

Genus Drassus, Walck.

Drassus perelegans, sp.nov.

(Plate x. figs. 1 and 1*a*.)

♀. Cephalothorax 2 mm. long, 1·5 mm. broad; abdomen, 3 mm. long, 1·5 mm. broad.

Cephalothorax yellow-brown, furnished with few short yellow hairs. *Clypeus* broad, moderately convex, yellowish-brown; cephalic segment tinged with red at apex, and fringed with short yellowish hairs.

Eyes seated on anterior part of cephalothorax, in two curved diverging rows, the posterior of which is the longer and more curved.

Legs strong, moderately long, yellowish, furnished with rather long spines and hairs; each tarsus terminating with two claws and scopula; relative lengths 1, 2, 4, 3.

Palpi rather short, similar in armature to legs.

Falces yellowish, furnished with rather long coarse hairs or bristles; they are powerful, conical, and articulated on an inclined plane.

Maxillæ concolorous, broad, convex, inclined inwards, furnished with a few short yellowish hairs.

Labium concolorous also, short, broad, and rounded off at extremity.

Sternum cordate, sparingly furnished with short hairs; similar in colour to foregoing parts.

Abdomen oblong-ovate, moderately convex, slightly projecting over base of cephalothorax; colour, pale yellow; the superior surface is ornamented with two longitudinal bands of bright red, commencing near centre, and terminating towards posterior extremity, where they nearly meet, their inner margins rough and irregular.

Hab.—Sydney.

The *Drassidæ* construct silken cells which they fabricate among the branchlets and leaves of plants, in the crevices of rocks and walls, and under stones; some species form a cell by bending over the leaves at the extremity of the branchlets and binding them in position with web, lining the interior with the same material. The latter is the form of dwelling constructed by *Drassus perelegans.* These spiders conceal themselves in their cells, quitting them only when in quest of prey, which they capture either by surprise or active pursuit.

Family EPEIRIDÆ.

Sub-Family GASTERACANTHIDÆ.

Genus CYRTARACHNE, Thor.

The singular spider herein described closely resembles *Cyrtarachne furcata*, Camb.,* but differs from that not only in coloration and ornamentation, but also in the number and distribution of the tubercles upon the abdomen, as well as in the general contour of the latter.

The *Gasteracanthidæ* are remarkable for the hard, horny epidermis of the abdomen, but in the specimen at present under consideration the epidermis is soft and tumid.

* P.Z.S., 1877, pp. 560-2, Plate LVI., fig. 2.

The chief centre of interest in this remarkable spider is its cephalothorax, represented by fig. 2, plate x., on which there are several horn-like protuberances or prongs (seven in all); the tubercular (central) ocular eminence is somewhat the largest and strongest, is directed slightly forward, whilst in *C. furcata* it is perpendicular; in the specimen described in this paper, there are in conjunction with the central ocular eminence and proceeding from its base, two lateral "arms," distinctly, though in a much smaller degree, elevated above the surface of the cephalothorax, jutting out laterally, and directed slightly forward; placed in front, but in a somewhat lateral position, and at the summit of the tubercular ocular eminence, are four eyes, arranged in two rows, and these are the largest of the eight; at the extremity of each "arm" there are two minute eyes closely contiguous to each other.

The horn-like protuberances arranged along the middle of the clypeus (with the exception of two) are exceedingly prominent, and in addition to these the cephalothorax is furnished with rather long coarse hairs.

The abdomen of this spider gives the creature a most extraordinary hirsute appearance. It is thickly clothed with long hairs, and these are much longer and coarser than are those of the cephalothorax. The legs, too, are also thickly clothed with the same material, which project at right angles.

The type specimen is in the collection of the Australian Museum, to the Trustees of which Institution I am indebted, not only for allowing me access to it, but also for their courtesy in granting me permission to describe this extraordinary spider, and enabling me to make those notes necessary for the production of this paper.

CYRTARACHNE CALIGINOSA, sp.nov.

(Plate x. figs. 2, *2a*, *2b*.)

♀. Cephalothorax 3 mm. long, 4 mm. broad; abdomen 6 mm. long, 6 mm. broad.

Cephalothorax tuberculate, deeply curved inwards in front, dark brown (approaching sepia), glossy, furnished with a few long coarse hairs or bristles ; *caput* elevated, terminating with a strong, prominent ocular eminence ; *clypeus* broad, convex, exceedingly rough, furnished with six horn-like tubercles of a yellow-brown colour ; the front lateral pair is much the smallest and widest apart, the second considerably larger and perpendicular, the third pair is the highest of the group, the tubercles placed one behind the other and united at their base, which is broad ; of these latter the front tubercle is directed forward, and the second backward.

Eyes glossy black; the four intermediate eyes are the largest of the group, forming a square, and placed towards the summit of the tubercular ocular eminence, which is yellow-brown at its base and black at apex ; those of each lateral pair are exceedingly minute and contiguous, and are placed at the extremity of an "arm-like" protuberance extending from the base of the tubercular ocular eminence.

Legs moderately long and strong, yellow-brown, furnished with long coarse hairs which stand out at right angles ; each *tarsus* terminates with four curved claws, the two superior ones of which are much the longer and stronger, and have a row of teeth near their base on the underside. Relative lengths 1, 2, 4, 3.

Palpi moderately long, similar in colour and armature to the legs.

Falces inclined inwards, long, strong, dark brown, clothed with coarse and bristly hairs.

Maxillæ dull yellowish-brown, long, strong, inclined inwards, broadest at apex.

Labium concolorous, short, broad, rounded off at apex.

Sternum concolorous, cordate, sparingly hairy.

Abdomen broad-ovate, projecting over base of cephalothorax, convex ; dull yellowish-brown, thickly clothed with exceedingly long yellowish coarse hairs ; there are six lateral tubercles, the first pair of which is seated well forwards, and are somewhat the largest, the second and third pairs placed towards the posterior extremity, and situated rather low down ; inferior surface similar in colour to superior, clothed with long coarse hairs, but the latter are not so long as those of the upper side.

Hab.—Sydney. Type in the collection of the Australian Museum.

EXPLANATION OF PLATE X.

Fig. 1. —*Drassus perelegans.*

Fig. 1*a*.—Branchlet, showing leaves at the spur (A) bound together so as to form the nest.

Fig. 2. —*Cyrtarachne caliginosa*, profile, legs truncated.

Fig. 2*a*.— ,, ,, front view of cephalothorax, showing arrangement and position of eyes.

Fig. 2*b*.—*Cyrtarachne caliginosa*, right leg of first pair.

PLANTS OF NEW SOUTH WALES ILLUSTRATED.

By R. T. Baker, Assistant Curator, Technological Museum, Sydney.

No. vii. Genus Notothixos.

(Plate xi.)

Genus Notothixos, Oliver, N.O. *Loranthaceæ;* B.Fl. iii. 397.

This genus was established by Professor Oliver (Journ. Linn. Soc. vii.), who describes, as the result of his careful researches, three distinct species, which are united by Baron von Mueller under the name of *N. incanus* in his Fragmenta Phytographiæ (ii. 109, and iv. 178) and also in his Second Systematic Census of Australian Plants (1889), but which, however, are upheld by Bentham in the Flora Australiensis, who says:—"It is possible that *N. subaureus* may prove to be a remarkable variety of *N. incanus* which is only known from specimens with imperfectly-developed inflorescence, but as yet *intermediate forms have not been observed*, and *N. cornifolius* appears to me in all states to be quite distinct."

Through the kindness of Mr. J. H. Maiden, who placed his herbarium at my disposal, and by my own collecting, I have been enabled to bring together material which has assisted me to amplify the descriptions given by the three previously mentioned botanists, and to supply what appear to me the *intermediate forms* referred to by Bentham.

Whatever may be said of the claims of Forms i., ii., and iii. to rank as species, I think with Oliver and Bentham that Forms iv. and v. (collectively, *A. cornifolius)* should be regarded as having good claim or right to specific rank, as the difference between the inflorescence of iii. and iv. is too marked to be classed as varietal, and no one seems to have met with the intermediate forms.

The structure of the flowers in all the forms is the same, but the female flowers are far more numerous than the males, which are difficult to detect even in living specimens.

The results of my investigations may perhaps be best shown in the following tabulation :—

Form i. (fig. 1).—Drawn from material obtained at Ballina, Richmond River, N.S.W.; it agrees with Oliver's species except in the number of flower-heads, which were found to be in threes in all specimens examined ; a very delicate shrub.

N. incanus, Oliv., = *N. incanus*, F.v.M.

Form ii. (fig. 2).—Drawn from material obtained near Lismore and is without doubt the *N. subaureus* of Oliver. The common peduncle is very variable in length and the upper side of the leaf is distinctly 3-nerved ; Oliver's species name is very happily chosen.

N. subaureus, Oliv., = *N incanus*, F.v.M.

Form iii. (fig. 3).—From the same locality as previous variety (ii.), but has larger leaves than i. and ii., and there is a distinct departure from the golden tomentum to a silver sheen. It is also distinctly triplinerved, the transverse veins are distinctly prominent, and the leaf is also of a much thinner texture than forms i. and ii. Sufficient specimens have been examined to show that it is no sport.—Previously unrecorded.

Form iv. (fig. 4).—A robust shrub, leaves thick, almost fleshy, 3- to 5-nerved, glabrous. The flowers examined have generally been larger than those of Oliver's. Stipules much more prominent than in three previous varieties. Collected in large quantities by me on the ranges south of the Goulburn River, and also at Rylstone.

N. cornifolius, Oliv., = *N. incanus*, F.v.M.

Form v. (fig. 5).—An extreme form with ovate-lanceolate obtuse leaves ; thick in texture, 5-nerved, nearly 4 inches long and 2 inches wide, but in other respects agreeing with *N. cornifolius ;* stipules very prominent. Lismore, N.S.W.—Previously unrecorded.

Other figures in plate :—*a* and *b*, two views of female flower (enlarged) ; *c*, male flower (enlarged) ; *d*, back and front view of anther detached (enlarged) ; *e*, seed (nat. size).

DESCRIPTION OF A NEW *CROTON*, FROM NEW SOUTH WALES.

By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S.

(Plate xii.)

Croton affinis, sp.nov.

A small tree, glabrous or with stellate scales on the new growth whether twigs or leaves as in *C. acronychioides*, sometimes slightly hispid or scurfy ; the stellate scales scattered on the young leaves but absent on the older ones.

Leaves thin, with numerous transparent dots, broadly lanceolate to elliptical or ovate, not obtuse ; distinctly but not deeply dentate, rarely entire ; usually about 3 inches long, but occurring up to over 6 inches long and $2\frac{1}{2}$ broad, slightly paler on the underside, penninerved, finely veined ; petiole channelled above, from $\frac{1}{4}$ to $\frac{1}{2}$ inch long ; basal glands sessile.

Racemes 1 to 2 inches long as far as seen, terminal, the basal cluster consisting mostly of females, the upper flowers being nearly all males ; pedicels varying in length from 2 to 4 lines ; bracts 1 to 2 lines long.

Sepals of male flowers scarcely obtuse, imbricate in the bud, ciliate on the upper edges ; petals small, narrow, ciliate ; stamens 5 or 6, inflexed, filaments shorter than those of *C. acronychioides*, receptacle very hairy.

Calyx of the female flowers persistent under the capsule ; segments hardly obtuse, broad. Ovary densely hairy. Styles divided to near the base into three branches, which are again divided and subdivided to an apparently variable extent.

Capsule tridymous, furrowed, sprinkled with stellate scales; about 3 lines long and 6 lines broad; slightly depressed at the top.

Hab.—Banks of a rocky creek, near Tintenbar, Richmond River, New South Wales (*W. Bäuerlen*).

This species is most closely related to two Queensland species, *C. acronychioides* and *C. triacros*, and is quite distinct from any New South Wales *Croton*.

It differs from *C. acronychioides* and *C. triacros* in the texture of its leaves, which are thin; the pedicels are also much longer. In regard to the number of stamens, it has usually 5, and apparently never more than 6, while *C. acronychioides* may have as many as 8, and *C. triacros* as many as 10.

The stamens of *C. acronychioides* are longer than those of our species.

In the *Flora Australiensis* there is no reference to petals in either *C. acronychioides* or *C. triacros*, but in our species they are marked.

The persistent calyx under the fruit is also to be noted, as among Australian *Crotons* it appears only to be present in *C. opponens*.

The capsule of *C. acronychioides* is described as "*longer than broad, scarcely furrowed.*" The dimensions given above for the capsule of our new species will show that such a description does not apply to its fruit. As a matter of fact, the fruit of our species is both furrowed and deeply lobed, in which respect it resembles that of *C. triacros*.

ABBREVIATED ANALYSIS.

C. acronychioides.—Leaves *coriaceous.* Stamens 5 to 8. Capsule *longer than broad, scarcely furrowed.*

C. n.sp.—Leaves *thin.* Stamens 5, *rarely* 6. Capsule broader than long, *3-lobed and furrowed.*

C. triacros.—Leaves *coriaceous.* Stamens about 10. Capsule deeply 3-lobed at the top and 3-furrowed.

EXPLANATION OF PLATE.

Fig. 1.—Unexpanded pedunculate male flower.

Figs. 2 and 3.—Stamens, back and front view.

Fig. 4.—Expanded male flower.

Fig. 5.—Female flower.

Fig. 6.—Petal.

Fig. 7.—Fruit capsule showing persistent calyx and stellate scales.

Fig. 8.—Fruit viewed from underside.

Figs. 9, 10 and 11.—Seed.

All enlarged to various extent except fruit capsule.

DESCRIPTION OF AN APPARENTLY NEW *ACACIA* FROM NEW SOUTH WALES.

By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S.

(Plate xiii.)

Acacia neglecta, n.sp.

A variable shrub often flowering when only a few inches high, but attaining a height of 12 feet or more; glabrous in all its parts, rarely glaucous, the branchlets acutely angular at the extremities but soon terete.

Phyllodia ovate, narrowed at each end, sometimes obliquely falcate, mucronate, the margins thickened, coriaceous, much thicker than in *A. prominens*, 1-nerved, obscurely veined, marginal gland on the upper margin a little removed from the base, often absent; $\frac{1}{4}$ to $1\frac{1}{2}$ inches long, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad.

Racemes about twice the length of the phyllodes, with 3 to 15 globular heads of 6 to 10 flowers each, mostly 5-merous.

Flowers larger than those of *A. prominens* and seemingly smaller than those of *A. lunata*, as defined in the *Flora Australiensis.* Calyx smooth, short, and broadly lobed. Petals smooth, thin, easily separating. *Pod flat, slightly glaucous, straight or slightly curved, about* 4 *to* 6 *lines broad, usually about* 3 *to* 4 *inches long, neither so short nor so broad as the pods of A. prominens.*

Seeds small, slightly oblique, *in the centre of the pod,* funicle thickened at the end near the seed into a club-shaped aril, and one small fold below it.

Hab.—Bowenfels and Rylstone District, and other trans-Blue Mountain localities.

This species is fairly common in the above localities; its range cannot yet be fully defined.

When first obtained in flower this species was placed provisionally with *A. lunata*, but the pods had not then been received. When these were obtained it was at once evident that they were not the *lunata* pods described in the *Flora Australiensis*, as the seeds are *not* " close to the upper suture," which distinguishes it also from the immediate congeners of *A. lunata*, viz., *A. decora* and *A. buxifolia*. The position of the seeds in *A. lunata* as stated by Bentham is confirmed by Baron von Mueller *(Key to the System of Victorian Plants)*, who, at page 191 of that work, states "seeds close along the anterior margins of the fruit."

These two great authorities naturally give prominence to the position of the seed in defining *A. lunata*, and it is hardly probable that the pods were wrongly matched. There therefore seems no alternative but to give the Acacia (as defined by us) specific rank.

We realise the responsibility of adding to the already long list of specific names of Acacias, but the position appears to be this:—

1. Is the *Acacia lunata* of Sieber correctly described in such an important matter as the pods and seeds?

2. If not, can the description be amended so as to allow our description to replace Sieber's for this species?

3. We think that, if the description be imperfect to the extent suggested, there is no alternative but to define our plant as a distinct species. For it we therefore propose the name *Acacia neglecta*.

EXPLANATION OF PLATE.

Fig. 1.—Expanded flower.

Fig. 2.—Pistil.

Fig. 3.—Fruit.

Fig. 4.—Seed shown *in situ*.

All enlarged except the pod.

LIST OF MOLLUSCA FOUND AT GREEN POINT, WATSON'S BAY, SYDNEY.

By Arnold U. Henn, F.E.S., F.L.S.

With a few Remarks upon some of the most interesting Species and Descriptions of the new Species, by John Brazier, F.L.S., C.M.Z.S.

(Plate xiv.)

While searching for shells at Watson's Bay, Sydney, at the lowest spring tide in October, 1893, I found in a deep rock pool at extreme low water an old bottle, which on examination proved to be quite full of small shingle and sand. I took it home and as on a cursory examination, while washing the contents, small shells seemed to be rather numerous, I determined to work them out very carefully as a matter of curiosity.

The result was very astonishing, as I found no less than 155 species of molluscs, with a total of 1376 specimens, of which 121 species were Univalves, 32 species Bivalves, and one Brachiopod. Of these, fifteen species of Univalves appear to be undescribed or new to science, and one species *(Turbonilla tasmanica)* is, I believe, recorded from Port Jackson for the first time. At least two other species are very rare.

I feel that the result of my examination will be of sufficient interest to conchologists to place it on record, and I hope it may be an indication to some of a rich source of supply of material. I have examined the contents of several bottles since, but none of them approached this one in richness of molluscan fauna; and I can only conclude that it had lain undisturbed in the position in which I found it for a long time, and that some unusual conditions had conduced to the richness and variety of its contents. What these were I have been unable to determine. The pool is only to be approached twice a year for a day or two at the lowest tides.

Class GASTEROPODA.

Order PECTINIBRANCHIATA.

Family MURICIDÆ.

1. MUREX AUSTRALIS, Quoy et Gaimard; *M. palmiferus*, Sowerby. One specimen (juv.).

The history of this species is given in full by Mr. Brazier in his "Synonymy of, and Remarks on, Old-described Australian Mollusca, with Notes on their Distribution," P.L.S.N.S.W. (2), Vol. viii. pt. 1, p. 113 (1893).

2. TROPHON sp. Two specimens; rather broken and sea-worn.

3. PURPURA NEGLECTA, Angas. Twelve specimens.

4. PURPURA SUCCINCTA, Martyn. One specimen (larval state).

The larval state of this species has been described as belonging to the genus *Sinusigera*, d'Orb., = *Cheletropis*, Forbes.

5. PURPURA sp. One specimen (larval state).

6. RICINULA (SISTRUM) CHAIDEA, Duclos. One specimen.

Common in Lord Howe Island, Norfolk Island, and New Caledonia, but only recorded from Port Jackson once before (by Angas in 1867).

Family TRITONIDÆ.

7. TRITON SPECIOSA, Angas. Two young specimens.

Family FUSIDÆ.

8. PERISTERNIA RUDOLPHI, sp.nov., Brazier, (Pl. XIV. fig. 1).

Shell small, fusiform, turreted, yellowish-brown, dotted with dark reddish-brown spots, larger below the sutures; apex smooth, mammillated; whorls 6, slightly convex, longitudinally ribbed, crossed with spiral liræ, very conspicuous on the edge of the ribs, finer between and at the sides; aperture ovate, outer lip rather thick, slightly variced behind; interior of aperture with three to four small nodules; columella straight, canal short, curved.

Long $6\frac{1}{2}$, greatest breadth 4, least $3\frac{1}{2}$ mm. Five specimens.

This pretty little shell may be known by the large dark reddish-brown spots below the suture, and nearly on the angle of the whorls. A number of specimens of this species were collected in 1866-67 at Green Point and sent to Mr. Angas with a number of the species that are now described in this paper (J. B.).

Family BUCCINIDÆ.

9. CANTHARUS AUSTRALIS, Pease; *C. assimilis*, Angas, *non* Reeve. Twelve specimens; all young.

10. CANTHARUS UNICOLOR, Angas. One young specimen.

11. COMINELLA (AGNEWIA) TRITONIFORMIS, Blainville; *Adamsia typica*, Dunker; *Urosalpinx tritoniformis*, Tryon.

Twenty-three specimens, of which ten are young.

The larval state of this species has been described as belonging to the genus *Sinusigera*, d'Orb., = *Cheletropis*, Forbes. In fully adult specimens of *C. tritoniformis*, Blainv., the apical whorls show distinctly the claw or *Sinusigera* character.

Family NASSIDÆ.

12. NASSA PAUPERA, Gould. Six specimens, of which three are young.

13. NASSA sp. One specimen (juv.).

Family MARGINELLIDÆ.

14. MARGINELLA ANGASI, Braz. Nine specimens.

15. MARGINELLA METCALFEI, Angas. One specimen.

16. MARGINELLA (PERSICULA) NYMPHA, sp.nov., Braz. (Pl. XIV. fig. 2).

Shell shining, white, rather solid, having much the shape of *M. ovulum*, spire immersed; columella with four plications, the two upper very fine, the others more conspicuous; outer lip thickened, opaque, straight, minutely denticulated on the inner edge.

Long $1\frac{3}{4}$, broad 1 mm. Two specimens.

This minute species is allied to *M. Isseli*, Nevill, from Suez (J. B.).

Family OLIVIDÆ.

17. OLIVELLA NYMPHA, Ad. and Ang. One specimen.

Family COLUMBELLIDÆ.

18. COLUMBELLA SMITHI, Angas. Thirty-two specimens.

19. COLUMBELLA LINEOLATA, Pease; *C. dermestoides*, Angas, *non* Kiener. Two specimens.

20. COLUMBELLA VERSICOLOR, Sow.; *C. bidentata*, Menke. Seven specimens.

21. COLUMBELLA SEMICONVEXA, Lamarck. Seven specimens, three being young.

22. COLUMBELLA TAYLORIANA, Reeve; *C. albomaculata*, Angas. Two specimens.

23. COLUMBELLA ANGASI, Brazier; *C. interrupta*, Angas, *non* Gaskoin. One specimen (juv.).

24. COLUMBELLA SPECIOSA, Angas. Three specimens.

25. COLUMBELLA TENISONI, Tryon; *C. minuta*, Tenison-Woods, *non* Gould. Eleven specimens.

Family PLEUROTOMIDÆ.

26. PLEUROTOMA (CLATHURELLA) EDWINI, sp.nov., Braz. (Pl. XIV. fig. 3).

Shell small, fusiformly turreted, solid, reddish-brown and white spotted · whorls 5, the apical one white, smooth and mammillated, the second finely punctated like a thimble, third and fourth spirally and sharply carinated with two keels, a much finer one below, last sharply keeled at the angle having eight spiral lines below, between the suture and the spiral keels very finely longitudinally striated; aperture small, ovate, brownish within; columella whitish, nearly straight, outer lip finely denticulated at the edge, contracted below; posterior sinus wide and deep.

Long 4, greatest breadth $1\frac{1}{4}$, least 1 mm. One specimen.

This species is in miniature very much like *Drillia Laprestiana*, Calcara, from the Mediterranean Sea (J. B.).

27. Drillia Beraudiana, Crosse. Two specimens.

28. Drillia Angasi, Crosse. One specimen (juv.).

29. Clathurella rufozonata, Angas, var. Four specimens.

30. Clathurella modesta, Angas. Two specimens.

Family Conidæ.

31. Conus Smithi, Angas. Two very young specimens.

Family Naticidæ.

32. Vanikoro gracilis, sp.nov., Braz. (Pl. xiv. fig. 4).

Shell ovate, thin, whitish, whorls 5, the three apical quite smooth and glossy, the fourth large, last very large and inflated, minutely and finely spirally sculptured, marked with longitudinal growth-lines; umbilicus small, narrow; columella straight; aperture ovately elongate, outer lip thin.

Long 2, broad 1 mm. One specimen.

The specimen described is evidently young. I have seen much larger sea-worn specimens from shell sand, Middle Harbour (J. B.).

33. Vanikoro Gaimardi, A. Ad. One specimen.

34. Vanikoro granulosa, Recluz. One specimen.

Family Calyptræidæ.

35. Crepidula immersa, Angas. One fine specimen alive on the exterior of the bottle.

36. Crepidula aculeata, Gmelin. Fifty specimens, mostly young.

37. Hipponyx antiquatus, Linn. Five young specimens.

38. Hipponyx Danieli, Crosse. Two very young specimens.

Family Scalidæ.

39. Scala Jukesiana, Forbes. Two young specimens.

Family Turritellidæ.

40. Turritella (Torcula) parva, Angas. One specimen.

Family Vermetidæ.

41. Siliquaria lactea, Lam. Twenty specimens.

42. Vermetus sp. Two sea-worn specimens.

Family Turbonillidæ.

43. Turbonilla scalarina, sp.nov., Braz. (Pl. xiv. fig. 5).

Shell rather long and turreted, somewhat solid, white, shining; whorls 9 in the adult, 7 in the young, flattened, longitudinally prominently broadly ribbed, abruptly ceasing at the periphery; interstices quite smooth; sutures impressed; aperture small, quadrate; columella nearly straight, outer lip thin.

Long 5, broad $1\frac{1}{4}$ mm. in adult; long. $3\frac{1}{2}$, broad 1 mm. in young. Two specimens.

This species is distinct, and differs from any of the other known Australian *Turbonillæ*; it partakes more of the form of some species of *Truncatella*: the younger shells are much thinner and transparent (J. B.).

44. Turbonilla Hofmani, Angas; *T. nitida*, Angas, *non* A. Adams; *T. Angasi*, Tenison-Woods. One specimen.

45. Turbonilla tasmanica, Ten.-Woods. One specimen. Recorded for the first time from Port Jackson.

46. Eulimella pulchra, sp.nov., Braz. (Pl. xiv. fig. 6).

Shell thin, white, transparent, apex sinistral, whorls 6, strongly spirally two-keeled, keels flat, latticed between in the form of little square pits; suture deep, with a spiral line, and very finely latticed, last whorl with three keels, and finely spirally striated below; columella slightly curved; aperture quadrately ovate; outer lip simple (J. B.).

Long 2, broad $\frac{3}{4}$ mm. Two specimens.

This species is very much like *Eulimella cingulata*, Issel, from the Red Sea (J. B.).

47. Odostomia lævis, Angas. One specimen.

48. Odostomia Kreffti, Angas. Five specimens.

49. Odostomia sp. Three sea-worn and imperfect specimens.

50. Odostomia indistincta, sp.nov., Braz. (Pl. xiv. fig. 7).

Shell ovately conical, whitish, smooth, shining; whorls 5, slightly convex, last whorl ventricose, white below, sutures channelled; aperture ovate; columella fold small, situated some distance within the aperture; outer lip rounded, simple.

Long $2\frac{1}{4}$, broad 1 mm. Ten specimens.

This species has the fold on the columella so small that it can scarcely be seen with an ordinary lens when looking directly into the aperture. It can be plainly seen if the shell is placed at a slight angle when looking directly at the columella (J. B.).

51. Odostomia (Pyrgulina) Henni, sp.nov., Braz. (Pl. xiv. fig. 8).

Shell fusiformly turreted, solid, dull white; whorls 6, apical one mammillated and smooth, strongly and closely longitudinally ribbed, interstices with minute transverse striæ, ribs terminating at the periphery where there is one deep spiral groove, smooth below; whorls somewhat tabled at the sutures; aperture small, ovate; columella-plait transverse, rather sharp and thickened below, outer lip thin.

Long 4, $4\frac{1}{2}$, broad $1\frac{1}{2}$ mm. Seven specimens.

This species may very easily be recognised by its stout ribs, smooth base, and the deep spiral groove at the periphery, and its pagoda-like appearance at the sutures (J. B.).

Family Pyramidellidæ.

52. Obeliscus jucundus, Angas. One specimen.

53. Oscilla ligata, Angas. Four specimens.

Family Littorinidæ.

54. Littorina mauritiana, Lam. ; *L. Diemanensis,* Quoy. Twenty-three specimens, of which twelve are young.

Family Fossaridæ.

55. Fossarina Brazieri, Angas. Twenty-three specimens.

Family Planaxidæ.

56. Alaba lauta, A. Ad. One specimen.

57. Alaba sp. One specimen, broken in lip.

Family Cerithiopsidæ.

58. Cerithiopsis Angasi, Semper ; *C. clathrata,* Angas, *non* A. Adams. Three specimens.

Family Cerithiaceæ.

59. Bittium granarium, Kiener. Thirty-two specimens, of which twenty-five are young.

60. Bittium variegatum, sp.nov., Braz. (Pl. xiv. fig. 9).

Shell elongately turreted, rather solid, white, reddish-brown or chocolate, variegated with blue, black, and brown ; whorls 9, having four spiral rows of numerous small beads or grains, smooth between ; base convex, spirally striate ; back of last whorl with a prominent white varice, some specimens showing it more to the right and left of the centre ; sutures somewhat deep, aperture roundly ovate, outer lip simple, arcuate ; columella slightly twisted towards the base, canal short.

Long 5, $5\frac{1}{2}$, 6, broad $1\frac{3}{4}$ mm. One specimen.

This is one of the most variable species that I know. Some specimens are all white; others are white with a tinge of pink and with spiral brown lines at the base; others are of a dark brown or reddish-brown and spotted with white on the grains; others again are white with a blue-black band at the sutures and base. Mr. Henn and I found it rather numerous in shell sand from various parts of Middle Harbour, in good condition. It is one of the species overlooked by Mr. Angas (J. B.).

61. TRIFORIS GRANULATUS, Adams and Reeve. Six specimens.

62. TRIFORIS MACULOSUS, A. Ad. Thirteen specimens.

63. TRIFORIS sp. Two specimens, broken in lip and worn.

64. TRIFORIS sp. Three specimens, broken in lip.

65. TRIFORIS GRANIFERUS, sp.nov., Braz. (Pl. XIV. fig. 10).

Shell narrowly elongate, light brown, stout; whorls 12, two apical smooth, next three very finely granulated, next two with three rows of beaded granules, the centre row being much finer, four lower with the granules larger, the upper and lower whitish, centre row bright brown, last whorl with four rows of granules; base dark brown, with a spiral line; aperture subquadrate; outer lip thin; columella arcuate, canal very short.

Long 4, broad 1 mm. Two specimens.

This small species is very often found in dredgings off Green Point and in Middle Harbour (J. B.).

Family RISSOIDÆ.

66. RISSOIA SALEBROSA, Frauenfeldt. Two specimens.

67. RISSOIA (APICULARIA) NOVARIENSIS, Frauenf. Five specimens.

68. RISSOIA (APICULARIA) STRANGEI, sp.nov., Braz. (Pl. XIV. fig. 12).

Shell minute, imperforate, turbinately conoid, rather solid, whitish, faintly banded with light brown; whorls $5\frac{1}{2}$, apical whorls smooth, the others longitudinally strongly ribbed, ending at the periphery, interstices smooth, slightly noduled at the sutures, which are rather deep ; base convex, having three strong raised spiral lines ; aperture subcircular, outer lip rather thin ; columella white, thickened.

Long 2, broad 1 mm. Four specimens.

This species might have been mistaken for a small specimen of *Rissoia Lanciæ*, Calcara, from the Mediterranean, with specimens of which I have compared it (J. B.).

69. Rissoia (Sabanæa) incidata, Frauenf. Twenty specimens.

70. Rissoia (Amphithalamus) scrobiculator, Watson. One specimen.

71. Rissoia (Amphithalamus) olivacea, Frauenf. Twenty specimens.

72. Rissoia (Amphithalamus) Frauenfeldti, Schwartz. One specimen.

73. Rissoia (Setia) atropurpurea, Dunker, var. Twelve specimens.

74. Rissoia (Setia) Sophiæ, Braz. Forty-three specimens.

75. Rissoia (Setia) sp. One sea-worn specimen.

76. Rissoia (Cingulina) sp. Two sea-worn specimens.

77. Rissoia (Alvania) elegans, Angas. One hundred and thirty-two specimens.

78. Rissoia (Alvania) gracilis, Angas. Four specimens.

79. Rissoia (Alvinia) cheilostoma, Ten.-Woods. Fifteen specimens.

80. Rissoia (Alvinia) ochroleuca, sp.nov., Braz. (Pl. xiv. fig. 11).

Shell minute, imperforate, turbinate, thin, brownish ; whorls $5\frac{1}{2}$, convex, longitudinally ribbed as far as the periphery, much more conspicuous in the centre, crossed with spiral striæ wide apart, sutures moderately deep and smooth, base strongly and spirally sculptured ; aperture subcircular, slightly produced on the body whorl, outer lip thickened.

Long $2\frac{1}{2}$, broad 1 mm. Five specimens.

This species is not very common in dredgings off Green Point; rare under stones at low water at spring tides (J. B.).

81. Rissoina fasciata, A. Ad.; *R. Smithi*, Angas. One specimen.

82. Rissoina variegata, Angas. One specimen.

83. Rissoina (Phosinella) flexuosa, Gould; *R. turriculata*, Angas, *non* Pease; *R. Angasi*, Pease. Two specimens.

84. Rissoina (Phosinella) crassa, Angas. Two specimens.

Family Homalogyridæ.

85. Homalogyra pulcherrima, sp.nov., Braz. (Pl. xiv. fig. 13).

Shell thin, shaped like a *Planorbis*, white; whorls 3, the last rounded; suture moderately deep, whole surface distinctly cancellated, the spiral striæ very minute and close together; the longitudinals much thicker and wide apart; umbilicus wide and deep; aperture round, peristome thin, continuous.

Diam. $1\frac{1}{2}$, least 1, alt. $\frac{3}{4}$ mm. One specimen.

This very pretty species is the first record of the genus *Homalogyra*, Jeffreys, having been found in Australia. It is perfectly distinct from *H. cancellata*, Krauss, from South Africa. I have one or two other species, much smaller, from dredgings at Green Point, in eight fathoms, sandy mud (J. B.).

Order SCUTIBRANCHIATA.

Family Liotiidæ.

86. Liotia clathrata, Reeve. One specimen.

Family Cyclostrematidæ.

87. Teinostoma Brazieri, Angas; *Ethalia Brazieri*, Angas. One specimen.

88. Teinostoma (Cirsonella) australe, Angas. Twenty-one specimens.

Family TURBINIDÆ.

89. PHASIANELLA (ORTHOMESUS) VIRGO, Angas. One hundred and twenty-five specimens.

90. TURBO STRAMINEA, Martyn. Three young specimens.

91. AUSTRALIUM TENTORIFORME, Jonas. Four specimens, all young.

92. AUSTRALIUM FIMBRIATUM, Lam. Ten specimens, all young.

Family TROCHIDÆ.

93. TROCHUS (CLANCULUS) OMALOMPHALUS, A. Ad. Seven specimens.

94. TROCHUS (CLANCULUS) FLORIDUS, Philippi; *T. gibbosus*, A. Ad. One specimen.

95. TROCHUS (CLANCULUS) CLANGULUS, Wood. Twenty specimens, all young.

96. TROCHUS (CANTHARIDUS) BADIUS, Wood. Four specimens.

97. TROCHUS (GIBBULA) STRANGEI, A. Ad. Thirteen specimens.

98. TROCHUS (CALLIOSTOMA) POUPINELLI, Montrouzier; *T. comptus*, A. Ad., *non* Philippi. Five specimens.

99. TROCHUS (ASTELE) SCITULA, A. Ad. Two specimens.

100. TROCHUS (EUCHELUS) BACCATUS, Menke. Fourteen specimens.

101. TROCHUS (EUCHELUS) SCABRIUSCULUS, Ad. and Ang. Seven specimens.

Family PLEUROTOMARIDÆ.

102. SCHISMOPE CARINATA, Watson. Two specimens.

Family HALIOTIDÆ.

103. HALIOTIS NÆVOSA, Martyn. One young specimen.

Family FISSURELLIDÆ.

104. GLYPHIS LINEATA, Sow.; *G. incei*, Reeve. One young specimen.

105. GLYPHIS WATSONI, sp.nov., Braz. (Pl. XIV. fig. 15).

Shell small, narrow, oblong, depressed, anterior slope a little more than half as long as the posterior slope; sculptured with alternately larger and numerous radiating riblets, interruptedly rayed with light pink; apex smooth, inclined forward, with a small groove in the centre; fissure square behind and rounded below, giving it the appearance of a horseshoe; interior with a septum square across, and the whole of the fissure thickened with white callus, with a deep pit at the fore part behind the septum; margins of the shell minutely crenulated.

Long 6, broad $3\frac{1}{2}$, alt. $1\frac{3}{4}$ mm. Two specimens.

This new species will have to be placed in a new genus, but for the present I have placed it in *Glyphis*. It comes much nearer to the genus *Puncturella* in having the apex inclined forward, the fissure horseshoe-shaped, and the interior with a thick septum. The sculpture allies it to *Glyphis*.

Specimens have been dredged off Green Point. I dredged a specimen on the 21st November, 1874, off Tacking Point, three miles south of Port Macquarie, in 12 fathoms, rocky bottom. Only about five specimens are known, all collected by Mr. Henn and myself (J. B.).

106. MEGATEBENNUS NIGRITA, Sow.; *Fissurella nigrita*, Sow. One specimen.

107. PUNCTURELLA HENNIANA, sp.nov., Braz. (Pl. XIV. fig. 14).

Shell small, white, obliquely conical, apex curved, smooth, surface ornamented with thirteen slender radiating ribs not so distinct towards the apex; interstices smooth, finely striated under a higher power; fissure elongately ovate, narrow, pointed behind; septum triangular, slightly inclined forward under the fissure; margins crenulated at the edge and showing inside the radiating ribs.

Long $2\frac{1}{2}$, broad $1\frac{3}{4}$, alt. $1\frac{1}{2}$ mm. Two specimens.

This is the first record of the genus *Puncturella* from New South Wales, although numerous specimens were sent to Mr. Angas some years ago, obtained by me in dredging off Green Point (J. B.).

108. Emarginula dilecta, A. Ad. Two young specimens.

109. Emarginula concinna, A. Ad. One young specimen.

110. Subemarginula rugosa, Quoy. One specimen.

111. Subemarginula rugosa, Quoy, var. Three specimens.

Family Patellidæ.

112. Helcionsiscus tramoserica, Martyn. Four specimens.

Family Acmæidæ.

113. Acmea saccharina, Linn., var. stellaris, Quoy. Three specimens.

114. Acmea septiformis, Q. et G. Three specimens.

115. Acmea conoidea, Q. et G. Sixteen specimens.

116. Acmea costata, Sow.; *A. alticostata*, Angas. Twelve specimens.

117. Acmea marmorata, Ten.-Woods. Seventeen specimens.

118. Acmea mixta, Reeve. Four specimens.

119. Acmea sp. Ninety-two sea-worn and very young specimens.

Order POLYPLACOPHORA.

Family Chitonidæ.

120. Cryptoplax striatus, Lam. One specimen, three valves.

Family Siphonariidæ.

121. Siphonaria denticulata, Q. et G. Eighteen specimens.

122. Siphonaria funiculata, Reeve. One specimen.

Seventy-seven sea-worn Gasteropods, principally *Rissoia*.

Class PELECYPODA.

Order SIPHONIDA.

Family Saxicavidæ.

123. Saxicava arctica, Linn. Thirty-three young specimens (sixty-six valves).

124. Saxicava arctica, Linn., var. australis, Lam. One complete specimen and one valve.

This species is world-wide in its distribution. Lamarck named specimens obtained by Péron, the naturalist to Baudin's Expedition, 1802-3, at Kangaroo Island, South Australia, *Saxicava australis;* and large individuals attaining to $2\frac{1}{2}$ inches long have been named *Saxicava Angasi*, A. Ad.

Family Anatinidæ.

125. Thracia sp. One valve, very young.

Family Veneridæ.

126. Venus (Chione) Chemnitzii, Hanley. One valve of young specimen.

127. Tapes fabagella, Deshayes. One valve of young specimen.

Family Lucinidæ.

128. Lucina quadrata, Angas. One valve of young specimen.

Family Ungulinidæ.

129. Mysia sp. One valve.

Family Erycinidæ.

130. Montacuta variegata, Braz. Thirty-five valves.

131. LASEA RUBRA, Montague. Forty-three valves.

132. LASEA RUBRA, Montague, var. SCALARIS, Philippi. Sixty valves.

133. KELLIA ROTUNDA, Deshayes. Three valves, one young.

134. KELLIA SOLIDA, Angas. Two very small valves.

135. KELLIA CYCLADIFORMIS, Deshayes. Two valves.

136. KELLIA ADAMSI, Angas. One valve.

137. KELLIA sp. One valve.

138. MYLITTA TASMANICA, Ten.-Woods; *Pythina tasmanica*, Ten.-Woods. One valve.

Suborbicular, divaricate ribs, latticed with concentric sulcations. Very rare. Specimens have been dredged between Balls' Head and Goat Island in 18 fathoms *(Brazier)*. Also found in Tasmania by Rev. Tenison-Woods, and in South Australia by Professor Tate.

139. MYSELLA DONACIFORMIS, Angas. Three valves.

140. SCINTILLA sp. Three sea-worn valves.

Family ASTARTIDÆ.

141. MYTILICARDIA EXCAVATA, Desh. Two very young valves.

Order ASIPHONIDA.

Family NUCULIDÆ.

142. NUCULA PUSILLA, Angas. Two young valves.

Family ARCIDÆ.

143. ARCA FASCIATA, Reeve. Two valves, one young.

144. ARCA GUBERNACULUM, Reeve. One valve.

145. ARCA (ACAR) PLICATA, Chem.; *A. domingensis*, Lam.; *A. squamosa*, Lam.; *A. gradata*, Brod. and Sowb.; *Byssoarca divaricata*, Sowb. *Arca pusilla*, Sowb.

This species was also named *A. pusilla* by Angas in his List of Port Jackson Mollusca, 1867. Specimens sent to Mr. W. H. Pease in 1870 were returned named *A. divaricata*, Sowb., var.

It is a very common species, being found in the West Indies, Mauritius, New Caledonia, Marshall and Gilbert Islands. It is also recorded from Port Jackson by Dr. W. Stimpson from material obtained by the United States Exploring Expedition under Capt. Wilkes (J. B.).

Family MYTILIDÆ.

146. MYTILUS HIRSUTUS, Lam. One young valve.

147. MODIOLA AUSTRALIS, Gray. One valve.

148. MODIOLARIA CUMINGIANA, Dunker. Three valves.

149. MODIOLARIA BARBATA, Reeve; *Lithodomus laniger*, Dunker, MS.; Reeve, Conch. Icon. pl. v. fig. 30; *L. barbatus*, Reeve, fig. 27 (Reeve's specific name takes priority over Dunker's); *Modiolaria barbata*, Angas. One hundred and fifty valves.

150. MARGARITIFERA FIMBRIATA, Reeve. Two valves.

Family PECTINIDÆ.

151. PECTEN TEGULA, Wood. One young valve.

152. PECTEN sp. One very young valve.

153. LIMA MULTICOSTATA, Sow. Three valves.

Family OSTREIDÆ.

154. OSTREA CUCULLATA, Born, var. SUBTRIGONA, Sow. Three young valves.

Class BRACHIOPODA.

Family TEREBRATULINÆ.

Subfamily KRAUSSININÆ.

155. KRAUSSINA LAMARCKIANA, Davidson. Seven specimens.

EXPLANATION OF PLATE XIV.

All figures magnified to various and independent scales, and photolithographed from the pen drawings of Mr. C. Hedley, prepared by microscope with Abbé camera lucida.

Fig. 1.—*Peristernia Rudolphi.*

Fig. 2.—*Marginella nympha.*

Fig. 3.—*Pleurotoma (Clathurella) Edwini.*

Fig. 4.—*Vanikoro gracilis.*

Fig. 5.—*Turbonilla scalarina.*

Fig. 6.—*Eulimella pulchra.*

Fig. 7.—*Odostomia indistincta.*

Fig. 8.—*Odostomia (Pyrgulina) Henni* (lip broken).

Fig. 9.—*Bittium variegatum.*

Fig. 10.—*Triforis graniferus.*

Fig. 11.—*Rissoia (Alvinia) ochroleuca.*

Fig. 12.—*Rissoia (Alvania) Strangei.*

Figs. 13a, 13b.—*Homalogyra pulcherrima* (lip broken).

Figs. 14a, 14b.—*Puncturella Henniana.*

Fig. 15.—*Glyphis Watsoni.*

ON A *PATELLA* SAID TO HAVE BEEN FOUND ON THE KERMADEC ISLANDS.

By John Brazier, F.L.S., C.M.Z.S.

Patella (Scutellastra) Pilsbryi, Brazier.

Patella Kermadecensis, Pilsbry, Nautilus, No. 10, Vol. vii. p. 109, Feb., 1894.

Hab.—South Africa, not the Kermadec Islands.

Mr. H. A. Pilsbry says the two specimens of this large species of the subgenus *Scutellastra* described by him were sent to him by Mr. E. W. Roper, of Revere, Massachusetts, U.S.A., "who obtained them from the original collector." The name of the collector, however, is not given.

This fine large *Patella* first came under my notice three years ago, when a specimen much eroded on the back was offered to the Australian Museum by Mr. J. Dall of Collingwood, New Zealand, for a small sum. Since then specimens of the same species, under the name of *Patella magellanica*, Martyn, from the Kermadec Islands, have been offered by a New Zealand curio dealer to Sydney conchologists.

A large specimen, 5 × 4 inches, received by me from my correspondent Mr. R. Murdoch of Wanganui, N Z., who purchased it from a N. Zealand dealer under the name *P. magellanica*, Martyn, has adhering to it two specimens of *P. cochlear*, Born. Now this is a species known only from the Cape of Good Hope and the S. African coast in general.

Mr. Pilsbry in his description says, "apparently strongly ribbed when perfect but the specimens described are everywhere deeply eroded." The shell when in good order is somewhat strongly ribbed, and between the primary ribs are much finer ones very close together, giving the shell the appearance of canvas.

If such a conspicuous species as this *Patella* exists on the Kermadec Islands, I cannot but think that it would have been found long since. The late John Macgillivray visited the Kermadecs in H.M.S. "Herald" in 1854, and collected there for some weeks while Captain Denham and his officers were engaged in making surveys. The specimens so obtained were forwarded to the British Museum, but they did not include this *Patella*, or if they did it was never recorded.

My father during his whaling cruises sixty years ago visited the islands, and collections of shells were made, but no examples of this *Patella* were ever so obtained. Moreover, to the half-starved white people who lived upon the islands for some years, such an addition to the larder as this *Patella* would have afforded would not have been by any means to be despised.

In my opinion, therefore, *Patella Kermadecensis*, Pilsbry, is a misnomer, and the locality given for it, the Kermadec Islands, simply the invention of a New Zealand dealer, who to my knowledge gives *Pandora rostrata*, Lam., a well-known shell found in European seas, as dredged off the Three Kings, North Cape of New Zealand. Instances are known to me, too, in which South Sea Island species, and even Australian species, have been palmed off as from New Zealand.

It should also be borne in mind that large numbers of shells from the Cape of Good Hope are constantly being brought to Australia by the passengers and sailors of the large mail steamers.

NOTES AND EXHIBITS.

Mr. Hedley showed samples of young oysters from Vaucluse Bay destroyed by the operations of a boring mollusc, *Ricinula marginatra*, Blainv., together with examples of the latter; and he communicated the following Note:—

"Wherever oysters are used, species of carnivorous gasteropods—whelks, whelk-tingles, or borers—have been seen to prey upon them. On the coasts of England and France an especial pest is *Murex erinaceus*, the target for whose piercing radula is the thinnest part of the half-grown shell. Fischer has described (Journ. de Conch. xiii. 1865, pp. 1-8) the havoc wrought by this species in the "parcs" at Arcacahon. The experiments and observations of Lieut. Winslow, detailed in the Report of the United States Coast and Geodetic Survey for 1881, p. 70, prove the damage effected by *Urosalpinx cinereus*, in Long Island Sound. Mr. Saville Kent describes and illustrates the harm done in Moreton Bay to young oyster brood by *Urosalpinx paivæ* in his Report on the Oysters and Oyster Fisheries of Queensland, Brisbane, 1881, p. 10, pl. I. ff. 1, 10, 11.

"A few days ago (22nd April, 1894) my attention was directed by J. Hill, Esq., to a mollusc not hitherto accused, at least in books, of evildoing. A heavy fall of spat had coated thickly with young oysters the rocks, between tide marks, in Vaucluse Bay. Most of these had already died and lost their upper valves. An examination showed *Ricinula marginatra*, Blainville, to exist in such abundance that from a square foot one of our party gathered a handful. Further search betrayed several specimens settled on doomed oysters, whose upper valves were firmly grasped by the aggressors' feet. On plucking off the *Ricinula* I repeatedly found a hole partly or completely drilled through the oyster shell. All the victims were young oysters the size of a penny. Specimens of destroyed and destroyer, seized in the act of boring, are now submitted for inspection."

Mr. Froggatt showed specimens of the beetles referred to in his paper, and of adult females of a destructive Floridan coccid, *Icerya rosæ*, Riley and Howard, from the vicinity of Sydney, respecting which he communicated the following Note:—

"Early last December, when collecting on the other side of Cook's River, opposite Canterbury, I found some *Hakea acicularis*, the branches of which were covered with a large oval dull reddish-brown scale, with its edges fringed with white waxy matter. A number of these specimens were forwarded to Mr. W. M. Maskell, of N. Zealand, who has identified them as *Icerya rosæ*, described by Messrs. Riley and Howard in Insect Life, Vol. iii. p. 93, 1891, where the life history is illustrated with drawings of the female in all stages of development. It was received by them from Key West, Florida, U.S., where its attacks were very destructive to roses, causing the limbs to wither and the leaves to fall off. This is the first time, as far as I am aware, that this *Icerya* has been recorded from any locality except Florida, and its discovery here therefore is very interesting."

Mr. North exhibited a set of three eggs of the New Holland Honey-eater, *Meliornis novæ-hollandiæ*, taken on the 21st inst. at Canterbury, and he pointed out that this species in the neighbourhood of Sydney and probably elsewhere has two distinct breeding seasons in the year. During the past week he had found at Canterbury and Botany seventeen new nests of this Honey-eater, eleven of them containing eggs or young ones a few days old, the remainder of the nests being in different stages of construction; and in addition he saw fledgelings in the bush that had just left the nest. This was the fourth year in succession this species had been observed breeding in autumn during the bright warm days of April and early May. In the normal breeding season of birds in New South Wales, this species commences to breed at the beginning of July and continues as late as the end of December; nests, however, are more frequently found during August, September, and October. There is a distinct break in the breeding seasons during the very hot weather between mid-summer and the middle of March, but nests of this Honey-eater containing eggs are as plentiful again during April as they are in August. It is possible that the seasons may overlap with straggling late autumn breeders, but he had never found this species breeding during the month of June.

Mr. E. R. Waite exhibited a very young example (80 mm. long) of *Hemisphaeriodon gerrardii*, Gray, and he pointed out that at this early age the ground colour was a creamy-white, the entire under surface uniform black, and the transverse bands intense black. With age the ground colour darkens and the bands become brown and generally broken before reaching the ventral surface, which in the adult is yellowish mottled with brown. The specimen was obtained at Northfield, on the summit of the Kurrajong Hills, N.S.W., in July last (1893). The locality mentioned is the most southern point at which this species has been obtained, it having been previously recorded in New South Wales only from the Clarence and Richmond Rivers.

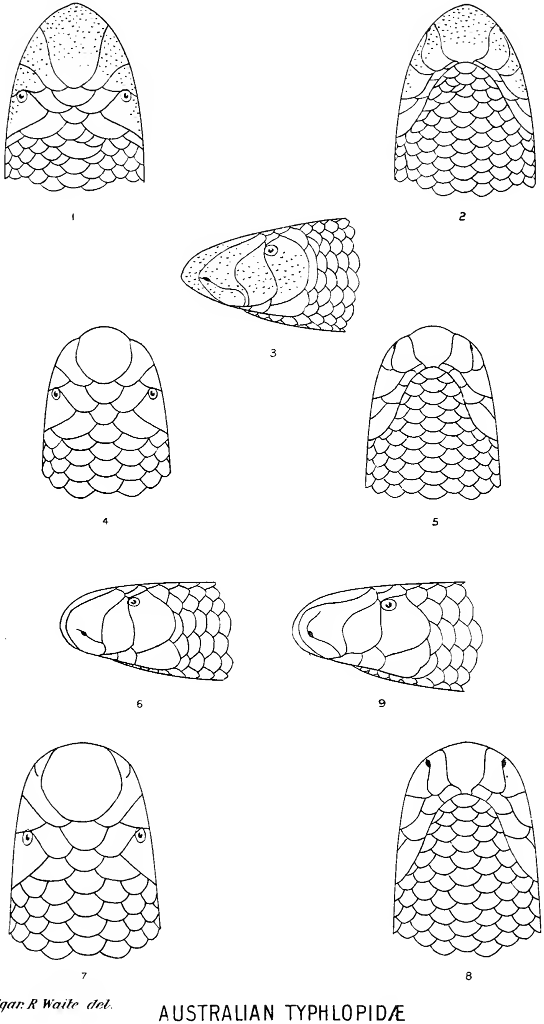
Mr. Brazier exhibited the large *Patella* mentioned in his paper, and pointed out that its habitat was not the Kermadec Islands but South Africa. Mr. H. A. Pilsbry's specific name *Kermadecensis* being therefore a misnomer, he proposed to rename the species *P. Pilsbryi*, Brazier. Also a magnificent new Cone, *Conus pulcherrimus*, Brazier, 3½ inches long, acuminated at both ends, dotted and reticulated with white and light yellow, deeply and spirally sulcated at the base spire with 15 whorls, sulcated at the sutures and smooth below. From Tanna, New Hebrides, found on the beach with other mollusca, thrown up after a submarine volcanic eruption in 1878.

Mr. Etheridge exhibited the remarkable implement referred to in his paper.

Mr. Henn showed the collection of mollusca treated of in the paper by Mr. Brazier and himself.

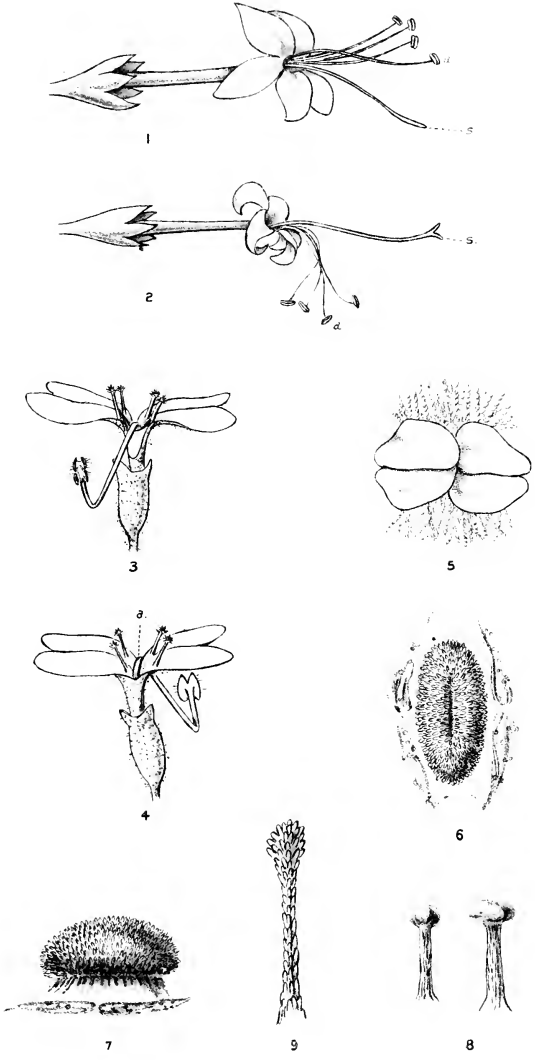
Messrs. Maiden and Baker exhibited the *Croton* and *Acacia* described in their paper.

Mr. Fletcher exhibited specimens of the new *Isopogon* from the Blue Mts., described by Baron von Mueller. Also specimens of *I. anemonifolius*, with entire leaves, always, however, mixed with divided leaves of the ordinary character, likewise from the Blue Mts.



Edgar R Waite del.

AUSTRALIAN TYPHLOPIDÆ



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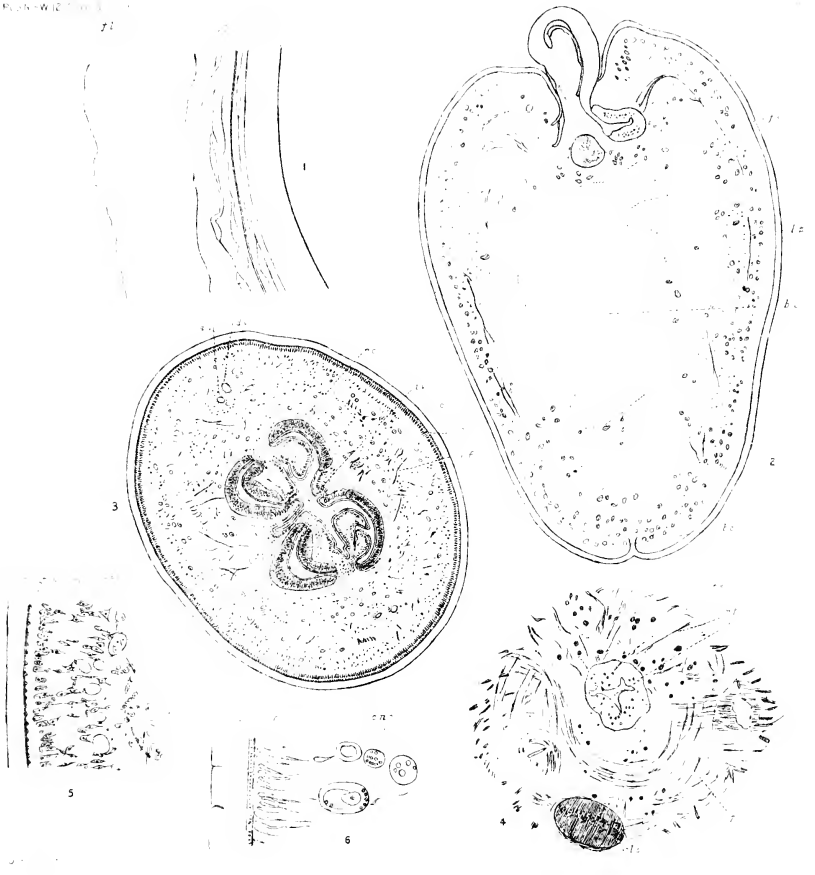
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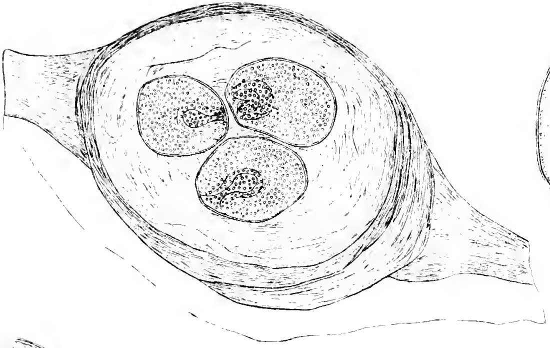

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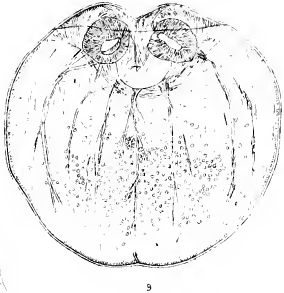

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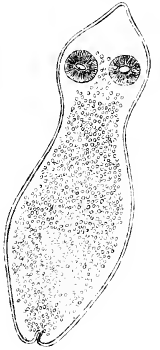

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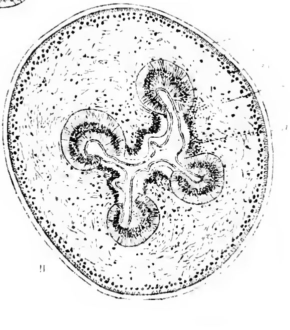

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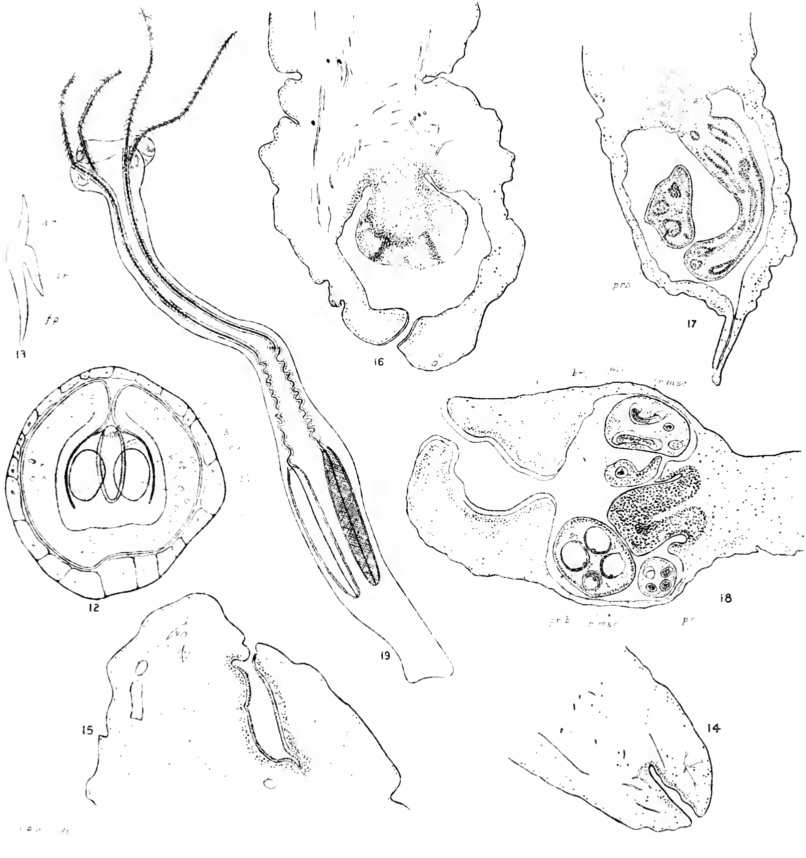
J. P. Hill del.



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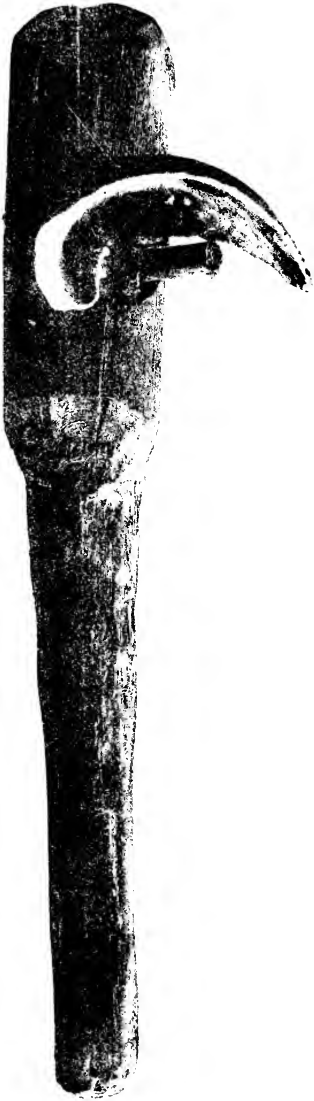

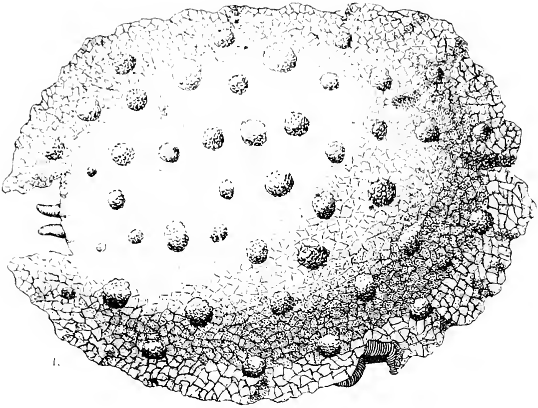

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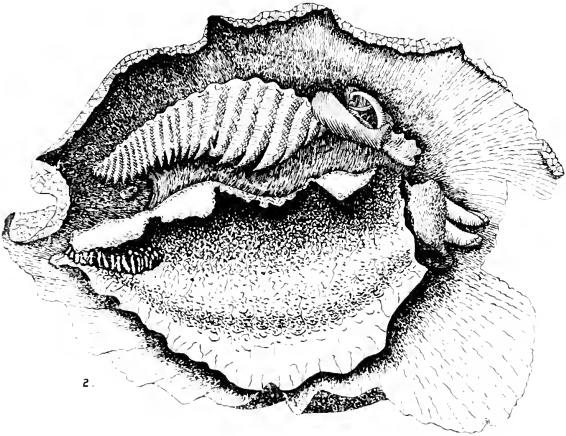

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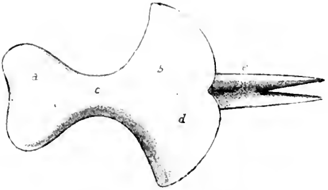
C. Hedley del

OSCANIUS HILLI.



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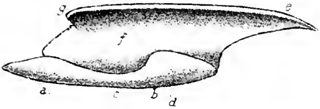

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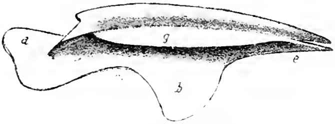

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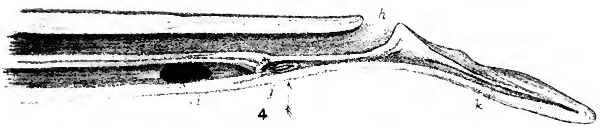

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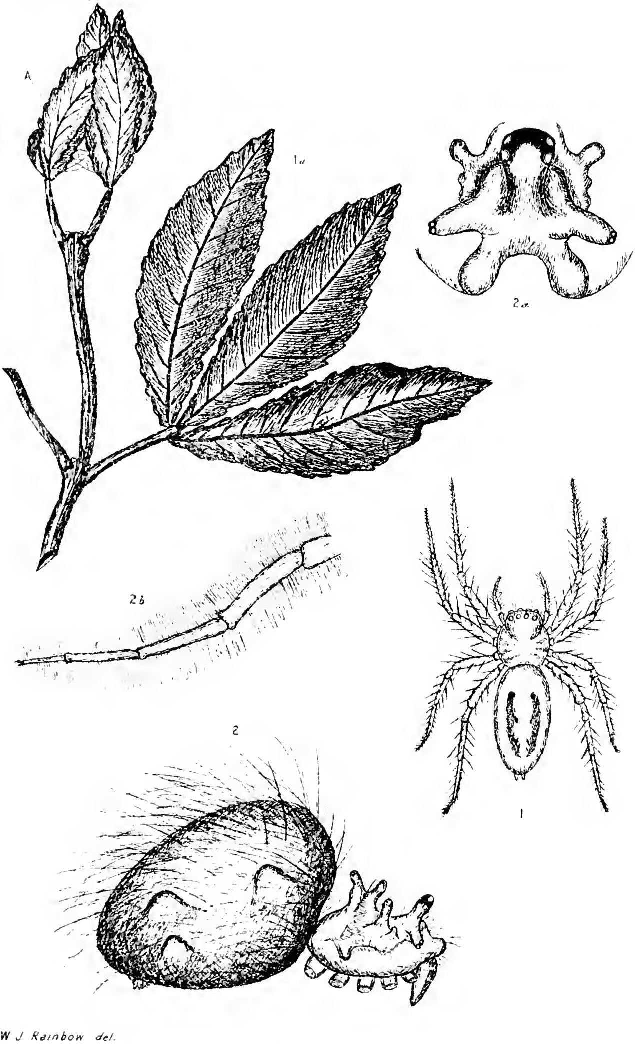
C.H.B. del.

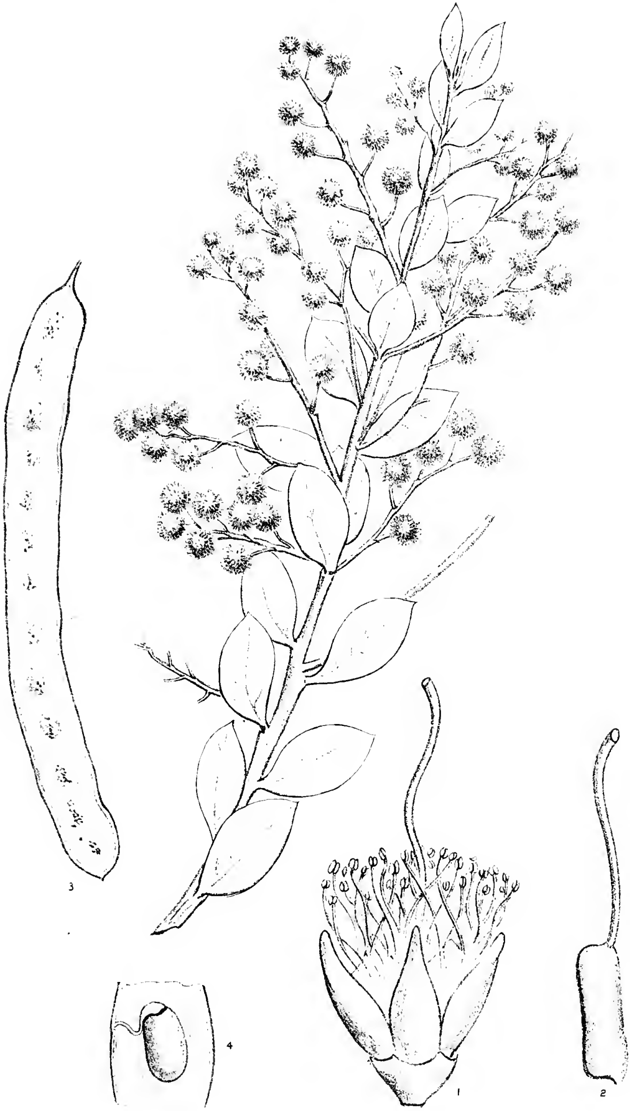


W. J. Rainbow del.

Genus NOTOTHIXOS.
(Showing all the recorded forms.)

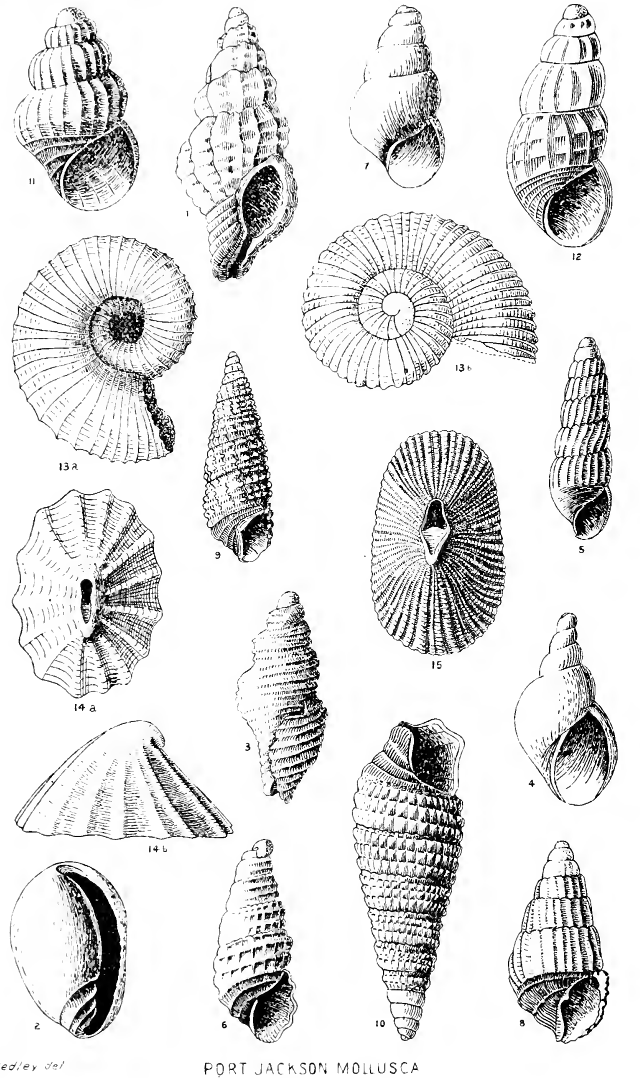
R T. Baker del

CROTON AFFINIS. Maiden and Baker



R. T. Baker del.

ACACIA NEGLECTA. MAIDEN & BAKER.



C. Hedley del.

PORT JACKSON MOLLUSCA

WEDNESDAY, MAY 30TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

Mr. Henry Selkirk was introduced as a visitor.

Mr. W. S. Dun, Department of Mines, Sydney, was elected a Member of the Society.

The President announced that, in the hope of arousing a wider interest in the Society's work, the Council had decided, as an experiment, to hold the Ordinary Monthly Meetings during the remainder of the current Session (June-November) in town (at the University Chambers, Phillip Street), commencing with next month's Meeting. Members were requested, therefore, to accept notification of the contemplated change.

DONATIONS.

"Zoologischer Anzeiger." xvi. Jahrg. (1893), Titel und Inhalt, sowie Litteratur, ii. Sem. Bogen 28-40 ; xvii. Jahrg. (1894), Nos. 442-444. *From the Editor.*

"Gesellschaft für Erdkunde zu Berlin—Zeitschrift." Bd. xxviii. (1893), No. 4 u. 6 : "Verhandlungen." Bd. xx. (1893), No. 8 u. 9 ; Bd. xxi. (1894), No. 2 u. 3. *From the Society.*

"Société Géologique de Belgique—Annales." T. xxi. 1re Liv. (1893-94). *From the Society.*

"Société Royale de Géographie d'Anvers—Bulletin." T. xviii. 2me et 3me Fascs. *From the Society.*

"Museum of Comparative Zoology at Harvard College—Bulletin." Vol. xxv. Nos. 5-6. *From the Curator.*

"Société d'Horticulture du Doubs, Besançon—Bulletin." Nouvelle Série, No. 39. *From the Society.*

"Cambridge Philosophical Society—Transactions." Vol. xv. Part 4 (1894). *From the Society.*

"Zoological Society of London—Abstract," 20th March and 3rd April, 1894. *From the Society.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 7-8. *From the Government Secretary.*

"Naturwissenschaftlicher Verein des Reg.-Bez., Frankfurt a/O. —Helios." xi. Jahrg. Nos. 10-12 (1894): "Societatum Litteræ." viii. Jahrg. Nos. 1-3 (1894). *From the Society.*

"Faculté des Sciences de Marseille—Annales." T. i. (Fascs. 1-2); T. ii.; T. iii. (Fascs. 1-4); Suppl. au T. iii. *From the Faculty.*

"Intercolonial Medical Congress of Australasia—Transactions of the Third Session" (Sydney, 1892). *From Professor J. T. Wilson, M.B.*

"Agricultural Gazette of N.S.W." Vol. v. (1894), Part 4. *From the Hon. the Minister for Mines and Agriculture.*

"American Naturalist." Vol. xxviii. No. 328. *From the Editors.*

"Société des Naturalistes de la Nouvelle-Russie—Mémoires." T. xviii. Part 1: "Mémoires de la Section Mathématique." T. xv. *From the Society.*

"Société Royale Linnéenne de Bruxelles—Bulletin." xixme Année, Nos. 5 et 6 (1894). *From the Society.*

"Geological Survey of India—Records." Vol. xxvii. Part 1 (1894). *From the Director.*

"Bombay Natural History Society—Journal." Vol. viii. No. 3 (1893). *From the Society.*

"Naturwissenschaftlicher Verein zu Bremen—Abhandlungen." xiii. Bd. 1 Heft ; Extra-Beilage zum xiii. Bde. *From the Society.*

"Marine Biological Association of the United Kingdom—Journal." n.s. Vol. iii. No. 2 (1894). *From the Association.*

"Journal of Conchology." Vol. vii. Nos. 8-10 (1893-94). *From the Conchological Society of Great Britain and Ireland.*

"Department of Mines and Agriculture, Sydney—Annual Report, 1893." *From the Hon. the Minister for Mines and Agriculture.*

"Royal Society of Edinburgh—Proceedings." Vol. xix. (1891-92) : "Transactions." Vol. xxvii. Parts 1-2 (1891-3). *From the Society.*

Eight New Zealand publications entitled :—"Manual of the Indigenous Grasses of N.Z." By J. Buchanan, F.L.S. (1880) : "*Phormium tenax* as a Fibrous Plant." 2nd ed. (1889) : "Reports on the Durability of New Zealand Timbers" (1875) : "Indian and Colonial Exhibition, London, 1886, New Zealand Court" : "Handbook of New Zealand." 3rd and 4th editions (1883-86) : "Studies in Biology for New Zealand Students." Nos. 3 and 4. *From Captain F. W. Hutton, F.R.S.*

Pamphlet entitled—"River Temperature. Part i.—Its Daily Changes and Method of Observation." By H. B. Guppy, M.B. *From the Author.*

Pamphlet entitled—"Descriptions of the Eggs of three Species of South Australian Parrakeets." By A. J. North, F.L.S. *From the Author.*

"Victorian Naturalist." Vol. xi. No. 1 (April, 1894). *From the Field Naturalists' Club of Victoria.*

Thirty-two publications—catalogues and pamphlets—published by authority of the N.S.W. Commissioners for the World's Columbian Exposition, Chicago, 1893. *From the Commissioners.*

Two conchological pamphlets. By Edgar A. Smith. *From the Author.*

"Hooker's Icones Plantarum." (Fourth Series) Vol. ii. Part 4 (1894). *From the Bentham Trustees.*

"Australasian Journal of Pharmacy." Vol. ix. No. 101 (May, 1894). *From the Editor.*

"Department of Mines, Victoria—Annual Report for the Year 1893." *From the Secretary for Mines.*

"Konink. Natuurk. Vereeniging in Nederl. Indië—Natuurkundig Tijdschrift." Dl. lii.-liii. *From the Society.*.

"American Museum of Natural History—Bulletin." Vol. vi. Sheet 6, pp. 81-96. *From the Museum.*

"Royal Society of N. S. Wales—Journal and Proceedings." Vol. xxvii. (1893). *From the Society.*

"Johns Hopkins University Circulars." Vol. xiii. No. 110 (March, 1894). *From the University.*

ON THREE HIGHLY ORNATE BOOMERANGS FROM THE BULLOO RIVER.

By R. Etheridge, Junr.
(Palæontologist to the Australian Museum, and Geological Survey of N. S. Wales.)

(Plate xv.)

The much more highly ornate carving and colouring of the weapons and implements of the Australian Aborigines throughout Northern Australia, as compared with those of the southern and western portions of the Continent, has no doubt struck all those who have made the Ethnology of these strange peoples their study. This fact has been already commented on by the late Mr. R. B. Smyth,* but with the knowledge we now possess his remarks are somewhat too casual. He observed that the boomerangs in use around Rockingham Bay, N.E. Queensland, and the districts adjacent thereto, were ornamented with incised lines, differing in this respect from those employed in the southern and western parts of Australia. Although, as may be inferred from my opening paragraph, this may be true in a general sense, yet the fact that Sir Thomas Mitchell,† the most celebrated of our Surveyors-General, and, at the same time, one of the most eminent of our Explorers, met with highly carved boomerangs, as early as 1836, in portions of the country much further to the south-east, to a great extent refutes Smyth's too sweeping generalisation.

In no weapon perhaps, with the exception of the beautiful clubs and shields figured by Smyth‡ from various localities, is this incised ornamentation more marked, than in the patterns used to

* Aborigines of Victoria, 1878, i. p. 329.

† Two Expeds. Int. E. Australia, 1838, ii. p. 342.

‡ Aborigines of Victoria, 1878, i. pp. 300 and 331.

enchase many of our Natives' boomerangs. As a general rule the surfaces of this interesting missile are plain, but in other cases a series of incised lines cover one at least of these aspects, arranged in a variety of devices, the figures being enclosed by right or undulating lines. Very few of these ornate weapons have been figured, and still less described, and perhaps, in consequence, a few notes on three very excellent examples may not be out of place. The boomerangs in question are from Norley on the Bulloo River, about twenty miles from Thargomindah, in N.S. Wales, and I am indebted to the kindness of Mr. S. Chatfield, L.S., of Sydney, for an opportunity of figuring them.

The weapons are nearly of a size, about two feet six inches long, whether measured from point to point, or along the curve, and from two, to two and a-half inches wide, practically flat on one face and plain, gently arched or convex on the other, that bearing the incised figures. Two of the weapons are gently and gracefully curved, the third is slightly elbowed or bent transversely in the middle line, and this is the most ornate, whilst all are emarginate at the apices, with a small central mucronate extension.

In the first boomerang (Pl. xv. fig. 1) the incised lines form four unequal disjointed serpentine figures, each consisting of four lines. They occupy three-fourths of the surface, the remaining portion being unornamented, possibly left so from want of time, or opportunity for its completion, and even one figure is more incomplete than its fellows. Each is returned on itself twice. Four of the loops and one of the marginal spaces are carved, three of the former with broken zig-zag markings, whilst in the latter the lines are double. The remaining loop carries two V-shaped notches, part of a third, and seven longitudinal series of single and separate incisions, from three to six in a row. In three instances the free ends of the loops are ended short off by transverse bars. The loops represent figures resembling a much drawn out letter S. The whole of the incised lines are well inscribed, the only trace of wavering appears to have been at the rounded ends or return of the loops.

The second boomerang presents a much simpler pattern, consisting of intra-marginal waved or serpentine figures that do not joint at their ends, but remain free and extend the whole length of the weapon. The figures consist of three runs, each of two lines, or six in all. The crown or centre of the boomerang bears a single run of broken zig-zag notches extending its whole length (Pl. xv. fig. 2).

The third boomerang (Pl. xv. fig. 3), that with the slight knee at the centre, presents the greatest complexity of ornament, and is the most highly carved boomerang that has yet come under my notice. The two halves of the surface differ somewhat in pattern, but the chief elements are the following:—The crown presents an undulating serpentine figure of three double incised lines returned at each end on itself in the form of loops, but one, the larger, ending abruptly against its first part, whilst the smaller passes underneath its first part. Both ends of this figure stop considerably short of the boomerang apices, and are not even perfectly equilateral with regard to the central transverse line of the weapon. The intra-marginal areas are occupied by a series of successive half-ovals, also formed by three runs of two lines each. There are two pairs of these ovals at each end beyond the termination of the central serpentine figure, but they are not equal in size, nor as to the space occupied by them. All other intervening spaces carry smaller ovals, and right or curved line incisions cut in different directions. The immediate apices of the boomerang are smooth, but at one end there is a space occupied by a broken zig-zag line of single notches.

The weight of these boomerangs is nearly the same, twelve and fourteen ounces respectively. They are, I believe, made of Miall wood, and are fighting boomerangs, and are propelled by being thrown under the left or shield arm.

It will be noticed that when these weapons are held in the hand with the incised or convex side uppermost, that two curve to the right, and the other, or that with the least sculpture, to the left. In other words, the surfaces have been reversed.

With regard to carved boomerangs generally, I have failed to obtain any evidence as to the meaning of the devices—whether tribal or individual, but Mr. E. Palmer* states that amongst the North Queensland Blacks, who use this weapon, incised undulating lines were used to denote ownership. Nor, so far as I am aware, is anything known of the area over which a boomerang with a given pattern ranges; or again, are fighting or come-back boomerangs differently carved. Many of our more experienced bushmen could doubtless answer these queries, and it would be very advantageous to possess the information in a published form. Mr. Palmer's statement is borne out by the much earlier expressed opinion of Collins, who says † that each tribe employed a particular form of carving on their weapons to indicate the part of the country to which they belonged.

I now purpose giving a few short notes on some of the various devices used in carved boomerangs, in each case citing the authority for the information.

(a) Single line of rhombs.—This was one of the earliest patterns observed, for when giving a general description of the weapon, Sir T. L. Mitchell ‡ figures an example in which the entire surface is so covered. The same pattern was in use about Port Macquarie, but the ends of this boomerang were incised with V-shaped markings, concave inwards. Breton figures § one of these, but the influence of the whites even at this early date (1833) was manifest, for the centre of the weapon bears the profile of a head, clearly intended, from the hat surmounting it, for that of a white man. Wood also, in his "Natural History of Man," depicts || one of the large "sword boomerangs" with a series of joined elongated rhombs in a single line. Again, a third example of this style of sculpture is represented ¶ by Mr. G. F. Angas in a short account of the Aborigines. It is said to be a recoiling boomerang, but no locality is mentioned.

* Journ. Anthrop. Inst. Gt. Brit. and Ireland, 1884, xiii. p. 288.

† Acc. of the English Colony in N. S. Wales, 1804, p. 377.

‡ Two Exped. Int. E. Australia, 1838, ii. p. 342.

§ Excursions in N. S. Wales, 1833, p. 255, pl. fig. 1-4.

|| Vol. Australia, 1870, p. 50, f. 1 (lower series).

¶ Waugh's Australian Almanac for 1858, p. 56, f. 10.

(b) Double line of rhombs.—Amongst his illustrations of native implement sculpture, Mr. R. B. Smyth figures a double line of rhombs,* but mentions no locality or district in which this pattern occurs.

(c) Treble line of rhombs, with scalloped edges.—The same author also gives a representation† of this form, three lines of rhombs parallel to another, not extending quite to the apices, and with the edges scalloped by triangular or semi-rhombic festooning.

(d) Single continuous zig zag pattern.—This is represented‡ by Mr. Angas at each end of a fighting boomerang, but the centre of the illustration is left plain, whether intentionally so or not I cannot say. The figures are enclosed by single lines on each side. In this instance, also, the locality is wanting.

(e) Double continuous zig-zag pattern.—Amongst Smyth's illustrations already referred to this form, occur§ two parallel fluctuating or zig-zag figures extending apparently the length of the boomerang, and re-uniting at the apices. Unfortunately this is not localised. This pattern is also given by Dr. George Bennett and the Rev. G. Wood. Dr. Bennett's illustration|| represents a "come-back," or recoiling boomerang, made of myrtle wood, but without locality. Wood's figure¶ is that of a large double curved weapon. Smyth states** that in the Mackay District waved lines are generally employed. How far north such boomerangs extend is not within my knowledge, for Dr. Creed says†† that the weapon is unknown at Cape York, a fact that is confirmed by my friend Mr. J. A. Thorpe, Taxidermist to the Australian Museum, who resided for many months in the old days amongst the northern Cape York tribes. MacGillivray even goes further and states

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* Aborigines of Victoria, 1878, i. p. 285, f. 37.

† Aborigines of Victoria, 1878, i. p. 329.

‡ Waugh's Australian Almanac for 1858, p. 56, f. 9.

§ Aborigines of Victoria, 1878, i. p. 285, f. 37.

|| Gatherings of a Naturalist, 1860, p. 291, f. 16.

¶ Nat. Hist. Man. Vol. Australia, 1870, p. 50, f. 2 (lower series).

** Aborigines of Victoria, 1878, i. p. 329.

†† Journ. Anthrop. Inst. Gt. Brit. and Ireland, 1878, vii. p. 266.

that the boomerang is unknown from Cape York to Port Essington, a distance covering about ten degrees of longitude. Spears and clubs only are met with at Cape York and Port Essington. This fact was also dwelt on by Mr. G. W. Earl,* and has been more recently referred to by myself† in connection with the Alligator River Tribes, Port Essington.

(f) Single longitudinal line of ovals.—Dr. Bennett figured‡ a fighting boomerang, without locality, bearing a line of oval figures joined together. A somewhat similar form of ornament has also been illustrated by myself,§ from the tableland country to the south of Port Essington, on a weapon collected by Mr. H. Stockdale.

(g) The same, with scalloped edge.—This type is also known from the Port Essington Tableland, and "consists of a median line of elongately-oval figures, interrupted at the centre of the weapon by a broad transverse bar, with a narrower bar at each end. The convex and concave edges bear a festoon [or scalloped] pattern, the festoons longitudinally grooved, and not necessarily facing one another on opposite sides [edges]. The synclines of the festoon outline are each distinguished by two transverse notches or nicks."‖

(h) Double longitudinal line of ovals, edges with semi-rhombs.—The single line of oval figures, always elongate, is replaced by two series, and cut in half by a median transverse band. The margins bear an edging of continuous half-rhombs or diamond-shaped figures. In each re-entering angle between the half-rhombs there are two V-shaped marks or notches. Port Essington Tableland.¶

(i) The same, edges with semi-ovals and semi-circles.—The lateral zones in this case exhibit on the one irregular semi-ovals, and

* Journ. R. Geogr. Soc., 1846, xvi. p. 247.

† Macleay Mem. Vol. (Linn. Soc. N.S. Wales), 1893, p. 236, t. 32, f. 5.

‡ Gatherings of a Naturalist, 1860, p. 291, f. 16.

§ Macleay Mem. Vol. (*loc. cit.*), t. 32, f. 6.

‖ Macleay Mem. Vol. (Linn. Soc. N. S. Wales), 1893, p. 237, t. 32, f. 1.

¶ Macleay Mem. Vol. (Linn. Soc. N. S. Wales), 1893, p. 237, t. 32, f. 3.

on the other semi-circles, all cross-hatched, and alternating in each series with V-shaped notches. There is no transverse central band in this case. Port Essington Tableland.*

(k) Double and treble line of ovals, with scalloped edges.—A highly and peculiarly ornate boomerang is figured† by Lumholtz, from Coomooboolaroo, Central Queensland. The weapon is centrally divided by the usual transverse bar in the centre, and one at either end cutting off the apices, which are not mucronate. On the one half the surface are two lines of long ovals, and on the other three, the ornament is therefore not bilaterally symmetrical. It is a gently curved and non-returning weapon.

(l) Single transverse chevron ornament.—A simple pattern of this nature is figured‡ by the Rev. G. Wood, in his work already referred to. The single chevron, or V-shaped sculpture, is concave inwards from both ends of the boomerang.

(m) Multi-transverse chevron ornament.—This description of ornamental carving, which, together with the herring-bone pattern, is one of the earliest styles of weapon and utensil sculpture in the world's history is figured§ by Dr. G. Bennett on a boomerang from Shoalhaven, N. S. Wales. The herring-bone and chevron pattern was the form of ornament that the old Celts decorated their clay pots with.‖

(n) Simple concentric ornament.—Concentric lines parallel to the outline of the boomerang are figured¶ by Smyth. In this particular instance there are three incised grooves, one within the other, whilst the centre of the weapon is occupied by a longitudinal bar, also three lines. As in the case of so many of Smyth's figures, this is without a locality.

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* Macleay Mem. Vol. (Linn. Soc. N. S. Wales), 1893, p. 237, t. 32, f. 2.

† Amongst Cannibals, 1890, p. 51, f. *b*.

‡ Nat. Hist. Man. Vol. Australia, 1870, p. 50, f. 3 (lower series).

§ Gatherings of a Naturalist, 1860, p. 291, f. 16.

‖ A. Lang, "Custom and Myth," p. 281.

¶ Aborigines of Victoria, 1878, i. p. 285, f. 37.

(o) Natural objects.—These appear to be of rare occurrence. Eyre figured* an object on the boomerang termed by him *Wāngn* or *Wangno*, resembling a snake, and I have published† a second from the Port Essington Tableland. It is also possible that another figure ‡ given in the "Macleay Memorial Volume" may represent a natural object; the outline of the figure, so far as it goes, and its snout-like termination favour this view. The marginal fringe of transverse lines might almost lead us to imagine this to be a Millipede.

This epitome of incised patterns is by no means intended as an exhaustive one; it simply includes those that have come within the scope of my own reading. Doubtless many others are known to those having a more extended knowledge of the subject than I have. At the same time, the present notes may tend to call attention to the wide field there is for profitable investigation in this form of aboriginal weapon.

I am indebted for the illustrations, as on former occasions, to Mr. Charles Hedley, F.L.S.

DESCRIPTION OF PLATE XV.

Fig. 1.—Boomerang carved over three-fourths of one surface, in the form of loops returned on themselves, and each representing a drawn out, and in three instances a reversed letter S.

Fig. 2.—Boomerang carved over the whole of one surface in the form of two longitudinal fluctuating figures, with a central zig-zag line.

Fig. 3.—Boomerang, highly ornate, with a central serpentine figure, marginal loops and other complex incisions.

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* Journ. Exped. Discov. Central Australia, 1845, ii. t. 3, f. 8.

† Macleay Mem. Vol. (Linn. Soc. N. S. Wales), 1893, p. 238, t. 32, f. 6.

‡ *Loc. cit.* t. 32, f. 5.

NOTES ON THE METHODS OF FERTILISATION OF THE *GOODENIACEÆ.*

Part I.

By Alex. G. Hamilton.

(Plate xvi.)

The remarkable nature of the organs of fertilisation in this order appears to have early attracted the attention of botanists, and there are many allusions to them in works on Australian botany. With one or two exceptions to be noted presently, the early observations appear to have been made on dried specimens, a fact to be deplored, although not to be wondered at when we remember that much of the systematic work was done by English botanists, and that those who actually collected plants in Australia in the early days had such a wealth of new material to work out that they would scarcely have time or inclination to make long continued and close observations.

The earliest reference which I can find to the subject is by J. Sims in a description of *Goodenia grandiflora* (1), in which he gives an account of the process, evidently from observation of fresh specimens. This is in the main correct, but he makes the mistake of supposing that the pollen falls from the anthers into the cup instead of being packed, as described in a later paper by me (2). R. Brown has a reference to the subject in his "General Remarks on the Botany of Terra Australis" (3), pointing out that the flowers cannot be impregnated at the time of the bursting of the anthers, but that later on they may be, by the pollen of other flowers, or at a still later stage, by their own. It will be seen in the course of these notes that this is a correct conclusion. C.

Darwin, in a paper "On the Fertilisation of *Leschenaultia*" (4), gives a good account of the fertilisation of this genus from observation of living specimens of several species. This was followed by a "Note on the Stigmatic Apparatus of *Goodenoviæ*" by G. Bentham (5), which is a wonderful account of the process, when it is taken into consideration that the observations were for the most part, if not entirely, made on dried specimens. I shall notice his conclusions as to the different genera as I reach them in the course of my notes. H. Müller also describes the process, and takes the view that the plants of the order are solely cross-fertilised (6). In the Manual by R. Brown, Junr., there is an account of indusiate stigmas, in which is repeated the erroneous statement that the pollen falls into the cup and causes fertilisation (7). Some of the authors mentioned call upon Australian observers to work the subject out from fresh plants. So far as I am aware, there have been only two who have attempted this—Mr. E. Haviland, whose papers (8 and 9) I shall refer to under the genus *Goodenia*, and myself, in a paper already mentioned. Other papers on the nature and origin of the indusium by R. Brown (10 and 11), Bentham (12), and Lindley (13 and 14) I shall also have occasion to refer to.

In the present paper I propose to give the results of my observations of those species of *Scævola*, *Selliera*, and *Brunonia* which have come under my notice, and I shall continue in other instalments with other genera which I have had the opportunity of observing. I regret that I have had no opportunity of seeing living specimens of West Australian species, and tropical Australian species generally. I should be very grateful to any members who could send me seeds of such plants, especially of the genera *Leschenaultia*, *Diaspasis*, *Calogyne*, and *Anthotium*, for the purpose of cultivating them for observation, or failing seeds, dried flowering specimens.

1. Scævola suaveolens, R.Br.

In this species the five petals spread out like an open hand, the three centre petals lying quite flat, while the outer one on each side slants upwards and outwards from the plane of the others, so as to form guiding walls to the throat of the flower. The petals are bright blue with a greenish-yellow band from the mid-length in the median line. This yellow part in the three centre petals is thickly studded with brush-tipped hairs standing perpendicularly (Fig. 1); they are sticky and well adapted to catch pollen. The lateral petals have very few of these hairs. The flower buds are at first closely pressed to the stem of the plant by the leaves, from the axils of which they spring; but, as the flower progresses, each leaf bends downwards till at last it assumes a horizontal position, and in this movement it is followed by the flower, which is fully open when the horizontal position is reached. In the upper part of the plant, the flower develops before the leaf grows to any size, but even in this case the same movements are gone through, and the leaf, though perhaps smaller than the flower, still gives it support.

The flower is proterandrous. In the early buds, the style and indusium stand slightly higher than the anthers (Fig. 2), but as the bud matures, the anthers grow rapidly till they overtop the cup (Fig. 3) which is edged with stiff hairs. The style then grows upward through the anthers (Fig. 4), and at the same time these dehisce introrsely, and the brush of hairs on the margin of the cup clears the pollen out of them completely, the pollen dropping into the indusium (Fig. 5). This alternation of periods of growth between the style and the anthers is a remarkable feature, and occurs in all the species of the order so far as I am aware, but it appears to have been missed by observers prior to my paper (2) already referred to. The upward growth being very rapid, and the filaments being so elastic as to keep the anthers closely pressed to the cup, the pollen is pretty firmly packed, in which the pressure of the bud on the anthers also assists. The stigma at this stage is immature, at the bottom of the indusium (Fig. 6) and hidden by the grains of pollen. The edges of the cup now approach each other by a flattening of the indusium (Fig. 7), till at last the opening is a narrow slit fringed with hairs (Fig. 8). Up till this time, the style has lain horizontally in the bud, but now it bends upwards in the middle, and bursts the bud open on the upper side (Fig. 9), and at the same time the pollen begins to be forced through the slit at the mouth of the indusium by the growth of the stigma. I have noticed in some flowers that the mouth opens quickly and allows the pollen to drop out in a solid mass. The petals now expand, and by a further bending of the style, the mouth of the cup rests upon and in contact with the brush-tipped hairs on the petals. During this period, the leaf from the axil of which the flower springs, reaches the horizontal position, and when the flower is fully open it is spread out on the leaf which forms a platform on which insects visiting the flower can alight. I have not observed this correlation of movements and growth between the leaf and flower in any other member of the order. When the flower is fully open, the stigma continues to grow outward from the bottom of the indusium, and forces a constant shower of pollen between the hairs at the mouth, which falls on the brush-like hairs on the petals. Any insect visiting the flower is guided in the right direction by the lateral petals, the convergence of the central petals, and the guiding lines of colour; to reach the throat of the flower it has to force itself under the pollen-shedding cup, and in doing this it is dusted with pollen on the dorsal surface by the cup, and on the ventral surface by the brushes on the petals.

Before the stigma has grown so much as to project from the opening of the indusium, the flower withers, the lateral petals a considerable time before the central ones, and the supporting leaf, by a twisting of the leaf-stalk, moves round so as to be above the flower, and then turns on one side and conceals it. It is during this movement, and after it is complete, that the stigma first emerges from the indusium (Fig. 9). It is difficult to give any reason for this concealment, as it is just at the stage when insects would begin to be useful to the plant by placing pollen from other flowers on the stigma, that concealment begins. The withering, too, seems to indicate that the plant no longer requires the aid of insects. But there is evidence that insects do visit these withered and concealed flowers, for if a series of stigmata from them be examined, most of them will be found to have moth scales adhering to them in addition to pollen and fragments of brush-like hairs. It would appear then that the visiting insects carry pollen from those flowers which are distributing it from the indusium, both on their upper and under surfaces, and in visiting other flowers, leave it either on the brush-tipped hairs whence it is taken up by the mature stigma resting on these, or on the stigma itself from their backs, and in this way cross-fertilisation is ensured. But it is not necessary for ensuring cross-fertilisation, that the concealed flowers should be visited, if when in the pollen-distributing stage they have been freely visited. For each insect not only takes pollen from an open flower, but if it has visited another, it also leaves some on the brushes, and as the stigma when it emerges from the indusium rests on these, it would find there the pollen necessary for impregnation. If the flowers should not be at all visited, they are very likely to be self-fertilised by the pollen which dropped on the brushes. In fact, even if insect-visited it would seem as if they were certain to be partly self-fertilised unless what has been shown to be the case with other plants obtains here, viz., that the foreign pollen is prepotent. In G. Bentham's account of the stigmatic apparatus in this order (5), he says—"In *Scævola* . . . . the stigma is small and more buried in it" [the indusium]. This I have not found to be the case. In fact, in the species I have examined, I have found the stigma to project very much—more so than in most other genera.

By cutting away the indusium from the mature stigma, pollen may be found inside the cup, being forced into the crevices behind the stigma by the packing process. But it is not at all likely that the base of the stigma is functional and capable of being fertilised, and I have never observed pollen-tubes emitted by the pollen in this situation. The plant fruits very freely, and, as the specific name denotes, the flower is sweet-scented. The leaves, stem and calyx are closely covered with stiff hairs, lying close to the surface, which give the plant a harsh feel, and which may be for the purpose of keeping away creeping insects, but they appear to me to lie too flat to be of service in this way.

2. Scævola hispida, Cav.

The flower spreads out rather flatly, the lateral petals being twisted so as to form guides to the tube of the flower, and there are guiding lines of yellowish-green on the petals, which latter are bright purple. The centre petals vary as to smoothness, being sometimes glabrous, sometimes with lines of soft hairs, or again having raised thin jagged ridges, passing into forked hairs in the throat of the flower (Fig. 11). The indusium when young and open is 4-angled at the mouth (Fig. 12), and has the fringe of stiff hairs which aid in brushing the pollen out of the dehiscing anthers. The method of packing the pollen into the indusium is as in the preceding species. The pollen is packed before the flower opens, and is driven out before the up-growing stigma. The style arches over so as to bring the mouth of the cup down upon the centre petals (Fig. 13). Insects visiting the flower and inserting their probosces into the tube are therefore dusted with pollen. Contrary to what occurs in *S. suaveolens*, the flower does not wither before the out growth of the stigma. This last grows out in a crescent shape so as to leave a passage between for insects (Fig. 13), and at the same time the horns can take up pollen adhering to an insect after a previous visit to a pollen-shedding flower. And the ridges and hairs of the petals, while not so effective as those of *S. suaveolens*, are yet capable of holding pollen received from the ventral side of an insect, which the stigma would then take up. The plant has the power of self-fertilisation as in the preceding species, as its own pollen lies in quantities on the hairs of the petals, and if not removed by insects, comes in contact with the stigma when that organ protrudes. In fact, it is certain that some of the plant's own pollen must reach the stigma. There is no scent, and I failed to detect nectar in the tube, but there is some attraction for insects, as they frequently visit the flowers.

3. Scævola Hookeri, F.v.M.

This species differs from the preceding two in having no hairs on the margin of the indusium, but the pollen is collected as in the others, and all the rest of the process is similar. The outgrown stigma is remarkable for its large size. In this and the other species, as indeed in most of the order, there are quantities of light stiff hairs on the style and outer sides of the cup. Their purpose is probably to prevent small insects getting at the pollen by a path which would not ensure the placing of pollen on the stigma. The whole of this plant is slightly hairy, and as it is a prostrate plant, it is perhaps for the same purpose that it is hairy.

4. Selliera radicans, Cav.

The flowers are less flattened than in *Scævola*, and assume a bell-shape, slit down one side. The process of pollen-packing is the same. The hairs on the lip of the indusium are remarkably few, and very thick and strong as compared with any other member of the order which I have seen (Fig. 14, *a*). They cannot act as a brush in taking the pollen out of the anthers, but they bend over the closed mouth of the indusium and form a grille, through which the pollen is strained (Fig. 14, *b*). The cup is hairy outside (Fig. 14) and these hairs are also much stronger; they are most plentiful on the lower side; pollen is frequently entangled in them. There are usually a number of small intensely black spots on the outside of the indusium, which may be a fungoid disease. The stigma grows out very largely (Fig. 15), and bends over at the corners (Figs. 16 and 17), a feature found in *Velleya* and at least in one *Goodenia*. There is no scent; the flowers are greenish, and secrete much nectar. The plants bear fruit very freely.

5. Brunonia australis, Sm.

In this species I met with a number of unusual features, which perhaps might have been expected considering the numerous affinities of the plant with orders outside the *Goodeniaceæ*. R. Brown advocated making a separate order of it (11), pointing out its many features of resemblance and difference when compared with the orders *Compositæ*, *Goodeniaceæ*, and *Campanulaceæ*, and concluding that its proper place in the natural system was between *Compositæ* and *Goodeniaceæ*. He also speculates on the origin of the indusium, and from a consideration of the order *Stylideæ* in connection with *Brunonia*, is disposed to think that it consists of a series of modified stamina.

The flowers grow in a head which bears a considerable resemblance to *Scabiosa*—a fact that is patent to the ordinary observer, as is evidenced by its bearing the common name of "Bachelor's buttons," which is also applied to *Scabiosa*. Indeed, Sir James Smith was disposed to refer it to the order *Dipsaceæ*. The colour is white, pink or pale blue. The anthers are connate as in *Dampiera* and *Leschenaultia*, and are sometimes emptied in the usual way by the upgrowing indusium. But in the same head of flowers I frequently found some indusia full of pollen, and closed by the accurate contact of the lips, which are destitute of the hairy fringe, but thickened (Fig. 18) ; and others in which, although the flower was open, the style and indusium had grown up above the anthers, which were still closed and full. The indusium in this case was so widely opened that the stigma could be seen at the bottom. Again, in others the flowers were withered, but the stigma not grown out, and the indusium was open and full of pollen. A few were found with the indusia closed and quite free from pollen, and the stigma not grown out (Fig. 19). Others again had the stigma grown out (Fig. 20) and either plentifully smeared with pollen or quite free from it, the styles being withered, brown, and on the point of dropping off. Packed indusia and outgrown stigmata were the exception ; empty indusia and ungrown stigmata the rule.

I am at a loss to account for such an anomalous condition in this plant, unless it be that there is less necessity for the collecting of pollen and doling it out a little at a time to visiting insects, on account of the flowers being compacted into a head ; but it would be necessary in that case that the stigmata should grow out freely, and that is not common, so far as my experience goes. It may perhaps be that, being a link between so many orders, the characters pertaining to the *Goodeniaceæ* have not become fully fixed, and that the plant is, so to speak, in a plastic condition.

The indusium is bilabiate in *Brunonia*, as in *Selliera* (Figs. 14 and 18), the outside of the style is glandular and has gland-tipped hairs all round for half its length upwards, and a few stiff hairs grow on the outside of the indusium. The stigma grows out transversely to the mouth (Fig. 20), in which it differs from all other plants of the order which I have examined.

The conclusion I have arrived at with regard to the first four plants is, that the contrivances all point to cross-fertilisation by insects, but that in case of that failing, the same contrivances secure fertilisation by the plant's own pollen.

It is interesting to compare the methods of distributing the pollen in the three natural orders, *Lobeliaceæ*, *Goodeniaceæ*, and *Campanulaceæ*. In the first, the anthers surround the style closely, and as that organ grows upwards, it pushes the pollen before it, so that it issues in a stream from the orifice of the tube formed by the anthers. In the second order, the open indusium, pushed up between the anthers by the growth of the style, brushes the pollen into itself, and then closing, the outgrowth of the enclosed stigma forces the pollen out gradually. In the last, the anthers are closely adpressed to the style, and wither, leaving their pollen adhering to it in a uniformly thick coat; the pollen is then set free by the drying up of the sticky glands on the style, to which it adhered, and is carried off by insects which visit the flower in search of nectar and pollen. These very different methods of securing the same end are all the result of modifications of the same organs.

I am inclined to think that the study of this subject throws some light on the descent of the order *Goodeniaceæ*. I take *Scævola* to be the ancestral form, or the nearest to it, on account of its manifestly simpler arrangements for fertilisation; and this view I think supported by the fact that *Scævola* is the only genus of the order which is very widely distributed, being found in Australia, New Zealand, several Pacific islands, Asia, Africa, South America, and the West Indies.

C. Darwin has pointed out that a very wide distribution probably indicates a very ancient origin. I hope to be able to discuss this subject in another paper.

I have to thank Dr. Maxwell T. Masters, Editor of the "Gardeners' Chronicle," for a manuscript copy of C. Darwin's very interesting account of *Leschenaultia*, which I could not find in any Sydney library. Mr. C. Moore and Mr. C. Musson, too, very kindly gave me specimens of a number of plants of the order which I had not previously seen.

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(13) Lindley, J. "Nature of Indusium in *Goodeniaceæ*," "Vegetable Kingdom," p. 694.

(14) Lindley, J. "Indusium in *Goodeniaceæ*," Introduction to Botany, p. 366.

Postscript (July 3rd, 1894) :—The quite recent addition to the Society's library of some of the earlier volumes of the Proceedings and Transactions of the New Zealand Institute—wanting since the destruction of the library in 1882—has enabled Mr. J. J. Fletcher to call my attention to an important paper* by Mr. Cheeseman, on the fertilisation of *Selliera*, of which I was previously unaware, and which I regret that I was unable to refer to in the proper place. The author's observations (made in 1876) agree with mine, except in some minor details which arise from slight structural differences. For example, he describes the hairs on the margin of the indusium, and the outside, as few and weak, whereas I have always observed them to be stiffer than in others of the order. He believes the functions of the hairs to be to catch the pollen and detain it on the outside of the indusium. But examination of many species of the order leads me to think that the marginal cilia are, first, intended to brush the pollen out of the anthers as the style lengthens ; and second, to strain it out a little at a time as the stigma grows outward. The function of the hairs on the upper surface of the indusium I think is to protect the pollen

* On the Fertilisation of *Selliera*. By T. F. Cheeseman, F.L.S., Proc. and Trans. of N.Z. Inst. Vol. ix, p. 542.

from dew, but I shall enter into this more fully in another contribution. Mr. Cheeseman gives a most interesting account of the visits of insects to the flowers. He finds that the most frequent visitors are Diptera, but Hymenoptera, including the hive-bee, and ants also frequent the flowers, as does a day-flying moth, *Leptosoma annulatum*.

EXPLANATION OF PLATE XVI.

Scævola suaveolens.

Fig. 1.—Brush-like hairs on petals.
Fig. 2.—Anthers and indusium in early bud.
Fig. 3.—Anthers in advanced bud ready to dehisce.
Fig. 4.—Style grown up and anthers emptied of pollen.
Fig. 5.—Cup full of pollen before closing.
Fig. 6.—Indusium cut open, showing immature stigma at the bottom.
Fig. 7.—Indusium closed on pollen.
Fig. 8.—Mouth of closed indusium, showing strainer of hairs.
Fig. 9.—Bud bursting from bending of style.
Fig. 10.—Stigma outgrown from indusium.

Scævola hispida.

Fig. 11.—Ridges and hairs on petals.
Fig. 12.—Indusium, showing 4-angled shape.
Fig. 13.—Position of indusium and mature stigma in flower.

Selliera radicans.

Fig. 14.—*a*, Indusium showing hairs on margin ; *b*, closed, showing strainer of hairs.
Fig. 15.—Stigma outgrown.
Fig. 16.—Stigma outgrown, with corners bent down ; from below.
Fig. 17.—Stigma outgrown, with corners bent down ; from side.

Brunonia australis.

Fig. 18.—Open indusium, showing rib round mouth.
Fig. 19.—Indusium closed.
Fig. 20.—Indusium with outgrown stigma.

NOTE ON THE TERTIARY FOSSILS FROM HALL SOUND, NEW GUINEA.

By Professor Ralph Tate.

The collection of Tertiary fossils from Hall Sound, New Guinea, which was reported on by the late Rev. Tenison-Woods,* has been entrusted to my care by the Trustees of the Macleay Museum, through the intervention of Professor David, with the view to a critical comparison of the mollusca with those of the Older Tertiary of Southern Australia, to certain species of *Voluta* from which some approximate identifications had been essayed by the late Mr. Wilkinson.† My examination of the fossils dispels the notion of such a correlation; indeed, the genus *Voluta* is unrepresented in the collection, and it is not at all improbable that the cast of a species of *Strombus* may have been mistaken for that of *Voluta macroptera.* Nevertheless, Tenison-Woods expressed the opinion that the "deposits were a very recent Tertiary formation, much newer than any of the Murray River or Western Victorian beds," &c. I am not only able to confirm this opinion, but press for a more recent date than that implied by Tenison-Woods.

The collection embraces a very limited number of fossils with their tests preserved, the very large majority being casts or moulds in a very friable matrix. Of the species in the former category, the following have had names applied to them by the author above-quoted, viz.—*Pecten Novæ-Guineæ*, *Peronella decagonalis* and *Temnechinus Macleayi.*

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* P.L.S.N.S.W. Vol. ii. pp. 125 et 267 (1878); see also Jack and Etheridge, Geol. Queensland, pp. 690-698.

† Jack and Etheridge, *op. cit.*

Pecten Novæ-Guineæ, Tenison-Woods.

The types of this species I have compared with authentic examples of *P. pallium* and I fail to find any distinguishing feature, not one amounting to individual variation. Tenison-Woods relied on the meagre development of the scales as a specific character for his new species. An examination of the two specimens on which the species was established reveals signs that they possessed scales on the ribs, which had evidently been worn down before fossilisation, whilst towards the front of all the ribs scales remain equal in strength to those of recent examples of the same size. There is no escape from the opinion that *P. Novæ-Guineæ* is simply a somewhat worn state of a typical *P. pallium.*

Peronella decagonalis.

I accept Mr. Woods' identification of the fossil with the recent species of this name.

Temnechinus Macleayi, Ten.-Woods.

This echinoid does not belong to this genus; it has some resemblance to *Paradoxechinus novus*, Laube, but in my judgment it has greater affinity with *Psammechinus Woodsi*, Laube, though I cannot attach it to that species. I am not sufficiently familiar with the recent species of that or related genera to venture a specific determination, particularly also in view of the imperfection of the unique specimen.

Of the rest of the fossils, which are casts, some approximate determinations are possible to the following species:—*Triton olearium*, Linn.; *Dolium costatum*, Lam.; *Strombus Campbelli*, Gray, or *S. vittatus*, Linn.; *Corbula crassa*, Hinds; *Arca granosa*, Linn.; *Lithodomus Cumingianus*, Reeve; *Orbitolites complanatus.*

One better acquainted with the living mollusca of Torres Straits than I am might approximately identify the large number of the casts and moulds with living species, so impressed am I with the absolutely modern facies of the fauna. The age of the deposit may, for the present, be accepted as Pleistocene.

NEW OR RARE FISHES FROM MAROUBRA, N.S.W.

By Edgar R. Waite, F.L.S, Zoologist, Australian Museum, Sydney.

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(Plate xvii.)

All the following fishes have been obtained at Maroubra Bay, and by my colleague Mr. Thomas Whitelegge unless otherwise stated.

Maroubra is situated between Port Jackson and Botany Bay, and is a deep inlet about one and a half miles across; it is bounded on both sides by low cliffs, at the bases of which are numerous rock-pools, the home of many small blennies, gobies, and other littoral fishes; these also occasionally detain fishes not usually found in such localities. Stretching between the rocks is an area of sand, on to which, more especially after heavy seas, many other forms are to be met with; frequently those small pelagic species unable to withstand the tempestuous waters when driven near the land. It is to be further remarked that only during winds from seaward are such fishes to be found on the coast. It is almost useless, on the shores of this colony, to attempt much shore work during or immediately after a westerly wind, and this leads us to a further consideration as to how pelagic fishes become stranded. It can scarcely be considered likely that the wind actually drives them in, but it probably has, indirectly, much to do with it.

A large amount of information may be obtained by observing the invertebrate life on the coasts under varying atmospheric conditions. Easterly winds drive in small Pteropods, Medusæ, Salpæ, and other pelagic forms, and it is to be noticed that they are frequently accompanied by the smaller crustaceans, such as Amphipods and Copepods, which are also sought after as food by fishes.

Such immense shoals of almost invisible invertebrates have probably a great bearing on the situation of fishes directly or indirectly accompanying them, and cause them to change their position much as do swallows when hawking for flies, which, as is a well-known fact, accommodate their movements to the varying pressure of the atmosphere. This simile is by no means strained, for, as Dr. Francis Day remarks (Food of Fishes, p. 17) :—"The mackerel, it has been observed, swim higher or lower in the water in accordance with atmospheric vicissitudes most probably due to the influence of such upon the food they subsist upon."

The occurrence of an influx of pelagic life upon the coasts may be assumed by noticing the behaviour of the gulls and other sea birds. At such times they flock upon the shore and eagerly watch the edge of the water, where they secure not only the fry of our valuable edible fishes but doubtless also a large proportion of the smaller organisms which bring the fish to the coasts and within easy reach of the fishing community.

Seagulls are protected by law and no one would desire that these beautiful ornaments to our coasts should be banished. It will be well for those who have charge of the fishing interests of the colony to see that these birds are not permitted to become so numerous as to interfere with our future fish-supply. I have endeavoured to show that fish are largely attracted coastwise by the food to be found there, and if we permit the birds to consume such food-supply the fish will seek other feeding grounds. Thither the fishermen will have to follow them at much loss of time and without the possibility of bringing them to market in such a fresh condition. This may be but a small factor towards the depletion of the coast, yet we should be fully alive to the truth that it is a *possible* factor. It may be long ere this state of things can arise here, but surely we should take warning from what has occurred in England and zealously guard not only our present but our future fish-supply also.

Of the fishes hereafter mentioned one is described as new and the others are more or less worthy of remark as being either new to the fauna of Australia, or of exceedingly rare occurrence.

Dules argenteus, Bennett.

Although recorded from several of the Polynesian islands, this species has not been previously identified from the mainland of Australia.

Numbers of these fishes may be observed almost any time at Bondi and Maroubra, and are probably to be met with all along the coast in suitable localities, but owing to their seclusive habits have hitherto been overlooked.

In a collection of fishes recently brought from Lord Howe Island by Mr. T. R. Icely, the Visiting Magistrate, is one of this species, an addition to the published fauna of that island; although in 1887 small fishes were seen there (but not obtained) by members of Mr. Etheridge's party, since recognised as of this species.

I have myself seen them on the coast where they may generally be observed in rock-pools. They are extremely shy and wary, and usually live under boulders, whence they may be enticed by throwing in morsels of food. From the circumstance of their thus hiding themselves they may be regarded as shore-loving fishes; the truly pelagic forms when cast into rock-pools do not appear to have the idea of thus secreting themselves, but rush wildly about when alarmed.

Acanthurus triostegus, Linn.

Gunther remarks (Fische der Südsee, p. 109) :—"This species is common throughout the whole of the Indian Ocean and the South Seas as far as the Sandwich Isles." He further says :—"Throughout Polynesia it is called 'Manini'." Macleay, giving the locality of the type of *Teuthis australis*, Gray, includes it in his "Catalogue of Australian Fishes" (p. 161) as from the west coast of Australia. It is also recorded as far south as New Zealand, and I now include it as a member of the fauna of New South Wales, an example having been obtained at Maroubra by Mr. Whitelegge, who observed it swimming in a rock-pool and obtained it by baling out the water.

PSENES WHITELEGGII, sp.nov.

(Pl. XVII. fig. 1.)

B. vi., D. $11\frac{1}{19}$, A. $\frac{3}{18}$, V. $\frac{1}{5}$, P. 18, C. 18, L. lat. 55. Length of head 3·6, of caudal 4—4·48, height of body 3·24 in the total length. Diameter of eye 2·9 in length of head, half a diameter from the end of snout and less than a diameter apart. Dorsal profile elevated and bulging above the nostrils. Abdominal profile not so convex, body compressed, jaws equal, maxilla reaching to just within the anterior margin of the eye. Teeth in a single series, small, palate toothless, preopercle and opercle scaly.

The dorsal fin commences above the hinder edge of the opercle, 3rd and 4th spines longest and equal, nearly half the length of the head and higher than the soft dorsal, to which the anal is similar both as to relative position and extent. Pectorals long, reaching slightly beyond the anal and as long as the head, less the snout. Ventrals reach slightly beyond the vent. Caudal deeply forked.

Scales cycloid, moderate, and adherent. Lateral line continuous following the dorsal curvature as far as the 48th pore, where it bends horizontally to the caudal. A second and very distinct line, but without pores, runs straight from the opercle to the caudal.

Ground colour delicate salmon, crossed by 3 brownish transverse bands, the first very broad, extending from the head to the vent; the second much narrower, connecting the dorsal and anal rays, and the third narrow, at the base of the caudal: these bands are not equally defined in all the examples. Above the head brown;

beneath, including opercles, silvery ; fins brownish. Several examples were washed on to the beach at Maroubra alive and obtained by Mr. Whitelegge. The largest specimens are equal in size and measure 47 mm. in length.

Type in the Australian Museum ; registered number I. 3297.

Nomeus gronovii, Gm.

Respecting the distribution of *N. gronovii* Günther writes :—"Tropical parts of the Atlantic. The species appears to inhabit also the Indian Ocean and the coasts of Australia." Macleay, writing without further evidence, suggests Western Australia as its habitat. It is now possible to give one definite locality of its occurrence on Australian coasts. From Feb. 25th to March 5th last, living examples were being constantly washed up on to the beach at Maroubra, and during this period Mr. Whitelegge obtained several specimens.

Schedophilus maculatus, Günther.

Up to September last, when Mr. Ogilby wrote his review of the genus *Schedophilus* (Records, Australian Museum, II. p. 65), only one example of *S. maculatus* had been obtained from the coast of this colony. In December last Mr. A. M. Lea brought us a small fish from Maroubra, which we identified as a second example, and later in the same month a third specimen was brought from Lord Howe Island by Mr. Icely, together with the *Dules argenteus* already mentioned, and as with that species is a new record to the known pisci-fauna of the island.

Glyphidodon brownriggii, Bennett.

This very variable little species, which appears to be scattered through the seas between Ceylon and the Sandwich Islands, has not, so far as I am aware, been recorded further south than Fiji or the New Hebrides. I am, however, able to record it from

Australian coasts, two examples having been seen alive at Maroubra, one of which was obtained. The colours were brilliant, an orange-coloured ground with brilliant blue longitudinal streak ; the head was also lined with blue. The presence of two spots, a large one at the posterior base of the dorsal fin and a smaller one occupying a similar position in relation to the soft dorsal, would point to its being of the variety described as *G. antjerius*, C. & V.

On showing the above note to Mr. J. D. Ogilby, he told me that some years ago Dr. James C. Cox had presented a small *Glyphidodon* to the Museum. In consequence I searched the registers, and found that it was obtained in Port Jackson in 1888, and had been named *G. antjerius*. Further search showed that specimens of *Glyphidodon* were brought from Lord Howe Island in the following year, and are without doubt referable to this species.

Solenognathus, Swainson.

(Pl. xvii. figs. 2-11.)

Several fresh specimens of *Solenognathus* having been recently presented to the Museum, and knowing that all the examples in the galleries were named *S. spinosissimus*, Günth., I was led to re-examine those exhibited, and found that they were readily divisible, a certain number being referable to the very well marked species, *S. hardwickii*, Gray. Of the remainder I made an examination to decide whether they should be called *S. spinosissimus* or *S. fasciatus*, Günth. According to the published descriptions, the latter differs from the earlier described species in having 41 dorsal rays instead of only 35, a somewhat wider forehead, the trunk ornamented with seven blackish cross-bars, and in the preanal region being blackish.

The number of dorsal rays in the specimens of *S. spinosissimus* at my disposal is by no means constant, individuals possessing 35, 36, 37, 38, and 39 rays.

Having named his second species *S. fasciatus*, Dr. Günther seems to have considered the colour markings as peculiar to the species, but I may remark that in all fresh specimens of *S. spinosissimus* which I have seen, the seven cross-bars are a most noticeable feature, and even in a dry state are frequently to be traced by a darkening of the dorsal tubercles where the bars existed. The inferior portion of the two preanal rings is very bright orange during life, but becomes blackish after death.

If adequately described the claims of *S. fasciatus* to be a distinct species appear to be somewhat slight. Of the other species, a few remarks based on recent observations may be of some interest.

SOLENOGNATHUS HARDWICKII, Gray.

(Pl. XVII. figs. 2-4 and 7.)

D. 43-45. Osseous rings 26-28 + 55-60. Dorsal surface concave or flat. Forehead convex or flat. Occipital scute simple, or but slightly compound generally forming one large median, and two smaller lateral lobes. Scutes rugose, but with scarcely any spines. The lateral row of scutes does not terminate at the end of the dorsal fin, but is to be traced to the extremity of the tail. Length 17 inches and beyond.*

When referring to the *Solenognathus* in general, Günther writes:—†"All the specimens in the British Museum are unfortunately dried, so that the sexes cannot be ascertained; but although some of them must be of the male sex, there is no trace of a pouch or other receptacle for the ova."

As I have not access to Marensen's paper on the sexual characteristics of the Syngnathi,‡ or any other paper dealing with the subject, I write the following at the risk of having been anticipated.

In the species under consideration, the sexes are remarkably distinct, as least in the adults. The tail of the male is greatly

* Günther says that *S. hardwickii* attains a 'ength of nearly two feet, "Study of Fishes," p. 682.

† Brit. Mus. Cat. of Fishes, viii. p. 195.

‡ Sitzungsb. der Natur. Gesel. "Isis," 1872, p. 1

expanded from its commencement at the vent to the termination of the dorsal fin, the expansion gradually disappearing at the following third or fourth scute. The lateral row of scales on each side of the tail constitute the expanded edges, these edges are bent downward, and form the boundaries to two inferior shallow grooves separated by a flat portion of equal breadth. The whole of the under surface of the tail thus occupied—about fifteen scutes—although bearing traces of tubercles, is covered with a smooth skin, which, in the breeding season, becomes flaccid and to which the ova are attached.

The tail of the female bears no trace of the lateral expansion so noticeable in the male, and the scutes of its lower surface are as rough and rugose as any other portion of the body. In the adult the body proper is relatively longer and deeper than in the male.

This species was originally described from China, but there are examples in the British Museum from Houtman's Abrolhos, a group of islands off Western Australia. Examples in the Australian Museum were labelled "*Solenognathus spinosissimus*, Port Jackson," and Mr. Whitelegge has obtained specimens at Maroubra Bay. These appear to be the only other localities whence it has been obtained, and it is now recorded for the first time from New South Wales. If the specimens of this family preserved in the museums of other Australian colonies were examined, I have no doubt our knowledge of its distribution would be considerably extended.

Solenognathus spinosissimus, Günther.

(Pl. xvii. figs 5 and 8.)

D. 35-39. Osseous rings 27 + 55. Dorsal surface convex. Forehead concave. Occipital scute in the form of a rosette consisting of a median lobe surrounded by 6-8 smaller ones. All parts* covered with very distinct spines, a stronger one arising

* With the exception of the inferior basal portion of the tail of the male and the prehensile portion in all species.

from the centre of each tubercle. The lateral row of scutes is not continued to the extremity of the tail, as such, but passes upward and merges into the upper row at the end of the dorsal fin. Length 16 inches.

I have not noticed any important structural differences in the sexes, beyond the fact that the female has a relatively longer body than the male, and has the lower surface of the tail spiny as in other parts.

Some little time ago Mr. Whitelegge obtained a fresh male at Maroubra, with six or seven ova adhering; they were unfortunately lost before I had an opportunity of seeing them, but the mode of attachment and the area occupied were very apparent. Counting along the inferior surface the non-spiny portion extends from the vent to the fifteenth scute. Along the sides the lateral row forms the upper boundary as far as the eleventh scute, thence to the fifteenth scute the boundary is the series which there becomes the lateral row of the tail. The area thus restricted is covered with a smooth skin. During the breeding season it becomes flaccid and thrown into ridges, forming shallow pits. Into each pit an ovum is placed and no doubt glued into position with some viscid secretion. It occurred to me that this skin might be but the remnants of an egg-case, but as all the male specimens in the Museum, both dry and in spirits, possess it, and as it is scarcely likely that they were all taken during the breeding season, I am led to consider it as part of the animal. The fact of the ova-bearing male above referred to having been taken on March 4th would appear to indicate autumn as the spawning season.

Günther described this species from Tasmania; Klünzinger records it from Port Philip, Victoria; and we have it from Wollongong, thence from various places to Port Jackson, where several examples have been obtained at odd times.

MONACANTHUS FILICAUDA, Günther.

As far as I am aware, this species has not been recorded since originally described* from the South of New Guinea in the Arafura Sea. From January to March last small numbers were to be met with at Maroubra; many of them were living, but all appeared to have been injured, and being thus unable to withstand the heavy surfs, were washed on to the sandy beach. The black spot below the dorsal fin is, as Günther observes, a constant feature.

MONACANTHUS NITENS, Hollard.

Mr. Whitelegge has been fortunate in securing a second member of this genus, which, so far as I can ascertain from the literature at my disposal, has not been found since 1854, when it was first described and figured.† Hollard appears to have considered that the single specimen described might be miniature and possibly the young of a previously described species, but as our example seems to agree with it in all particulars, there can be little doubt that it is an adult form, and therefore quite distinct. Our example was obtained at Maroubra during the present month (May), and as it is probably only the second specimen ever obtained it will be well to describe it.

D. 30. A. 26. P. 12. C. 12. Length of head (to gill opening) 3·3, of caudal 5·2, height of body 2·5 in the total length.

Eyes 3·6 in the length of the head, barely a diameter apart and 2·6 from the end of the snout. Gill opening but little oblique, beneath the posterior margin of the orbit and distant from the centre of the eye one diameter.

Upper and lower profile of snout concave, back between the spine and the fin straight and horizontal. The spine arises immediately over the centre of the eye, is moderately strong and very slightly curved backwards; it is long and equals its distance from the end of the snout. The barbs are in two lateral series pointing

* Challenger Shore Fishes, p. 50, pl. XXIII. f. D.

† Ann. des Sci. Nat. 4me Série, Tom. ii. p. 364, pl. 14, f. 12 (f. 4 in text).

outward and downward. Toward the base they are opposite, but gradually lose this position and become alternate. Anteriorly the spine is provided with minute barbs having an upward aspect excepting towards the apex, where they are much larger and have their points directed downward.

The dorsal fin arises exactly at the point reached by the spine when depressed into its groove ; it is low, the seventh ray longest. Anal similar to the dorsal. Ventral spine large, its apex jointed : towards the hinder margin of the fixed portion are two strong barbs on both sides, united at their bases, having their hooked points directed upwards and backwards; four precisely similar barbs on the movable portion having a slightly less upward aspect. At the base of the spine are four barbs pointing upward, the remaining portion studded with smaller barbs.

The pectorals arise directly behind the gill openings and are 1·7 in the length of the head ; the caudal rounded.

The scales are small and from each arises a short obtuse spine, some of which are bifurcate or even trifurcate from the base.

The name *nitens* is most felicitous, for the greater part of the body has the appearance of being silvered. The dorsal edge is olive and the portion between the snout and the ventral spine is closely spotted. Vertical and pectoral fins immaculate, caudal with four delicate brownish transverse bars.

Total length of the specimen 46 millim.

Leptocephalus, Bonaparte.

Until quite recently none of the forms described under this name have, I believe, been met with in Australian waters. Dr. Haast records *L. longirostris*, Kaup, from the coast of New Zealand, as the only one ever obtained in that colony. On March 18th last Mr. Whitelegge secured a living example at Maroubra, and only two months later Mr. Frank Middleton brought us a second specimen from Dee Why, north of Port Jackson. Both were transparent when alive, and could barely be distinguished when in water. They became opaque, however, on being placed into weak spirits.

Owing to the still uncertain nature of these remarkable forms, I have not attempted any critical examination of them; I may merely mention that in neither specimen is there trace of pectoral fins. In the one from Maroubra the height is contained about 18 times in the length and the tail is not produced. In the other one the height is contained 14 times in the length and the tail is tapering and pointed.

The following extract from the "Study of Fishes" will be read with interest by those who have not access to Dr. Günther's work.

"Taking into account all the various facts mentioned, we must come to the conclusion that the Leptocephalids are the offspring of various kinds of marine fishes, representing, not a normal stage of development (larvæ), but an arrest of development at a very early period of their life; they continue to grow to a certain size without corresponding development of their internal organs, and perish without having attained the characters of the perfect animal. The cause by which this abnormal condition is brought about is not known; but it is quite within the limits of probability that fishes usually spawning in the vicinity of land sometimes spawn in the open ocean, or that floating spawn is carried by currents to a great distance from land; and that such embryos, which for their normal growth require the conditions afforded by the vicinity of the shore, if hatched in mid-ocean, grow into undeveloped hydropic creatures, such as the Leptocephales seem to be" (p. 181).

Postscript.—Since the paper was read I have, through the kindness of Prof. David, had the opportunity of examining three specimens of *Solenognathus* preserved in the Macleay Museum at the Sydney University. These differ somewhat from *S. spinosissimus* and are without doubt referable to *S. fasciatus*. Günther writes of it*:—"This species is most closely allied to *Solenognathus*

* Challenger Shore Fishes, p. 30.

spinosissimus, having the same rough and spiny scutes." It is, however, the nature of these scutes that at once showed me the specimens were distinct, and wherein I perceive the readiest means of distinguishing the species. It may be characterised as follows:—

SOLENOGNATHUS FASCIATUS, Günther.

(Pl. XVII. figs. 6 and 9.)

D. 39-41. Osseous rings 27 + 55. Dorsal surface slightly convex. Forehead concave. Occipital scute trilobed, each lobe being of nearly equal size. Tubercles not conspicuously raised; from each rises a comparatively prominent and stout spine, the rest of the surface covered with spines so minute as to be scarcely noticed without a lens. The lateral row of scutes as in *S. spinosissimus*. Length, 13 inches.

I have purposely avoided giving particulars of colouration, but have pointed out such characters as will enable anyone to determine the three species either from dry or spirit specimens.

EXPLANATION OF PLATE XVII.

Fig. 1.—*Psenes whiteleggii*. (Enlarged).
Fig. 2.—*Solenognathus hardwickii*. Male; basal portion of tail.
Fig. 3.—*Solenognathus hardwickii*. Seen from beneath.
Fig. 4.—*Solenognathus hardwickii*. Female.
Fig. 5.—*Solenognathus spinosissimus*. Male.
Fig. 6.—*Solenognathus fasciatus*. Female.
Fig. 7.—*Solenognathus hardwickii*. Outline of dorsal scutes (magnified).
Fig. 8.—*Solenognathus spinosissimus*. Outline of dorsal scutes (magnified).
Fig. 9.—*Solenognathus fasciatus*. Outline of dorsal scutes (magnified).

ON THE MODE OF ATTACHMENT OF THE LEAVES OR FRONDS TO THE CAUDEX IN *GLOSSOPTERIS;*

WITH

REMARKS ON THE RELATION OF THE GENUS TO ITS ALLIES.

By R. Etheridge, Jun.
(Palæontologist to the Australian Museum, and Palæontologist and Librarian to the Department of Mines, Sydney).

WITH A NOTE ON ITS STRATIGRAPHICAL DISTRIBUTION IN AUSTRALASIA.

By T. W. Edgeworth David, B.A., &c.
(Professor of Geology, &c., in the University of Sydney).

(Plates xviii.-xix.)

CONTENTS.

1. Introduction.

The genus *Glossopteris* is probably familiar to those possessing but a limited knowledge of the Palæonotology of N.S. Wales. So intimately are the leaves or fronds of this plant, whichever the reader may choose to call them, associated with the coal-bearing rocks of this country, "forming more than nine-tenths, and perhaps ninety-nine hundredths, of all the fossil bands of these regions,"* and so closely interwoven is the genus with the old dispute as to the age of our Coal-measures, that it seems almost superfluous to refer to its general structure. But the fortunate discovery of a more than ordinarily interesting specimen near Mudgee, by Mr. C. J. Horsley, J.P., showing the attachment of the fronds to the caudex, has necessitated a reconsideration of the entire history and structure of *Glossopteris.* More particularly is this the case, as there is only one previous authentic record, and a second less so, of the relation of these parts in the genus. The almost universal mode of occurrence is that of separate petiolate fronds, throughout the shales of our Coal-measures, either singly or in matted masses.

The exigencies of the Palæo-botanist necessitated the christening of these various forms of fronds with different names, often, no doubt, erroneously, as there are at the present time no less than fifteen† accepted species of *Glossopteris* in the Australasian Coal-measures alone; in the Indo-Chinese Gondwana Formation eighteen, and perhaps more; and in the Karu Formation of S. Africa, six. So they must remain, until the fortunate discovery of specimens similar to the present enables us to gradually reduce the multiplicity of species by learning more about the leaf-attachment, or association of one with the other on the same caudex, to say nothing of the fructification.

2. Description of the Specimen.

Turning now to the specimen, we see the remains of a small caudex or stem, surmounted by a clump of closely packed fronds, with ample traces on the former of the previous existence of

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* Dana. Wilkes U.S. Explor. Exped. x. (Geology), 1849, p. 716.

† We do not include *G. ovata*, Johnston, in this enumeration, as it seems to be little more than a variety of *G. ampla*, Dana ; neither are varieties of other species counted.

many others. The whole of the organic matter has been removed, nor is the slightest trace of any hard epidermal envelope remaining, leaving only the impression of the parts on the slab of fine sandstone forming the matrix.

The caudex is represented by a matrix-cast, reposing in its own impression, six inches long, and in its compressed state three-quarters of an inch in width. It is covered from end to end with cicatrices, or leaf-scars, that will be described later on. The fronds are attached in a clump at the upper or younger end, to the number of about eight, in various states of completeness, but only one of them can be said to be entire. The manner in which they overlap one another leads us to believe that these fronds were not placed in a vertical, but spirally on the caudex, after the manner of a tree-fern, and the appearance of the leaf-scars supports this view.

The fronds are elongately-lanceolate, apparently sessile, and without any evidence of the existence of a long petiole. There is the impression of a strong persistent mid-rib, and secondary veins that curve outwards obtusely and gradually. Commencing on the right-hand of the specimen (Pl. XVIII. fig. 1), an entire leaf is followed by the broken base of a second. In a line with the latter, but above and separated by matrix, and clearly passing underneath it to a lower level on the caudex, is a third frond ; adjoining the third leaf, although not seen to articulate with the caudex, is a fourth and broader frond, slightly overlain on the left side by the fifth, which shows the most satisfactory evidence in the whole series of stem-attachment. Following this to the left are portions of certainly three others, and possibly a fourth, most of them showing traces of a downward prolongation towards the caudex.

The first and best preserved leaf on the right, although by no means the widest, is five and three-quarter inches long, and three-quarters of an inch wide. The partially preserved fourth frond is one and a quarter inches in width.

From the method of the fossil's preservation, the retention of the mesh formed by the reticulation of the secondary veins, is but very faintly visible, although under a low power lens it can be caught in certain lights on the narrow frond on the right-hand. The secondary veins, so far as they can be made out, leave the mid-rib at an obtuse angle, curving gradually outwards, and for quite half their distance are simple. The mesh then occupies the other half of the frond, and forms an acutely rhomboidal net-work. The lower portion of all the leaves in which that part is visible shows a transversely puckered or wrinkled surface. This is not structural, but arises, in all probability, from pressure.

The upper end of the caudex is rounded. The cicatrices, or leaf-scars, seen on its impression (Pl. XVIII. fig. 2), seem to be ovo-rhomboidal, arranged alternately, or in oblique rows. The internal cast, lying loosely in its impression, bears on its surface a number of ill-preserved rod-like projections (Pl. XVIII. fig. 3), that in all probability represent the vascular bundles. Some of the leaf-scars, more particularly when taken by a wax mould, show the scars of three vascular bundles to the cicatrix. The lower portion of the internal cast bears a series of concentric undulations, which are probably superinduced (Pl. XVIII. fig. 4).

Now, the facts we learn from a study of this specimen are the following:—

1. A general confirmation of Dana's (and possibly McClelland's) description of the mode of attachment of the fronds, so far as it was known to them.

2. The leaves did not merely form a clump at the growing end of the root-stalk, but were successively developed along the whole course of the latter, and were deciduous.

3. The leaves were both petiolate (Dana's) and sessile (Pl. XVIII. fig. 1, Pl. XIX. fig. 1), or probably sub-sessile.

4. The leaf-scars were probably ovo-rhomboidal, and to each there appear to have been three bundles of vessels.

3. The structure of the Genus *Glossopteris*.

The genus was founded by A. Brongniart, on fronds received both from India and Australia, which he described as *G. browniana*, var. *indica*, and var. *australasica* respectively.* It includes simple petiolate leaves, varying in shape from elongately-elliptical, oblong-elliptical, widely ovate, and spathulate to lingual-lanceolate, and possessing a generally strong and frequently striate mid-rib, sensibly attenuating upwards, and at times reaching the apex, or even evanescing a short distance before attaining the top of the leaf. The secondary veins emerge from the mid-rib usually at an acute angle, and by frequent anastomosis form a very characteristic, elongately-hexagonal network, extending over the whole or only a portion of the frond. The fronds attain a large size, for McCoy mentions those of *G. browniana* as six inches in width, and probably reaching a length of two feet.† Brongniart imagined that the reticulation of the secondary veins was confined to near the mid-rib, but this erroneous view was corrected by Morris,‡ who pointed out the distribution of the mesh at times over the whole surface.

Of such simple leaves has *Glossopteris* been supposed by all but two writers to be composed, the existence of the so-called species depending on the outline of the leaf and form of the net-venation. It seems to have escaped the notice of subsequent writers that Dana figured§ a number of fronds of *Glossopteris*, believed to be *G. browniana* var. *australasica*, attached in a clump to a fragment of stem. Zigno expressed the opinion, so Bunbury states,‖ that this species had a compound or digitate frond, and quoted a report that a specimen had been found to establish the fact. This, how-

* Hist. Vég. Foss. 1828, i. p. 223.

† Ann. Mag. Nat. Hist. 1847, xx. p. 151.

‡ Strzelecki's Phys. Descrip. N. S. Wales, &c., 1845, p. 247.

§ Wilkes, U.S. Explor. Exped. x (Geology), 1849, p. 716, Atlas, t. 12, f. 13C.

‖ Quart. Journ. Geol. Soc. 1861, xvii. p. 327.

ever, Bunbury doubted, and said that nothing in the Indian examples, examined by him, showed them to be otherwise than simple fronds. Bunbury also stated* that Dr. McClelland, in one of his Indian Geological Survey Reports (1850), figured a *Glossopteris* that might at first sight be supposed to show a digitate frond, "but on examination of the drawing [McClelland's], it is clear that the leaves did not all grow in the same plane, and that instead of being leaflets of a digitate frond, they are really single fronds growing in a tuft (as is so common in recent ferns) from a short thick rhizoma." Dana says of his very interesting specimen, "fronds formed a clump, as is common now with numerous ferns, especially those of warmer climates. The foot-stalk into which the frond tapers is very long, quite equalling, in the young individual, the old frond. . . . . At least twenty fronds were clustered together in the clump and probably others."† The figure given by Dana exhibits seventeen or eighteen stipes radiating *apparently* from a common level, like a vertical. Only two portions of fronds remain, but the perfect one possesses a definite strong mid-rib. The fronds had evidently been converted into a black carbonised film, and in consequence the venation is not apparent. Many of the petioles or stipes are very long, as much as one and a-quarter inches in one case. The object to which the petioles are attached is seen obliquely and looks like a section of a caudex. It is manifest that this is not precisely the arrangement or method of union visible in our specimen, now under discussion. In this case, as before explained, the fronds are sessile, and placed one above the other on the caudex.

We may now turn our attention to the latter, and compare the structure of that of our specimen with some remarks of Prof. McCoy's.‡ He says—"I believe I have ascertained the rhizoma of this species [*G. browniana*], which is furnished with ovate, clasping (or at least very convex) subcarinate scales, having a

* *Ibid.* p. 328.

† Dana, *loc. cit.* p. 716.

‡ Ann. Mag. Nat. Hist. 1847, xx. p. 151.

divaricate reticulate neuration, resembling that of the parent frond, but much less strongly marked; these scales are of large size, some of them being nearly an inch in length, and terminating at the apex in a long flat linear appendage, about one line in width, which occasionally gives off small, lateral, flat, membraneous branches, nearly at right angles." Here, again, it is clear that no useful comparison can be made with the new specimen, for we have not observed any structure at all corresponding to this.

Before proceeding to discuss the highly important question of fructification, it is absolutely necessary to have a clear perception of Brongniart's constitution of *Glossopteris*. Of the four species described by him,* the only one we are at present concerned with is his *G. browniana*, the type, but of this two varieties are mentioned. The first is var. a. *australasica*, the second var. b. *indica*. By the laws of nomenclature, therefore, should it become necessary to separate these varieties generically, it is to the var. a., or the Australian form, that the name *Glossopteris* would have to be restricted. Schimper, on the other hand, in his great work, the "Traité de Palaeontologie Végetale,"† constitutes the var. b., or the Indian plant, the type of the genus, and restricts the two varieties of Brongniart under their respective names as species. In this he was afterwards followed by Feistmantel.‡

Now, the earliest indication of fructification in *Glossopteris* was seen by Brongniart on var. b. *(indica)*, in the form of what he believed to be the scars of large, rounded, sessile capsules, or sori, arranged at intervals, in a subserial manner, near the margins of the frond.§ For many years this was all that was known of the fruiting of *Glossopteris*, but in 1861 Bunbury published‖ similar figures of the Indian plant to Brongniart's, exhibiting small round spots subserially arranged parallel to the frond margin.

* Hist. Vég. Foss. 1828, i. p. 223.

† Vol. i. 1869, p. 645.

‡ Pal. Indica (Gondwana Flora), 1879, iii. Pt. 1, p. 100.

§ Hist. Vég. Foss. 1828, i. p. 224.

‖ Quart. Journ. Geol. Soc. 1861, xvii. p. 327, t. 8, f. 1 and 4.

He says on this point:—"The position of the fructification is indicated in several of the specimens by small round spots, very regularly arranged in one or two rows parallel to the margin—the outermost row at but a short distance from the margin, the inner about half-way between the outer and the mid-rib. When there is only one row it is always the inner that is wanting. In these spots I can find no organic structure at all, but only little lumps of sandstone, as if not only the sori themselves, but the very substance of the frond had decayed, or been displaced at these points. I think, however, from the regularity of their form and arrangement, there can be little doubt that they really indicate the places of the sori." Acting on this belief, Bunbury suggested an alliance of *Glossopteris* to the Polypodidæ or Aspideæ, but at the same time suggested that the venation of the fronds indicated a tendency towards the Acrosticheæ.

The next step in advance was made by Mr. William Carruthers, who detected on some Queensland examples of *Glossopteris*, collected by the late Richard Daintree, indications of fruiting,* in the form of linear sori, running along the secondary veins, and nearer to the margin than to the mid-rib. Unfortunately, no one has had the good fortune, notwithstanding the thousands of examples of *Glossopteris* that have been collected, to notice a similar structure, but the result of this discovery was at once grasped by Feistmantel, who pointed out that it would necessitate, if confirmed, the placing of the Australian and Indian plants in separate genera.† Feistmantel considered the Queensland *Glossopteris* to resemble the living *Anthrophyum*, an opinion in which he is supported by Zeiller,‡ but Tenison Woods states§ that *Anthrophyum* is devoid of a mid-rib, and therefore the comparison would not strictly stand. It appears to us, however, that there is a rudimentary mid-rib in *Anthrophyum* (or *Antrophyum*)

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* Quart. Journ. Geol. Soc. 1872, xxviii. p. 354.

† Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 97.

‡ Ann. des Mines, 1882, Livr. Sept.-Oct.

§ Proc. Linn. Soc. N. S. Wales, 1883, viii. 121.

extending but a short distance into the substance of the frond.* No doubt Feistmantel's comparison of the fructification of the two ferns was a very appropriate one.

Feistmantel also believed † he had discovered traces of a third kind of fructification in the Indian *G. angustifolia*, Brong. On the frond referred to there existed a clear space along each margin, "which perhaps shows that in fertile fronds the fructification is a marginal one." We would here suggest a comparison with the genus *Schizoloma* amongst recent ferns. He generally confirmed Brongniart and Bunbury's observations on the fruiting of *G. indica*, and gave some excellent additional figures of similar sorus scars in *G. communis*, Feist.

In lending provisional support to these views, Zeiller remarked on the absence of any hitherto discovered sporangia, and says that provided the foregoing evidences of fructification are sound, it is difficult to doubt the presence of the three groups proposed by Feistmantel. Their conjoint opinion may be briefly expressed thus:—

Group 1.—Type of *G. browniana*, Carruthers, allied to genera of living ferns, such as *Anthrophyum*, with linear sori on the nervules.

Group 2.—Type of *G. indica*, Schimper (*G. browniana*, var. b. *indica*, Brong.), allied to genera of living ferns, such as *Polypodium*, with round sori in longitudinal rows parallel to the frond margin.

Group 3.—Type of *G. angustifolia*, Feistmantel (? *G. angustifolia*, Brong.), with a supposed marginal fructification along the edge of the frond, as in the living genus *Pteris*.

Now, there is one weak point in this classification. We have already pointed out that, according to strict priority, should any division of *Glossopteris* be necessary, it is to Brongniart's

* *See* Beddome's Ferns of Southern India, 1863, t. 52.

† *Loc. cit.* p. 97, t. 39a, f. 1 and 2.

var. a. *australasica* that the generic name should be applied. But it is this very variety that is unprovided for in the triple subdivision, simply because the fruiting was not apparent in the original specimens received by Brongniart from Australia. To which division, therefore—that with the round sori, that with the linear sori, or that with the supposed marginal fructification, is Brongniart's var. a. *australasica*, to be referred? As a corollary to this arises the question—which of the three sections is *Glossopteris* in its restricted meaning?

We may tentatively dismiss Group 3 from consideration, for two reasons. It was one of the after species described by Brongniart, and we have no knowledge of its existence in Australia, but it certainly will hereafter require a name to distinguish it by.

The general question is further complicated by Mr. John Mitchell's discovery of what he believes to be the typical form of Indian fructification on a *Glossopteris* frond from the Newcastle beds, at Lake Macquarie Road, near Charlestown. He lately exhibited to this Society,* the leaf in question, an impression without organic film, showing two rounded bodies and the indication of a third. We are indebted to Mr. Mitchell for the loan of this specimen, and freely admit that in their serial arrangement they correspond to those scars described by Brongniart, and figured by the latter and Feistmantel, but the objects themselves do not convey to us the idea of sori. We must, however, bow to the evidence such as it is, and it would thus appear that we have in Australia *Glossopteris*-like leaves possessing two out of the three forms of fructification.

In answer to the question put by ourselves in a preceding paragraph—which of the three sections is *Glossopteris*? the course that best commends itself to us is, in this particular instance, to overlook strict priority and follow Schimper in selecting the var. b. *indica* as the type of the genus, and restricting the name *Glossopteris* to those forms that, like the latter, are provided with

* Proc. Linn. Soc. N. S. Wales, 1892, vii. (2), Pt. 3, p. 377.

round serially arranged sori, leaving those with the fructification placed in a linear manner along the secondary nerves, and typified by the *Glossopteris* described by Mr. Carruthers from Queensland, as the type of a new genus, should researches in the future furnish additional examples with similar structure. Again referring to a tabular form the classification will stand thus :—

Group 1.—*Glossopteris*, Brongniart. Type, *G. browniana* var. *indica*, Brong. (*G. indica*, auct.). Sori round, sessile, subserial, near the margin of the frond.

India and Australia.

Group 2.— ? . Type, *G. browniana*, Carruthers (*non* Brong.). Sori linear, sessile, along the secondary veins (and nervules ?).

Australia (Queensland).

Group 3.— ? . Type, *G. angustifolia*, Feistmantel (? *G. angustifolia*, Brong.). Fructification marginal, on a clear space along the margins of the fronds.

India.

With regard to that large body of leaves described under various names, and without evidence of fructification, it will be convenient to write them as *Glossopteris*, followed by a note of interrogation, until their true affinity shall become known. Amongst these will naturally fall the specimen from near Mudgee described in this paper.

4. Relation of the Mudgee Specimen to *Glossopteris* (Auct.)

We may now perhaps profitably engage ourselves with the consideration of how far the Mudgee specimen (Pl. XVIII. fig. 1, Pl. XIX. fig. 1) corresponds in structure with that of *Glossopteris*, as generally understood. On comparison with Dana's remarkable figure we have to note the petiolate leaves of the latter, and their apparently sessile condition in the former. All forms of *Glossopteris* are petiolate, in a greater or less degree, generally the former, and many highly so. That the fronds in Dana's illustration are devoid of net-venation is of small consequence, for they are apparently carbonised, with all trace of the venation lost, a by no means uncommon condition in these ferns. Notwithstanding these discrepancies, that the clump of leaves terminating our specimen are those of *Glossopteris* as ordinarily understood, we do not anticipate any impartial critic will attempt to deny, the combined form and characters of the mid-rib and venation being sufficient. As to the form of the leaves, they belong to the lanceolate division of the genus, as opposed to the spathulate, and oblong-elliptical sections, and practically resemble in outline those of *G. linearis*, McCoy,* or *G. Clarkei*, Feist.† The mid-rib is glossopteroid in the strictest sense of the word, extending quite to the apex of each leaf; whilst the venation, although differing, so far as we have been able to make it out, from that of *G. linearis*, by the simple nature of the secondary veins, when first issuing from the mid-rib, is obviously like that of *G. Clarkei.*

Touching the caudex, little can be said from a comparative point of view, for Dana's figure shows no structure hereabouts, whilst McCoy's description being that of a stem detached from leaves cannot carry any great weight with it, more particularly as he uses the term rhizome, in this case a rather ambiguous one. A rhizome, according to Balfour,‡ is "an underground stem which creeps horizontally or obliquely under the surface of the soil, and terminates in an aërial stem." Moore,§ on the other hand, says—"The caudex, sometimes called the rhizome or root-stock, is often erroneously regarded as the root. It is, however, a modified stem, and assumes, in the case of ferns, two very distinct appearances, sometimes lengthened and creeping, either beneath or upon the surface of the earth, and sometimes short and tufted, forming little more than a crown, whence the fronds issue." McCoy's description, we imagine, refers to a creeping stem as defined by

* Ann. Mag. Nat. Hist. 1847, xx. p. 151, t. 9, f. 5, 5*a*.

† Mem. Geol. Survey N.S. Wales, Pal. Series No. 3, 1890, p. 123, t. 13, f. 4.

‡ Manual of Botany, 3rd Edit. 1855, p. 692.

§ Handbook of British Ferns, 1848, p. 3.

Balfour, whilst our example more nearly accords with the latter portion of Moore's diagnosis. On the whole, therefore, we see no reason to doubt that we are dealing with a true *Glossopteris*, irrespective of the question of fructification.

As to the specific identity of the Mudgee fossil we offer no decided opinion, beyond the fact that it undoubtedly comes near to *G. linearis*, McCoy, in the general habit of the leaves, and *G. Clarkei*, Feist., in the venation. A further remark will also be found on this subject at the end of Section 6 *(Sagenopteris)*.

5. Relation of *Glossopteris* to *Gangamopteris*.

Gangamopteris, although proposed by Sir F. McCoy as a generic term in 1860,* was described in 1875† and is characterised by a simple, or impari-pinnate frond, the pinnules, or leaflets, varying from oblique-ovate to trigonal, spathulate, or flabelliform. The base is petiolate or oblique and adherent, or wide and embracing, but McCoy says never auriculate. There is no mid-rib, but the principal veins, at first parallel with one another and thick, are united by small more or less horizontal cross veins that alternately evanesce into the general substance of a frond. Many of the secondary veins arise direct from the base, others from the primary veins in the usual way, and after dichotomisation towards the margin, anastomose to form an irregular network or mesh.

The mode of attachment of the fronds to the caudex is not known, but McCoy considered that by their varied obliquity the plant was probably impari-pinnate.

The chief difference relied on to distinguish *Gangamopteris* from *Glossopteris* is the character of the mid-rib, "the place of which [in the former] is occupied by numerous dichotomous nerves."‡ No doubt, in thoroughly typical species of both genera this distinction holds good, such as *Glossopteris browniana* on the one hand and

* Trans. R. Soc. Vict. for 1860 [1861], p. 207, *note*.
† Prod. Pal. Vict. Dec ii. 1875, p. 11.
‡ Ann. Mag. Nat. Hist. 1847, xx. p. 149.

Gangamopteris obliqua on the other, but Feistmantel has figured some forms of *Glossopteris*, such as *G. tæniopteroides*,* *G. intermittens*,† in which the mid-rib seems to be dissolved into a series of parallel veins; whilst in his *Gangamopteris Clarkei*‡ there is an entire absence of the cross reticulating veinlets of the typical mid-rib of that genus. Neither will the non-auriculate base of the fronds in *Gangamopteris* wholly stand good as a differential character, for Feistmantel says that in *Gangamopteris cyclopteroides*, var. *subauriculata*,§ the base is partially auriculate. The same observer also figures another transitional form in his *Glossopteris decipiens*,‖ from the Lower Gondwana formation, wherein the secondary veins occupying the top portion of the frond closely resemble those in a similar position on the leaves of *Gangamopteris*.

It is, therefore, questionable how far the two genera, except in extreme species, can be separated. At the same time, it cannot be denied that on a casual glance the two genera have a very different appearance, and it will perhaps be better to regard the points of differentiation as those of a broad general, rather than of a minutely morphological nature. This view does not, of course, take into consideration the habit of growth, which may ultimately prove to be of a widely different character.

6. Relation of *Glossopteris* to *Sagenopteris*.

According to Schenk,¶ in *Sagenopteris*, Presl., the frond consists of four hardly petiolate leaflets, carried on a cylindrical stem, whilst later the same Author** says these are arranged in two pairs.

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* Mem. Geol. Survey N.S. Wales, Pal. Series, No. 3, 1890, p. 128, t. 18, f. 1.
† Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 99, t. 33*a*, f. 2-4.
‡ Mem. Geol. Survey N.S. Wales, Pal. Series, No. 3, 1890, p. 123, t. 20, f. 3.
§ Pal. Indica (Gondwana Flora), 1879, iii. Pt. 1, p. 13, t. 15, f. 1 and 3.
‖ Pal. Indica (Gondwana Flora), 1879, iii. Pt. 1, p. 17, t. 18, f. 3, 4, 5.
¶ Foss. Flora Grenzsch. Keupers-Lias Frankens, 1867, p. 59.
** Zittel's Paléontologie (Fr. trans.), Pt. ii.—Paléophytologie, Pt. 1, 1891, p. 150.

Possibly one of these pairs is displayed in *Sagenopteris tasmanica*, Johnston.* The leaflets vary in shape from lanceolate to elliptical and obpyriform. On the other hand, Fontaine† describes five leaflets in *Sagenopteris* from the Potomac younger Mesozoic Flora. Lindley and Hutton‡ figure one example of *S. Phillipsii* with four lanceolate fronds forming a clump, sessile in one case, sub-petiolate in another. Their second figure exhibits oval leaves. In *S.* (?) *longifolia*, Feist.,§ the fronds are increased to six in number, lanceolate, and again possessing the same fingered arrangement at the end of a small caudex, but in this case sessile. Again, in *S. polyphylla*, Feist.,‖ if this really be a *Sagenopteris*, an additional leaflet is present, making seven, and in this instance petiolate. The mid-rib is visible in the lower part of each, but is rapidly dissolved into the secondary veins, which branch at a tolerably acute angle and anastomose to form a network of elongated meshes, described by Schimper¶ as hexagonal-rhomboidal. In reality the mesh is polymorphous, and even variable on the same frond. Both Schimper** and Schenk†† agree in describing the leaflets as coriaceous. The centre leaflets are usually longer than those at the side, and more or less obovate, whilst the latter are elliptical and unequal-sided.‡‡ In his five pinnule frond Fontaine says that the right and left outermost leaflets are the smaller, which practically agrees with Schenk's observations. Or, the whole may be elliptical or even lanceolate. Feistmantel §§ believed that the

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* Feistmantel, Mem. Geol. Survey N.S. Wales, Pal. Series, No. 3, 1890, t. 29, f. 6.

† Mon. U.S. Geol. Survey (Powell's), 1889, xv.

‡ Foss. Flora, i. p. 63, t. 63.

§ Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 113, t. 40a, f. 1.

‖ *Ibid.* p. 113, t. 41a, f. 3 and 4.

¶ Traité Pal. Vég. 1869, i. p. 640.

** *Ibid.* p. 640.

†† Zittel's Paléontologie (Fr. trans.), Pt. ii.—Paléophytologie, Pt. 1, 1891, p. 150.

‡‡ Schenk, Foss. Flora Grenzsch. Keupers-Lias Frankens, 1867, p. 59.

§§ Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 114.

somewhat oblique shape of the outer segments in certain of his Indian forms indicated that they belonged to a fingered leaf. There is no doubt that the arrangement of these segments is characteristic of the plant, and the fact is well defined by Morris,* who remarks that the four or five pinnules arise in a flabellate form from a common rachis.

The fructification was unknown to Schenk at the time of his earlier writings, but later† he describes the fruit as spherical or oval, and smooth or hirsute. Nathorst‡ also discovered what he believed to be the fruit of *Sagenopteris undulata*, in the Swedish Mesozoic beds, as small spherical bodies plentifully scattered throughout the shale.

Lindley and Hutton,§ in figuring both the lanceolate and oval leaves of their *S. Phillipsii*, suggested that the longer leaves of their Fig. 2 might be the fruit-bearing, and the oval fronds the barren.

Touching the relation of *Sagenopteris* to *Glossopteris*, Bunbury‖ long ago, agreeing with Zigno, doubted the wisdom of their separation. He remarks—"Notwithstanding the difference in the composition of the frond between the typical species of *Glossopteris* and *Sagenopteris*, I yet agree with De Zigno in doubting whether the two genera are sufficiently distinct. In specimens of *Sagenopteris Phillipsii* from Scarborough, I find the venation so similar to that of the Australian *Glossopteris*, that it would be very difficult to found a generic difference upon this character. . . . The fructification of *Sagenopteris* is still entirely unknown; and it is possible that, when discovered, it may prove the two genera to be quite distinct." Schenk¶ retained

* Strzelecki's Phys. Descrip. N. S. Wales, &c., 1845, p. 247.

† Zittel's Paléontologie (Fr. transl.), Pt. ii.—Paléophytologie, Pt. 1, 1891, p. 151.

‡ Floran vid Bjuf, 1878, i. p. 26, t. 5, f. 1.

§ Foss. Flora, i. t. 63, f. 1 and 2.

‖ Quart. Journ. Geol. Soc. 1861, xvii. p. 328.

¶ Beiträge zur Flora der Vorwelt. *Palaeontographica*, xvi. Heft 6, p. 222.

them distinct, although with evident reluctance, chiefly on account of the simple non-pinnate leaf in *Glossopteris*.

The margins of the leaflets are not always entire in *Sagenopteris*, Nathorst having described a species, *S. dentata*,* in which they are largely dentate. Notwithstanding that this is uncommon in *Sagenopteris*, so far as our experience has gone, nothing of the sort occurs in *Glossopteris*, and probably between us we have examined many thousand specimens.

That the mid-rib in *Glossopteris* does evanesce before reaching the apex of some leaves is equally true, such for instance is the case in *G. longicaulis*, Feist.,† but in general it is at about the last fourth towards the apex and often less that the mid-rid commences to dissolve into the secondary veins. On the other hand, in all the short and broad-leaved forms of *Sagenopteris* the mid-rib disappears low down, and even in a limited number of cases it is difficult to detect more than the rudiment of a mid-rib. The latter is the case in Nathorst's *S. undulata*,‡ Fontaine's *S. rhoifolia*,§ and Schenk's *S. Mantelli*,‖ from the Wealden Coal-measures of Osnabrück. But in some long-leaved species of *Sagenopteris*, *e.g.*, *S. Phillipsii*, Phill., from the Yorkshire Oolite, figured by Lindley and Hutton,¶ the mid-ribs resemble those in *Glossopteris* leaves, and are strong and persistent almost to the apices. Also in *S. polyphylla*, Feist.,** there is a strong mid-rib, whilst in another plant referred provisionally to *Sagenopteris* by Feistmantel under the name of *S. (?) longifolia*,†† this vein extends almost to the apex. In fact *Glossopteris longicaulis*, Feist., and *Sagenopteris (?) longifolia*, Feist., may be regarded as transitional forms between

* Floran vid Bjuf, 1878, i. t. 2, f. 5-7.

† Pal. Indica (Gondwana Flora), 1881, iii. Pt. 1, Suppl. p. 53, t. 31, f. 1, 3.

‡ *Loc. cit.* t. 2, f. 4.

§ Mon. U.S. Geol. Survey (Powell's), 1883, vi. t. 49, f. 5.

‖ Beiträge zur Flora der Vorwelt, Pt. 4, p. 20, t. 10, f. 5.

¶ Foss. Flora, i. p. 63, t. 63.

** Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 113, t. 41a, f. 3 and 4.

†† *Loc. cit.* t. 40*a*, f. 1.

the two genera. As a rule the leaflets of *Sagenopteris* are much smaller than those of *Glossopteris*, but in *S. göppertiana*, Zigno,* they are large and very *Glossopteris*-like.

From the foregoing remarks it is manifest how difficult it is to distinguish between the fronds of the two genera, if the venation is alone relied on, except in extreme forms of either.

Amongst the species at present included by authors in *Sagenopteris* there are three distinct types in the form and method of attachment of the leaves :—

a. Leaves elliptical or obpyriform, sessile, or hardly petiolate, *e.g.: Sagenopteris rhoifolia*, Presl., (the generic type) ; *S. goeppertiana*, Zigno ; *S. undulata*, Nath.

b. Leaves lanceolate, petiolate, *e.g.* : *Sagenopteris Phillipsii*, L. and H.

c. Leaves lanceolate, sessile, *e.g.*: *S. (?) longifolia*, Feist.

With regard to the first section, when the leaves are found attached to the stalk, as is very frequently the case, the whole facies of the plant, *plus* its venation, is so manifestly different from our present fossil that we do not think there need be any doubt of the distinctness of the two.

As to the second section, the matter is not so clear. There the form and arrangement of the leaves, together with the more or less persistent mid-rib, are so markedly that of our Mudgee plant (Pl. XVIII. fig. 1) that one is led to doubt the wisdom of separating the latter from it, were it not for the petiolate nature of this section. On the other hand, the sessile condition of the leaves in the Mudgee fossil distinctly allies it to the third, or section *c.* After all, as in so many other instances, generic separation will probably have to depend on the fructification when that shall become more thoroughly known. For this, however, we must await further discoveries.

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* Flora Foss. Form. Oolithicæ, i. p. 188, t. 22, f. 1 and 2.

A few words may now be said about the stems of our Mudgee fossil and *Sagenopteris*. That of the former has already been described, but so far as we have been able to ascertain the caudex properly speaking of *Sagenopteris* is unknown, the leaves or fronds being attached at the end of a long leaf stalk, and as described by Count von Solms-Laubach,* "spring from the same point." Such is certainly the case in *S. polypyhlla*, Feist., *S. rhoifolia*, Presl., *S. elongata*, Braun, &c. On the other hand, the caudex or leaf stalk in *S. (?) longifolia*, Feist., certainly has a roughened appearance, which may have been caused by leaf scars, or it may only be due to fossilisation. Feistmantel has figured† a "fern-rhizome" from the Karharbari Coal-field, ascribed to a *Neuropteris*, covered with rhomboidal scars, possessing a generally indistinct spiral arrangement, and not unlike those of our *Glossopteris*, but without fronds attached.

The general resemblance of our Mudgee *Glossopteris* to Feistmantel's *Sagenopteris (?) longifolia*,‡ in every detail, except the form of the venation and number of leaves, is remarkable, with a clump of six sessile lanceolate leaves at the end of a small leaf stalk.

7. Relation of *Glossopteris* to *Anthrophyopsis*.

The latter of these names was applied by Nathorst§ to certain portions of simple leaves, either lanceolate, or wide and round, with anastomosing veins forming a longitudinally rhombic-hexagonal mesh. The above Author remarks that it differs from *Glossopteris* in the absence of a mid-rib, but possibly Feistmantel‖ is more correct in suggesting a closer alliance to typical species of *Gangamopteris*. In the absence of the central portion of the frond it is difficult to discuss the systematic position of *Anthro-*

* Fossil Botany (Engl. Transl. by Garnsey and Balfour), 1891, p. 138.
† Pal. Indica (Gondwana Flora), 1879, iii. Pt. 1, p. 18, t. 13, f. 6.
‡ Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 113, t. 40a, f. 1.
§ Floran vid Bjuf, 1878, i. p. 43.
‖ Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 115.

phyopsis, but the best of Nathorst's figures* conveys the impression of a leaf in which the veins did not pass from a mid-rib, supposing it possessed one, after the manner of *Glossopteris* or *Gangamopteris*, but rather as in *Macrotæniopteris*, practically horizontal and at right angles. One very characteristic feature about these Swedish leaves is that the rhombic-hexagonal venation of the mesh is confined to one side of the leaves, probably the outside or marginal portion. On that part of the leaf contiguous to the mid-rib, if it existed, the veins are simple and parallel to one another.

In his Fig. 4† Nathorst represents a series of very regular punctæ, in a single line, within the boundaries of each rhombic-hexagon of the mesh. Supposing these to represent fructification, we know nothing like it in *Glossopteris*. Fontaine, however, figures the supposed fructification of his *Sagenopteris elliptica*,‡ as small elevations or dots, in the substance of the mesh between the anastomosing veins.

8. Relation of *Glossopteris* to *Dactylopteris*.

Ottokar Feistmantel, the describer of *Dactylopteris*, assigns to it a digitate frond of six or more sessile or petiolate leaflets on a common stalk. The leaflets are lanceolate, with a mid-rib in the basal portions dividing upwards into anastomosing secondary veins forming a polygonal or oblong mesh.§

It is difficult to understand how, on this definition, *Dactylopteris* differs from *Sagenopteris*, unless it be by the number of leaflets on the frond, and the more defined condition of the mid-rib. Even Feistmantel does not appear too positive, for he simply remarks that *Sagenopteris* "has somewhat different characters."

The genus was provisionally proposed for the two species already mentioned as *Sagenopteris longifolia* and *S. (?) polyphylla*. In

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* *Loc. cit.* t. 7, f. 3.

† *Loc. cit.* t. 7, f. 4.

‡ Mon. U.S. Geol. Survey (Powell's), 1889, xv. p. 149, t. 27, f. 15, 15a.

§ Pal. Indica (Gondwana Flora), 1881, iii. Pt. 3, p. 113.

the former the leaves are sessile, in the latter elongately petiolate; in the one case forming a clump, like our Mudgee fossil, in the other an open-leaved pinna. The name may perhaps be retained for *S. (?) polyphylla* with advantage, but hardly for *S. (?) longifolia*: the latter in this sense corresponds to the third section into which we have divided *Sagenopteris*.

9. General Conclusions.

After due consideration of the facts passed in review, we are led to the following general conclusions.

1. For simplicity' sake, and in common with Schimper, Feistmantel, and others, it is more convenient to restrict the name *Glossopteris* to fronds after the type of *G. browniana* var. *indica*, Brong.

2. In common with the Indian plant described by McClelland, the Australian form from Mudgee possessed leaves growing in a clump at the end of a caudex, and did not form a digitate pinna.

3. The Australian Glossopterids possessed both sessile and petiolate leaves, the latter condition being in the majority.

4. It is impossible to define the number of sessile leaves in a clump, owing to their deciduous nature; and as regards the petiolate condition we do not yet know sufficient about it to dogmatise.

5. Of the three states of fructification known in leaves so far referred to *Glossopteris*, we possess two in Australia.

6. The Mudgee fossil is allied to two Australian forms of *Glossopteris*, viz., *G. linearis*, McCoy, and *G. Clarkei*, Feist.; to the one by general habit, and to the other by the character of its venation.

7. The Mudgee fossil in its long lanceolate and sessile leaves, continuous mid-rib, &c., bears a strong resemblance to the 3rd section of *Sagenopteris*, typified by *S. (?) longifolia*, Feist.

8. As pointed out by Zeiller, no trace of sporangia has yet been met with in *Glossopteris*, so far as we have been able to ascertain.

9. Eliminating the habit of growth, of which we know nothing definite in *Gangamopteris*, it is questionable how far the leaves of the two genera *Glossopteris* and *Gangamopteris* can be separated, except in extreme cases.

10. It is evident that those leaves of *Sagenopteris*, possessing a moderately developed mid-rib, such as *S. elongata*, Br., are with difficulty separated from those of transitional species of *Glossopteris*, but once such leaves referred to *Sagenopteris* are seen attached to their leaf-stalk, or it is permitted to observe the fructification, the separation is possible.

11. We have no leaves in Australian rocks exactly analogous to *Anthrophyopsis*, Nath.

12. In all probability it will be necessary to separate Feistmantel's *S. (?) polyphylla* from *Sagenopteris*, and restrict *Dactylopteris* for its reception. It presents the additional peculiarity of possessing the secondary veins all of one order.

10. STRATIGRAPHICAL DISTRIBUTION OF *GLOSSOPTERIS* IN AUSTRALIA.

Glossopteris is known to occur in Queensland, N. S. Wales, and Tasmania. It has also been recorded from New Zealand, but hitherto its occurrence in that country cannot be considered to be an established fact. As regards the occurrence of *Glossopteris* there, Sir James Hector says*—"At the base of the Kaihiku Series are the *Glossopteris* beds of Mt. Potts." To these Kaihiku beds he assigns a Permian age, but the range of the genus *Glossopteris* is stated to extend into the higher Wairoa Series of Triassic age. On this Sir James remarks†—"In some districts the Wairoa Series is divided into two horizons, yielding marine fossils, separated by sandstones containing fossil plants

* Indian and Col. Exhib. N. Zealand Court, Geol. Cat. and Guide, 1886, p. 77.

† *Ibid*. p. 74.

from which forms of *Glossopteris*, *Zamites*, and *Rhacophyllum* have been obtained." There is no reference, however, to the occurrence of *Glossopteris* in the fossil flora of New Zealand in Baron von Ettingshausen's masterly paper—" Contributions to the knowledge of the Fossil Flora of New Zealand."*

Writing to one of us on Feb. 26th of this year Captain Hutton states—" I still think that *Glossopteris* has not been found in New Zealand. We have no Palæozoic flora." The earliest statement as to the occurrence of a plant, alleged to be *Glossopteris*, in New Zealand is contained in Reports of Geological Explorations, New Zealand, 1868-1869, p. iii.

In Tasmania *Glossopteris* occurs in marine strata of Permo-Carboniferous age south of Hobart at Adventure Bay, South Bruni, where in company with *Gangamopteris* it is associated with a seam of coal, two feet in thickness.†

In the Mersey Coal-field, near Latrobe, *Glossopteris* is met with in abundance in the shaly-beds of the thin productive Coal-measures, which are there capped by marine strata of Permo-Carboniferous age. It is associated with *Gangamopteris* and with leaves of *Nöggerathiopsis.*

At the above localities the age of *Glossopteris* in Tasmania is undoubtedly Palæozoic. According to the following statements, however, *Glossopteris* possibly ascends into Mesozoic strata in that island. In 1874 the late R. B. Smyth published a note‡ to the effect that he had discovered at Spring Hill, near Hobart, a leaf of *Glossopteris browniana* associated on the same piece of shale with the characteristic Mesozoic fern, *Alethopteris australis*, " from the south-eastern part of Tasmania," and thus from the Upper or Mesozoic Coal-measures. This plant has never been figured to the best of our knowledge, and the strange association remained unconfirmed until Mr. R. M. Johnston described another fern

‡ Trans. N. Zealand Inst. 1891, xxiii. p. 42.

§ R. M. Johnston. Geology of Tasmania, p. 143 (Govt. Printer, Hobart, 1888).

* Second Geol. Survey Vict., Progress Report i. 1874, p. 24.

from a similar horizon at Lord's Hill, New Town, Tasmania, under the name of *Glossopteris (?) moribunda.** Mr. Johnston states† with regard to this fossil—" I have discovered two fragments of a small species associated with the common Mesozoic forms at the shaly beds at Lord's Hill, New Town. It is not certain that they may yet prove to be a form of Sagenopteris, as their bases were both imperfect. The largest fragment is 42 millimetres long, 13 millimetres at its broadest part near the top, and 9 millimetres at the base of fragment, to which it gradually tapers; mid-rib distinct, from which branch off at an acute angle about 12 principal nerves in the length of fragment. These nerves, after acutely ascending from the mid rib, curve and branch outward dichotomously and flexuously, forking two or three times before reaching margin, anastomosing at each fork. The meshes, however, are more open than in the larger forms of *G. browniana* from the lower coal-measures, and the nerves appear to be more raised and wrinkled. The frond itself appears to be more coriaceous and fleshy.

" As indicated by the measurements, the frond is somewhat linear-spathulate in form. In the smaller specimens the spathulate appearance is far less pronounced. They are unlike any description given of *Sagenopteris rhoifolia* or *S. Tasmanica*, and apart from the circumstance that their bases and mode of insertion are unknown, they seem to me to be more akin to the genus Glossopteris to which they have been provisionally referred. It would appear, therefore, that these rare forms are the dwarfed or degraded descendants of that genus which gave such a peculiar character to the shales of the lower coal-measures by its wonderful profusion, and are an indication of the fast approaching extinction of the genus in Australian rocks." Mr. Johnston states‡ that Mr. Wintle informed him that he discovered some years previous to 1886, near the same spot (Lord's Hill, New Town, Hobart), " a

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* Proc. R. Soc. Tas. for 1886 [1887], pp. 161 and 169-170.

† *Loc. cit.* pp. 169-170.

‡ *Loc. cit.* p. 162.

form which he considered to be identical with *Glossopteris browniana*."

If Messrs. Smyth and Wintle's statements are correct, and if Mr. Johnston's plant be a true *Glossopteris*, it must be admitted that the genus ranges into the Australasian Mesozoic beds, but it is more than probable that *G. (?) moribunda* is only a lanceolate *Sagenopteris* after the type of Feistmantel's *S. (?) longifolia*. We can only reiterate Mr. Johnston's wish to see the supposed *G. browniana* critically examined and figured.

In Victoria *Glossopteris* has never yet been discovered, as far as is known to us. Strata perhaps homotaxial with some of the *Glossopteris*-bearing beds of Tasmania, New South Wales and Queensland are known to occur at Bacchus Marsh and Wild-duck Creek. At the former locality *Gangamopteris* is represented by four species.*†

In New South Wales *Glossopteris* occurs in profusion in the productive Coal-measures of Permo-Carboniferous age, and, as far as at present known, it is wholly restricted in this Colony to that horizon. The fact, however, should be mentioned that Sir F. McCoy has recorded *Glossopteris* from the rocks of Arowa, in New South Wales, the age of which is Carboniferous, and therefore considerably older than that of the typical Permo-Carboniferous rocks.‡

He states that *G. linearis* is "not uncommon" at the above locality. This alleged occurrence, however, has not yet been confirmed, and no instance is known to us in New South Wales of *Glossopteris* being associated with either *Lepidodendron* or *Rhacopteris*, though these last two are abundant in the local Carboniferous Flora.

The Permo-Carboniferous System of New South Wales in the type district comprises in descending order the following divisions:—

* Sir F. McCoy, Prod. Pal. Vic. Dec. ii. 1875, pp. 11-13, Pl. 12 and 13.
† Selwyn, Phys. Geog. Geol. and Min. Vict. 1866, p. 16.
‡ Ann. Mag. Nat. Hist. 1847, xx. p. 152.

Newcastle Coal-measures	Upper Marine Series
Dempsey Beds	Greta Coal-measures
Tomago Coal-measures	Lower Marine Series

The total thickness of this system is between 10,000 and 11,000 feet.

Glossopteris ranges from near the top of the Lower Marine Series to the top of the Newcastle Coal-measures.

The oldest fossil plant at all related to *Glossopteris* at present known to us is represented by somewhat imperfectly preserved leaves in a fine grained sandstone, in the Lower Marine Series, near Lochinvar.

This horizon is probably over 2000 feet below the top of the Lower Marine Series and the base of the Greta Coal-measures. The leaves, which have not yet been figured or described, appear to resemble *Gangamopteris* rather than *Glossopteris*. The lowest horizons from which undoubted *Glossopteris* has been obtained in New South Wales are (1) near Farley (Stony Creek), West Maitland, a few hundred feet below the base of the Greta Coal-measures ; and (2) at Nicholson's Quarry on the Hunter River, about three miles above Belmore Bridge, West Maitland.

In the Greta Coal-measures *Glossopteris* is very abundant and is associated with almost equally abundant *Gangamopteris*, *Nöggerathiopsis*, and *Vertebraria*. It occurs most plentifully in the clay shales forming the floors and roofs of the productive coal-seams. At Richmond Vale, near East Maitland, as already described by one of us,* *Glossopteris* leaves have been found with so much of their original organic structure preserved as to be quite flexible. Many of the leaves were rolled up by the mechanical action of water, but after they had been treated for a few hours in glycerine it was found possible to unroll them to their full original length.

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* T. W. E. David. Proc. Linn. Soc. N.S. Wales, 1890, v. (2), Pt. 3, pp. 424-426.

Glossopteris occurs sparingly in the Upper Marine Series, fragments of wood referred to *Araucarioxylon* being the only other kind of plant known to be contemporaneously interbedded in the same series.

In the Tomago Series *Glossopteris* is still largely associated with *Gangamopteris*, but in the Dempsey and Newcastle Coal-measures, while *Glossopteris* is very abundant, *Gangamopteris* appears to be somewhat rarer.

At Joadja Creek and at Hartley Vale, *Glossopteris* leaves occur contemporaneously interbedded in kerosene shale, on the horizon of the Newcastle Coal-measures. Kerosene shale has been determined by Professors Bertrand and Renault in their interesting and able memoir just published* to be chiefly formed of the alga *Reinschia australis.*

At Joadja Creek *Glossopteris* is frequently found in company with *Vertebraria*, the former being horizontal in position, the latter almost invariably vertical. *Glossopteris* leaves have been observed to form portion of the coal in the Bulli Coal-seam in the Illawarra District on the horizon of the Newcastle Coal-measures.

The horizon from which the specimen which forms the subject of this paper was obtained, is probably that of the Newcastle Coal-measures, the locality being in the Western Coal-field. The fossil was found by Mr. C. J. Horsley, J.P., on the Wollar Road, then (1890) in course of construction, on the southern fall of "The Gap," about seventeen miles from Mudgee. The finder generously gave it to Mr. N. J. C. MacTaggart, B.E., of the Water Conservation Branch, Public Works Department, who presented it to the Geological Museum, University of Sydney. A note on its occurrence has already been contributed by one of us.† *Glossopteris* has never been found in New South Wales in

* Reinschia Australis et premières Remarques sur le Kerosene Shale de la Nouvelles-Galles du Sud, par MM. C.-Eg. Bertrand & B. Renault. Autun. Imprimerie Dejussieu, Père et Fils. 1894.

† T. W. E. David. Proc. Linn. Soc. N.S. Wales, 1893, viii. (2), Pt. 2, p. 218.

association with any Mesozoic plants such as *Tæniopteris* or *Thinnfeldia*. If, therefore, we reject the doubtful case of the *Glossopteris* from Arowa, presumably of Carboniferous age, mentioned by Sir F. McCoy, *Glossopteris* is exclusively Permo-Carboniferous in its range in New South Wales.

In Queensland *Glossopteris* occurs in the Middle and Upper Bowen Series, in both of which it is associated with a Marine Permo-Carboniferous fauna. It is of Palæozoic age at the Bowen River Coal-field ; at the Dawson River Coal-field ; at Peak Downs, Townsville ; Oakey Creek, near Cooktown ; and the Little River Coal-fields, Palmer River. Until lately it was considered to be wholly of Palæzoic age in Queensland as in New South Wales. As far back, however, as 1872, the late Mr. Norman Taylor (formerly of the Geological Survey of Victoria), identified *Glossopteris* leaves from a hill south of the Mitchell River, in the Cape Gold-field, Queensland, in a formation subsequently considered to be Upper Cretaceous, but which he at the time considered to be Permo-Carboniferous. In 1890, Mr. Rands discovered *Glossopteris in situ* at Betts' Creek, Cape Gold-field, in rocks considered by him to belong to the Desert Sandstone, and therefore to be of Upper Cretaceous age.*†

In July, 1891, Mr. R. L. Jack, F.G.S., the Government Geologist of Queensland, confirmed Mr. Rands' opinion as to the horizon where his specimens were obtained being in Upper Cretaceous rocks.‡ With the exception of the reference just given relating to the Cretaceous age of *Glossopteris* in Queensland, as far as the Authors are aware the only other statement as to *Glossopteris* being of Post-Jurassic age is contained in a quotation by the late Dr. Ottokar Feistmantel § from Trautschold, who described ‖ a leaf like that of *Glossopteris*, with a

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* Report on the Cape Gold-field, p. 10. Brisbane. By Authority, 1891.

† Jack and Etheridge, Junr. Geology and Palæontology of Queensland, p. 518. ‡ Geology, &c., of Queensland, p. 519.

§ Mem. Geol. Survey N. S. Wales, Pal. Series, No. 3, 1890, pp. 119-120.

‖ Nouv. Mém. Soc. Imp. Nat. Moscou, xiii. p. 221.

faint anastomosis of the veins in the lower portion, from the Russian Klinische Sandstone of Cretaceous age. This leaf Trautschold terms *Glossopteris solitaria*; and again, a leaf figured by Visiani and Massolongo, from the Tertiary beds of Novale, in Italy, which Feistmantel says, if correctly figured, cannot be a *Glossopteris*. The above Authors name this plant *G. apocynophyllum*. On the other hand, Schenk states that no form of *Glossopteris* is found in Europe.*

Glossopteris has not yet been recorded from South Australia, including the Northern Territory. In South Australia no rocks of Permo-Carboniferous age have as yet been identified. In Western Australia, however, Permo-Carboniferous rocks have been proved to exist at the Irwin River, from which locality several marine fossils have been enumerated by one of us.†

Quite recently Mr. B. H. Woodward, Curator of the Geological Museum at Perth, has forwarded a named collection of fossils from the Gascoyne River to the Geological Survey of New South Wales. Amongst these are two pieces of dark shale displaying perfectly distinct leaves of *G. browniana*. We believe that this is the first recorded instance of the occurrence of *Glossopteris* in that Colony.‡

Our present knowledge of the geographical distribution and geological range of *Glossopteris* in Australasia may be briefly summarised as follows :—It is extremely doubtful whether *Glossopteris* ever existed in New Zealand. In Eastern Australia during the Permo-Carboniferous Period *Glossopteris* having a form resembling that of a dwarf tree fern flourished abundantly in the great swamps of the coast and portion of the inland areas of

* Zittel's Paléontologie (Fr. trans.), Pt. II., Paléophytologie, Pt. 1, 1891, p. 130.

† R. Etheridge, Junr., Ann. Rept. Dept. Mines, N. S. Wales, for 1889 [1890], p. 239.

‡ We find, however, that in the "Western Australian Year Book" for 1892-93, p. 241 (8vo. Perth, 1893), it is stated that Mr. R. Etheridge, F.R.S., detected "portions of *Glossopteris* or *Næggerathia* in coal, submitted to him from the Collie River Coal-field, W.A."

Eastern Australia, ranging from near Cooktown, in Queensland, to South Bruni, in Tasmania, a range in latitude of over 1900 miles. To this may be added the isolated occurrence on the Gascoyne River in West Australia.

No evidence has as yet been obtained to show that *Glossopteris* ever flourished in South Australia or in the Northern Territory.

As regards its geological range, one doubtful locality has been cited by Sir F. McCoy, that of Arowa, in New South Wales, where its age may possibly be Carboniferous rather than Permo-Carboniferous; but on the other hand no well established case has come under our notice in which *Glossopteris* has been found in Australia in association with either *Lepipodendron* or with *Rhacopteris*. *Glossopteris* is the predominant type of plant and is enormously abundant in the Permo-Carboniferous Coal-measures of Queensland, New South Wales, and Tasmania. Three doubtful cases have been recorded from Tasmania of *Glossopteris* having been found in association with Lower Mesozoic plants, but it is possible that the plants are referable to some form of *Sagenopteris* rather than to *Glossopteris*.

In Queensland undoubted specimens of *Glossopteris* have been found on a geological horizon, which in the opinion of Mr. R. L. Jack, the Government Geologist, and Mr. W. H. Rands, the Assistant Government Geologist, belongs to that of the Desert Sandstone, and is therefore Upper Cretaceous. The locality, however, has not yet been mapped in detail, and the question of the exact geological horizon whence these specimens were obtained cannot therefore as yet be considered to have been definitely settled.

DESCRIPTION OF PLATES.

Plate XVIII.

Fig. 1.—The specimen from near Mudgee, showing the attachment of the leaves to the caudex. Nat. size.

Fig. 2.—Portion of the matrix-cast of the caudex, taken from the hollow impression in Fig. 1, showing the ovo-rhomboidal leaf-scars.

Fig. 3.—The upper and decorticated surface of the matrix-cast, with small projecting rods, that are perhaps the casts of the vascular bundles.

Fig. 4.—Another portion similar to Fig. 3, with concentric undulations, probably super-induced.

Plate xix.

Fig. 1.—The upper portion of the caudex, and lower parts of the fronds, seen in Pl. i. fig. 1. Enlarged.

Fig. 2.—Portion of a frond, showing mid-rib, proximal parallel secondary veins, and distal reticulation or mesh. Enlarged.

DESCRIPTION OF A NEW MITE BELONGING TO THE GENUS *HETEROPUS*, FOUND IN WASPS' NESTS.

By Walter W. Froggatt.

When examining the contents of the nests of *Alastor eriurgus*, Sauss., obtained in the neighbourhood of Sydney, I have on several occasions, while breaking up the clay cells, found numbers containing dead pupæ, which, upon close examination, were found to be covered with small globular yellow excrescences, varying from the size of a pin's point to the size of small shot. Upon first noticing these I took them to be grease or some fatty exudation from the insect, but upon placing them under the lens I was astonished to see that these globular bodies had legs and heads attached to them, which were constantly moving from side to side; the globular portion in fact being the distended abdomen of the gravid female of some minute carnivorous mite. Besides the mites attached to dead pupæ, there were numbers scattered all over the walls of the cell from which they were taken, and among them I noticed several of very different form, which I took to be males, though they might possibly be unimpregnated females. Two species of these Acari are known from the nests of bees. Mr. G. Newport (Trans. Linn. Soc. Vol. xxi. tab. 10, p. 95, 1850) described a species he had discovered in the nests of *Anthophora retusa* feeding upon the larvæ; he placed it in the family *Sarcoptides*, forming for its reception the genus *Heteropus*, giving it the specific name of *H. ventricosus*. Newport also says that in the genus *Trichodactylus*, Dufour, the mites are found in the nests of the mason bees *(Osmia)*.

In the Bulletin Soc. Ent. France, 1868, Lichtenstein described a somewhat similar mite under the name of *Physogaster larvarum*.

HETEROPUS ALASTORIS, n.sp.

♀. Head rounded, coming to an obtuse point at the tip; thorax broadest and swelling out in the centre, constricted at the junction with the abdomen, marked with parallel wavy lines running into the abdomen; legs of about equal length, hairy; the whole insect pale yellow, $\frac{3}{4}$ of a line in length; abdomen globular and semi-transparent, the lower half milky white, eight times the length of the head and thorax combined.

♂. Very much more elongate, with the head rounded in front; abdomen narrow, of uniform width from the shoulders towards the apex, which is rounded.

Hab.—Granville, Sydney; in the nest of *Alastor eriurgus*, Sauss.

DESCRIPTION OF A NEW AUSTRALIAN SNAKE.

By J. Douglas Ogilby.

(Communicated by Edgar R. Waite, F.L.S.)

Hoplocephalus waitii, sp.nov.

Head broad and depressed, distinct from trunk ; pupil round. Rostral very little broader than deep, visible from above ; frontal longer than broad, equal to or a little longer than its distance from the end of the snout, but little shorter than the parietals ; one pre- and two postoculars ; temporals 2 + 2, the posterior pair small ; upper labials 6, the third and fourth entering the eye ; two pairs of chin-shields, the anterior the larger, in contact with three, rarely two, labials, the posterior pair wholly separated by two elongate scales. Scales in 21 series, the outer rows scarcely enlarged ; ventrals sharply keeled laterally, 210-223 ; anal plate entire ; subcaudals in a single series, 47-57.

Colours.—Head above bluish-gray; prefrontals with a yellowish tinge, and with a black spot covering their posterior half ; a small black spot above the eye; a large spot at the inner anterior angle of the parietals followed by a smaller one; a broad white band behind the head, continued forwards to the eye; an elongate black spot behind the parietals, and two spots on either side of them ; a black streak from the eye to the nostril ; upper and lower labials obliquely banded with black and white ; a black nuchal band extending forwards to the angle of the mouth; lower surface of head white, with scattered white spots : entire upper surface of body uniform dark brown; lower surface grayish-brown, becoming darker posteriorly, that of the tail similar to the back.

Some months ago I received from Tamworth a specimen of a snake, which I put aside without examination, referring it to *H. pallidiceps*, Günth.; being now engaged in drawing up diagnoses of the members of this genus, I made an examination of this specimen with the result that I discovered that my example had twenty-one series of scales round the body, not fifteen as in the true *pallidiceps;* I had in the meanwhile discovered in the Museum collection a much mutilated specimen of the same snake from the Dubbo district, which, wherever it was possible to examine it, agreed absolutely with the Tamworth example; this suggested to me the advisability of examining Krefft's specimen, which I did in the presence of Mr. Edgar R. Waite, with the result that we found that both it and another specimen labelled *pallidiceps* in the Museum collection belonged to this new species. Krefft's description of *H. pallidiceps* (Snakes of Australia, p. 59), being merely a copy of Günther's original diagnosis (Catalogue of Colubrine Snakes, p. 214), is correct for that species, but it must be borne in mind that the head figured by him *(op. cit.* pl. XI. fig. 1) belongs rightly to *H. waitii*, not to *H. pallidiceps.*

Krefft's specimen has no locality attached, and the habitat of the species, therefore, so far as at present known, is restricted to the central district of New South Wales, where it takes the place of the North Queensland *pallidiceps.*

The measurements of the largest of the four examples are :—
Total length 475 mm.; tail 62 mm.

Type in the Australian Museum; register number, 6590.

THE MORPHOLOGY OF THE MUSCLES OF THE SHOULDER-GIRDLE IN MONOTREMES.

By W. J. Stewart McKay, M.B., M.Ch., B.Sc.

(Plates xx.-xxiii.)

The observations contained in this paper were made in the Anatomical Laboratory of the Medical School of the Sydney University. The subject was suggested to me by my friend and former teacher Professor J. T. Wilson, who not only allowed me to work in his private laboratory, but also supplied me with abundant material. I take this opportunity of thanking him, not only for the material, but for his advice throughout the work; and if this paper has any merit it is entirely owing to his guidance and teaching. I do not, however, wish it to be understood that the opinions herein expressed are necessarily those that Professor Wilson holds.

I have to thank Professor Haswell for a fresh specimen of *Ornithorhynchus*, which he was good enough to present to me. I am also indebted to Mr. J. J. Fletcher for the loan of Coues' paper on *Ornithorhynchus*.

With regard to the literature on the myology of the Monotremes, I have been able to consult all the chief papers with the exception of one by Fewkes (5).

Of the various writers who have contributed to our knowledge of the subject, Meckel (13) was the first to publish, in 1826, a complete description of the muscles of *Ornithorhynchus*. His work, written in Latin, will ever remain as a book of reference.

Cuvier added to our knowledge by his dissections, as also did Owen (15). In the work by Cuvier and Laurillard, published in 1849, are to be found many excellent illustrations of the muscles of *Ornithorhynchus* (4). Coues (3), working in America, wrote in 1871 a monograph on the myology of this animal, and his views are interesting, since, with the exception of Owen's short account in Todd's Cyclopædia, he had seen no previous works on the muscles of this animal, and indeed had Coues not been influenced by Owen, it is probable that he would in several cases have assigned to the muscles a more correct homology than he did.

Westling (20) in 1884 published a paper on the nerves to the fore and hind limbs of this animal, and this seems to have been the first paper which dealt in detail with the nerve supply to the limb muscles.

With regard to *Echidna*, no important paper on the myology of this animal had appeared before 1866, when Mivart (14) wrote his contribution.

In 1855 Fewkes published his paper; but, as I have mentioned above, I have not been able to see it.

The most important work on the *Echidna*, however, is that published in 1889 by Charlotte Westling (21), and, as far as I am aware, this is the only paper on the myology of this animal in which the nerve supply of the muscles is fully investigated.

Leche (12) has followed Westling, for her work appears to have been executed under his supervision.

Besides these papers there are many isolated observations scattered throughout numerous works, and in some instances I have quoted these remarks in full. The most important of them are by Fürbringer (7), Humphry (11), Testut (18), Alix (18), Smith (17), and Windle (23).

With regard to the scapula and humerus, it is not my intention to give a detailed account of these bones; but as the surfaces and borders of the scapula have received many different interpretations, I will quote here the conclusions arrived at by Professor Wilson and myself, and published in a previous paper (22):—"If the views we have expressed are correct, then there can be little difficulty in homologising the two forms of monotreme scapula. In both forms the actual anterior border is meso-scapular. In both the prescapular part of the bone is suppressed, though in Platypus its site is still indicated by a ridge on the inner surface. In both scapulæ the actual posterior border is really secondary, being an exaggerated subscapular ridge, the subscapularis muscle taking origin both from the ridge itself and the bone on both sides of it. Finally, and in consequence of the last character, the postscapular border is displaced outwards and exists as a mere tricipital ridge upon the outer surface of the flat bladebone."

Again, with regard to the humerus, the view that I have taken with regard to its surfaces and borders will best be understood by reference to Figs. 18 and 19 with the accompanying description.

Lastly, I have found that many different formulæ have been given for the vertebræ and ribs of *Echidna*. I have collected a number of these, which I give in the subjoined table.

Authority.	Cervical.	Dorsal.	Lumbar.	Sacral.	Caudal.	Total.
BRUEHL (2).....	7	16	3	4	11	41
FLOWER AND GADOW (6)...	7	16	3	4	11	41
	7	16	4	3	10	40
GIEBEL (9)......	7	16	3	(4 ?)	11	41 (?)
	7	17	3	(4 ?)	11	42 (?)
	7	15	4	4	12	42
HOWES (10).....	7	15	3	4	11	40
	7	16	3	3	12	41
	7	16	2	4	11	40
	7	16	4	4	?	?
THOMAS (19)...	7	16	3	3	12	41
	7	17	4	3	12	43
McKAY.........	7	15	4	4	9 (+?)	39 (+?)
	7	15	3	3	14	42
	7	15	?	?	?	?
	7	14	4	3	11	39
	7	16	3	3	12	41
	Right side 7	17	2	4	12	42
	Left side 7	16	3	4	12	42

M. PANNICULUS CARNOSUS.

Echidna.

On the integument covering the ventral aspect of the abdomen being reflected, the panniculus comes into view. There is no difficulty in the dissection for about 4 to 5 cm. on either side of the median line, since the ventral aspect is devoid of spines ; but, as we approach the lateral region, the integument is reflected with difficulty, since the bases of the spines pierce through it and end in the panniculus which sends bundles of fibres to each spine.

Starting from the postero-vertebral region, the muscular sheet runs forward and outwards, winding round the lateral aspect of the body, while more anteriorly it extends over the scapula and cervical regions and on to the forearm.

Following the muscle round the lateral aspect of the body, we then find it running as a continuous sheet over the abdominal muscles, the fibres taking an antero-posterior direction, with an inclination towards the mid-ventral line.

Arriving at about the region of the metasternum this single layer now becomes cleft into a superficial and a deep stratum.

The superficial Stratum of the Panniculus.—For convenience of description this may be subdivided into three parts (which can be actually shown to exist by a careful dissection): an internal, a median, and an external division.

The *internal* is represented by a small bundle of fibres, which springs from the internal border of the general sheet of panniculus, and which runs forward and inwards to meet a similar bundle from the opposite side in the mid-line, and together are attached to an aponeurosis in the region of the posterior part of the mesosternum.

The *middle division* (Fig. 1, *Pn. S. M.*) is much better developed, and is a broad band of muscle (connected with a similar band on the opposite side of the mid-line by a well-marked aponeurosis) which runs forward and inwards until it arrives in the region of the presternum. Here it encounters a large gland (Fig. 1, *Gl.*) placed superficial to the sterno-mastoid. The muscular band runs over the gland and, receiving an accession of fibres (which come from the direction of the opposite epicoracoid region), the whole turns suddenly outwards and runs forward over the clavicle, here to be joined by the prolongation of the external division next to be described.

The inner border of the *external division* (Fig. 1, *Pn. S.E.*) of the superficial stratum is not sharply defined, but fades away into an aponeurosis (containing scattered muscular bundles), which connects it with the median division, and beneath which the deep stratum of the panniculus lies (*i.e.*, the M. dermo-flexor brachii).

As the external division runs forward it encounters the arm and forearm, and the fibres now take different directions; the innermost pursue their course forward to the clavicle, there to join the fibres of the median division, and spread out over the lateral aspect of the cervical region, and coalesce with the dorsal portion of the panniculus; the outermost fibres turn out over the olecranon, and joining the general dorso-lateral sheet run along the dorso-external border of the forearm, and are inserted on the external aspect of the distal extremity of the ulna, close to its carpal articulation, forming a *dermo-flexor antebrachii.*

Deep stratum of the Panniculus (Fig. 1, *Pn. D.* 1).—This lies between the middle and external divisions just described. Running forward for a short distance in the same plane as these divisions it sinks deeper, and passing superficial to the P. quartus it becomes narrow; and having pierced the thick fascia, as it approaches its insertion, it undergoes cleavage in a plane parallel to its surface. This occurs from within outwards, but the cleavage does not extend quite to the outer border, and consequently the two layers remain connected at the external border. The upper (Fig. 1 et 2, *Pn. D.* 1) of the two layers thus formed runs forward over the tendon of the P. quartus, and disappears under the postero-internal border of the clavicular deltoid, to be inserted on the posterior edge of the proximal third of the pectoro-deltoid ridge. The deeper layer (Fig. 2 et 3, *Pn. D.* 11) sinks beneath the P. major and P. quartus, and is inserted by a narrow tendon on the proximal end of the antero-internal border of the pectoro-deltoid ridge. These two parts together constitute a *dermo-flexor brachii.*

Special regions and muscles.—Between the clavicular and mandibular regions the fibres have no longer an antero-posterior course, but their direction being now at right angles to the long axis of the body they encircle the neck and head, forming a superficial sheet which stretches ventral to the inter-mandibular muscles, and up over the sides of the head, being perforated for the ear and eye, and being attached to the parietal and frontal bones by aponeurosis.

M. dermo-dorsi cervicalis (Fig. 11, *D. D. C.*).—This band of muscle is displayed when the superficial layer of the panniculus and a thick layer of fascia (which lies immediately beneath the panniculus) are reflected from the postero-dorsal region. The muscle arises by tendons from the 9th, 10th, 11th ribs, the inner margin of the slip from the 11th rib being about 2·5 cm. distant from the mid-dorsal line, while the slips from the 10th and 9th ribs are further removed. These thin bands are very intimately connected with the tendons of the posterior trapezius arising from these ribs. The bands run forward and outwards, and coalescing, form a thin muscular sheet which becomes much wider as it approaches the scapula. The muscle continues its course, lying on the postero-external border of the trapezius, and passing superficially to the insertion of this muscle on the scapula, it becomes now superficial to the anterior part of the trapezius, and having reached the lateral aspect of the head and neck, the inner border of the muscle fuses with an aponeurosis which connects it with its fellow across the mid-dorsal line, while the remainder of the fibres are lost over the mastoid and squamosal regions of the skull; being placed superficial to the next division of the panniculus now to be described.

The dermo-brachio-cephalic bands arise by dorsal and ventral origins. The dorsal band arises by a flat tendon from the parietal bone just anterior to the origin of the trapezius. Running outwards and backwards a muscular band develops, and this courses over the side of the head and neck, to be presently joined by the ventral division which arises from the malar, squamosal and posterior mandibular regions. The conjoined muscles are prolonged on to the dorsal aspect of the forearm, and there inserted on the distal third of the external border of the ulna; being thus related to the dermo-flexor antebrachii, which is placed superficial and distal to it.

ORNITHORHYNCHUS.

The panniculus has a similar arrangement, on the whole, in this animal to the muscle in *Echidna*; a few points call for notice.

The muscle is well developed, but is not by any means so thick as in the *Echidna*, and though closely connected with the integument, there is little difficulty in dissecting it off.

As we follow the ventral sheet forward the fibres have an inclination towards the mid-line; but there is no marked differentiation into divisions as described in *Echidna*. A dermo-flexor antebrachii is present attached to the distal extremity of the ulna. When the superficial layer is raised, in the region of the axilla, it is found that a deeper layer is differentiated off, and that as it approaches the humerus this layer pierces the deep fascia, and cleavage occurs in a plane parallel to its surface, a superficial, middle and deep layers being the result. (Fig. 5, *Pn. S.*, *Pn. D.* i., *Pn. D.* ii.) The superficial layer (of the deep stratum), lying above the tendon of the P. major, is inserted on the middle third of the outer border of the pectooo-deltoid ridge; and also, as Smith (17) has pointed out, on to the outer part of the tendinous intersection of the P. major (see *post*). The middle (Fig. 6, *Pn. D.* iii.) division, hidden by the superficial, runs inwards and is inserted on to the tendon of the P. major; being intimately connected with the terminal fibres of the P. quartus. The deep division (Fig. 6, *Pn. D.* ii.) runs inwards, and approaching the outer border of the P. major forms an inverted Λ with that muscle, a tendinous intersection intervening between the muscular fibres of the two; it then has insertion on the distal part of the pectoro-deltoid ridge.

Special Regions and Muscles.

The Hyo-dermal slip.—As the superficial layer of the panniculus runs over the ventral aspect of the cervical region, there is developed a well marked band of muscle on either side from its deep (dorsal) surface. These bands run forward and inwards, and piercing the fascia of this region, are inserted in the basi-hyoid close to the median line.

M. dermo-dorsi cervicalis (Fig. 12, *D. D. C.*).—This muscle arises from the 11th, 12th, and 13th ribs; the inner margin of the slip from the 11th rib being placed about 1·5 cm. from the mid-line, while the more posterior slips are placed further out (the opposite condition holding in *Echidna*). These slips run forward and outwards, and coalescing, form a flat band of muscle which lies on the postero-external margin of the trapezius. Running forward the band becomes narrow, and passing over the insertions of both divisions of the trapezius on the scapula, the inner fibres of the muscle now become connected with an aponeurosis which stretches over the mid-dorsal line to the fellow muscle on the opposite side; while the terminal fibres are lost in the orbital regions.

The dermo-brachio-cephalic bands arise in two parts as in *Echidna*. The dorsal band has origin from the well marked depression on the parietal bone, immediately anterior to the origin of the trapezius. The ventral part arises from the superior maxilla and processus alveolaris, and ventrally by an aponeurosis which stretches over the inter-mandibular muscles. The ventral divisions run backwards over the buccal pouch, and after being joined by a slip attached to the hyoid bone, coalesce with the dorsal portion forming a figure like the letter Y; the auricle being placed in the fork of the Y. The united muscles are now continued as a long thin band to be inserted on the distal third of the external border of the ulna; being placed as in *Echidna* beneath the dermo-flexor antebrachii.

Innervation. Lateral cutaneous nerve of the thorax (Fig. 13, 54, *Echidna;* fig. 16, 54, *Ornithorhynchus*). Also branches from the i.-iv. cervical nerves (figs. 13 et 16, 10); and from the external branches of the posterior divisions of the spinal nerves.

Westling—*Echidna*: "Der Panniculus carnosus und seine tiefern Portionen werden theils von Cervicalnerven, theils von Plexus brachialis-Nerven und theils von den dorsalen Zweigen der Thoracalnerven innervirt."

Echidna.

Westling gives but a slight sketch of the panniculus.

Mivart gives a short account, saying—"It consists mainly of a large superficial muscular layer with certain deeper portions, and is firmly attached to the neck and tail and distal portions of the ulna," and under the head of P. major he further notes that the insertion of that muscle "is superficial to the insertion of a deeper layer of the panniculus, while an outer layer of that muscle is superficial to it."

Leche follows Fewkes, and gives a description of the various divisions of the panniculus, as follows:—

1. *M. dermo-dorsi cervicalis* arises from the 8th-10th rib and vertebra, as well as from the aponeurosis of the M. trapezius posterior, and terminates by fusing with the cervical portion of the panniculus.

2. *M. dermo-flexor antebrachii* (Pars posterior M. latissimi dorsi, Mivart) arises from the 8th-13th rib, and is inserted along the forearm, where it becomes connected with the M. flexor carpi ulnaris.

3. *M. dermo-brachialis anterior* arises from the panniculus, dorsal to the origin of the preceding; and is inserted in the tuberculum majus humeri, proximal to the insertion of the M. pectoralis major.

4. *M. dermo-brachialis posterior* arises more from the lateral aspect than the preceding, and, splitting into four or five divisions

(Westling), is inserted in the tuberculum majus humeri by a common tendon.

Both the last-named muscles are flexors of the anterior extremity.

5-7. *MM. dermo-extensores brachiales, internus inferior et superior* arise from the panniculus in the cervical region, and run to be connected with the ulna, carpus, and panniculus, which covers these parts.

8. *M. dermo-cervicis triangularis* arises in the dorsal middle line over the fore part of the anterior dorsum of the trapezius, and is inserted into the ulna.

Ornithorhynchus.

Coues gives a full acount of the panniculus, portion of which we extract :—

"*Panniculus: its special Slips and Attachments.*—An hyodermal muscle is thus formed : over the episternal bar, a curved fan or horn-shaped set of fasciculi are developed from the inner surface of the panniculus ; these curve inward as they pass forward, narrowing to a definite fleshy insertion into the body of the os hyoides, on either side of its median line, in mutual apposition. A brachio-dermal is formed over the latissimus and side of the thorax generally, by a heavy reinforcement to the inner surface of the muscle of a broad fan-shaped plane growing thicker and narrower as it passes forward to definite insertion (fleshy, or by a very short tendon on the pectoral crest of the humerus, alongside the insertion of the P. major. . . . The costo-dermal fasciculus arises from the 12th-13th ribs, respectively 1′ and 1½′ from the backbone, and forms a long slender flat ribbon, that runs straight up the side of the body along the anterior border of the lower trapezius, underneath the main plane of the panniculus, lying upon the latissimus to the shoulder; passing just behind the elbow ; widening over the shoulder, becoming then blended with the panniculus along the side of the neck, then separating again, and finally inserted into the back part of the cheek-pouch."

Owen gives a short account of the panniculus, and says—"The legs and the arms protrude through oblique apertures in this muscular tunic; some of the anterior fasciculi are inserted by a short tendon into the pectoral ridge of the humerus; others, still more anterior, are attached to the cranium, the lower jaw and lower lip. A strip of fibres is attached to the os hyoides; another fasciculus spreads over the cheek pouch, and assists in emptying that receptacle of the food."

Smith gives a short account of the panniculus in *Ornithorhynchus*, but the account contains nothing of importance.

Meckel says, towards the latter part of his description—"In thorace supremo, e regione fissuræ brachialis modo dictæ, duobus fasciculis, quorum praecipue inferior, et decursu et adhæsione presse superiorem sequens, fortissimus est, tendinibus brevibus, musculo pectorali magno junctis affigitur ossis humeri cristae anterioris dimidio inferiori. Magis antrorsum atque introrsum, in ipso extremo thoracis anteriore e claviculæ regione, similiter in plana duo, alterum externum, communis musculi continuationem, alterum internum profundum finditur."

"Hoc fasciculum sistit pyramidalem, pollices duos longum, inferiore extremo quatuor, superiore duas lineas latum in regione ossis hyoidis cum musculi omo- et sternohyoidei strato superficiale junctum. Ex hoc conjunctionis loco fasciculus hic, denuo dilatatus extrorsum et antrorsum tendit, maxillam inferiorem transgreditur, et in magnum tendinum tenuissimorum numerum finditur, labii inferioris duobus trientibus posterioribus insertorum. Hisce tendinibus labium hoc valide detrahitur. Fasciculus hic inferior Santoriniano conferendus videtur."

"Stratum externum sensim, ut jam diximus, maxime attenuatum; subito fibris transversis compositum collum et cranium laxe, pressius tamen parte reliqua circumdat, foraminibus ad aures oculosque ducentibus perforatum."

Cuvier and Laurillard give, in Plates 265-6-7, various figures of the panniculus with names attached to the differentiated portions. The part inserted in conjunction with the pectoralis major is called dermo-humérien: the dermo-dorsi cervicalis is called dorso-occipitien; other parts are called portion dorsal, lateral, ventrale; on Plate 267 a dissection is shown of the slips going to the hyoid, and is called "thoraco-facien," while a note says r + + "Faisceau qui se détache de la partie postérieure de la poche, et qui se parte transversalement à l'os hyoide."

MM. PECTORALIS MAJOR ET QUARTUS.

ECHIDNA: *P. major*, Mivart; *P. major, anterior and posterior portions*, Westling, Leche.

ORNITHORHYNCHUS: *P. major includes clavicular portion of deltoid*, Meckel, Owen, Coues, Leche, Westling, Cuvier, and Laurillard; *P. major et P. quartus*, S. Smith.

PECTORALIS MAJOR.

ECHIDNA.

Origin. This muscle arises from the posterior two-thirds of the ventral surface and border of the interclavicle; from the presternum, and mid-line of the mesosternum; and the anterior half of the ventro-lateral aspect of the metasternum; also from that portion of the sternal extremity of the second to the seventh rib (inclusive), that lies internal to the rectus.

Insertion. The anterior fibres of the muscle run directly outwards, the more posterior fibres run forwards and outwards, the muscle being inserted by a well marked tendon on the ventral portion of the external aspect of the greater tuberosity; having the epicoraco-humeral internal to it, while the cleft tendons of the pectoralis quartus and panniculus bound it anteriorly, distally, and posteriorly (Fig. 3, *Pt. M.*).

Relations. The anterior border of the muscle is separated from the clavicular deltoid by a slight interval in which there are some branches of blood vessels, and a small cutaneous branch of the N. supracoracoideus. More externally the clavicular deltoid hides from view the anterior edge of the pectoral. Along the mid-ventral line its origin is hidden, in great part by the sternomastoid, whilst it is separated from its fellow of the opposite side by a slight interval. The P. quartus lies superficial to and hides from view its postero-external border, while the pectoralis itself covers part of the epicoraco-humeral, biceps, coraco-brachialis and rectus.

P. QUARTUS. (Fig. 3, *Pt. Q.*).

ECHIDNA.

O r i g i n. This muscle arises from the posterior one-third of the ventral aspect of the metasternum, and from the anterior half of that portion of the aponeurosis of the external oblique that lies between the pubes and metasternum. Anteriorly the fibres of origin are close to the median line; more posteriorly they diverge slightly from the linea alba, and spread out into a fan-shaped sheet.

I n s e r t i o n. The muscle runs forward and outwards as a thin layer, gradually becoming narrower (but thicker), and as it approaches its insertion it becomes cleft in a similar fashion to the deep stratum of the panniculus. The upper layer (Fig. 3, *Pt. Q.*) is inserted superficial (ventral) to the P. major on the external aspect of the ventral portion of the greater tuberosity; the deeper layer (Fig. 3, *Pt. Q.*), continuous at its outer border with the other, is inserted on the greater tuberosity beneath the P. major.

R e l a t i o n s. At its origin this muscle hides from view the anterior fibres of the large pyramidalis which is inserted on the metasternum. As it runs forward and outwards it hides portion of the rectus, and the postero-external border of the P. major; and is hidden at its insertion by the superficial layer of the deep part of the panniculus.

PECTORALIS MAJOR.

ORNITHORHYNCHUS.

O r i g i n. This muscle is triangular in outline and arises from the ventral aspect of the transverse bar of the interclavicle at its junction with the median portion of that bone; from one-half of the ventral surface of the median portion of the interclavicle, presternum and mesosternum, and from that part of the ventral surface of the 2nd-6th rib (inclusive), which lies internal to the rectus; and also from 1·5 cm. of the anterior portion of the linea alba and the adjacent aponeurosis of the external oblique.

Insertion. The whole muscle is divided into anterior and posterior divisions by a tendinous intersection (Fig. 5, *Ti.*) which reaches from the presternum to a point situated a short distance from the proximal extremity of the pectoro-deltoid ridge. The anterior fibres of the anterior division run outwards, and somewhat posterior, to be attached directly to the ventral portion of the external border of the great tuberosity. The more posterior fibres of the anterior division, however, run to be inserted along the tendinous intersection, as do the anterior fibres of the posterior division, while the most posterior fibres run forwards and outwards, some to be attached by tendon to the proximal two-fifths of the pectoro-deltoid ridge, others to coalesce with the deep layer of the panniculus, as above described.

Relations. The muscle is separated from its fellow by a well-marked median line throughout. The antero-external border of the anterior division of the muscle is closely related to the clavicular deltoid (Fig. 5, *Dlt. C.*), but no difficulty is experienced in differentiating the one from the other in well preserved specimens; the dividing line being a cellular interval quite apparent when the superficial and deep fasciæ of the region are removed. The border of the clavicular deltoid does not, however, distinctly overlap the pectoral as in *Echidna.* The few fibres which arise from the transverse part of the interclavicle are closely related to the inner fibres of origin of the episterno-cleido-mastoid. The postero-external border of the muscle is overlapped by the P. quartus. The muscle hides from view the same muscles as those mentioned under *Echidna.*

PECTORALIS QUARTUS. (Fig. 5, *Pt. Q.*).

ORNITHORHYNCHUS.

Origin. This muscle is triangular in outline, and arises from the anterior half of the linea alba (with the exception of the small area occupied by the P. major), and from the aponeurosis of the external oblique.

Insertion. The muscle runs forward and outwards, lying superficial to the postero-external border of the P. major. It dives beneath the upper layer of the deep panniculus, and is inserted on the superficial (ventral) surface of the tendon of the P. major, its fibres being intimately related to the median layer (Fig. 6, *Pt. Q.*) of the deep panniculus (see *ante*).

Relations. The muscle at its origin is close to its fellow of the opposite side. As it runs to its insertion it hides part of the rectus. It does not reach, nor was it inserted on, the tendinous intersection of the P. major as stated by Smith. It undergoes no cleavage.

It will be understood from the above descriptions that the disposition of the various layers of the pectorals and panniculus is as follows :—

In *Echidna* (*a*) superficial layer of panniculus ; (*b*) upper layer of deep panniculus ; (*c*) upper layer of P. quartus ; (*d*) P. major ; (*e*) deep layer of P. quartus ; (*f*) deep layer of deep panniculus.

In *Ornithorhynchus* (*a*) superficial layer of panniculus ; (*b*) upper layer of deep panniculus ; (*c*) P. quartus and median layer of deep panniculus ; (*d*) P. major, and deep layer of deep panniculus.

Innervation. P. major, Nn. cervicales, iv., v., vi., vii. P. quartus in *Echidna* from nerve to the P. major, and possibly from the lateral cutaneous of the thorax. The same for *Ornithorhynchus* (Figs. 13 et 16 ; 36, 37).

WESTLING—*Echidna* : Innervation : Nn. cervicales v. and vi. *Ornithorhynchus*, C. vii., C. viii., D. i et ii. (Fig. 17, Pt.'')
(For further remarks on innervation see *post.*)

WESTLING—*Echidna* : "M. pectoralis major entspringt in gerader Linie vom medialen Theile des Episternum, dem Sternum, dem Processus xiphoideus und der Aponeurose des M. obliquus abdominis externus ; der Muskel besteht aus zwei ziemlich getrennten Theilen, einem vordern, kurzen und breiten, und einem hintern, der lang und schmal ist. Der ganze Muskel inserirt am Tuberculum majus, dorsal von dem Zipfel des Panniculus carnosus, den Fewkes M. dermo-brachialis anterior genannt hat, und ventral vom M. dermo-brachialis posterior desselben Forschers. Eine claviculuare Portion fehlt, scheint aber von der medialen Portion des M. deltoideus ersetzt zu sein; vergleiche die Beschreibung des letztgenannten Muskels. Innervation: Nn. Cervicales v. und vi."

LECHE follows Westling and remarks that a clavicular portion is absent, but appears to be replaced by the median portion of the deltoid.

MIVART describes the P. major as arising from the sternum, median portion of the interclavicle, "and also somewhat from the aponeurosis of the external oblique, but not at all from the clavicle, or from the lateral branches of the interclavicle."

MIVART mentions the fact that the insertion is between the layers of the panniculus. He makes no mention of P. quartus as distinct from the P. major.

OWEN says of the P. major in *Ornithorhynchus*, "the pectoralis is of very striking dimensions, the origin of the superficial portion extends from the acromion, along the sternum and linea alba almost to the pubes; a deeper-seated portion arises from the osseous sternal ribs; the fibres of both portions converge to be inserted on to the largely developed pectoral or anterior crest of the proximal half of the humerus."

SMITH gives a description of the P. major: "Prolonged inwards from the pectoral ridge of the humerus is a tendinous band passing transversely towards the mid-sternum. To the upper (anterior) border of this band and ridge the clavicular and anterior sternal fibres of the P. major radiate to be inserted, while to its lower (posterior) border are attached at its inner end the posterior sternal fibres of the pectoralis, then the P. quartus, and external to this the dermo-flexor brachialis. The P. quartus is a thin muscle arising from the fascia of the abdominal muscles, having its inner border touching the posterior edge of the P.

major, while its outer margin is contiguous with the anterior border of the dermo-flexor brachialis."

Coues says, "The pectoral major is of remarkable extent. Its origin is in a line from the acromion and whole episternal bar, and thence down the manubrium and sternum and linea alba to within a couple of inches of the pubes. Along the chest it has thick fleshy origin from the ends of the ribs as well as from the breast bone. The abdominal portion is extremely thin—thinner than the same part of the panniculus; the muscle thickens rather abruptly as it passes over the lower edge of the thorax, and there, near the median line, a slight cellular interval may occur between thoracic and abdominal portions. The chest portion is of nearly uniform and great thickness; there is no evident distinction of a deep-seated from a superficial part; but the outer half of the episternal portion and the acromial portion are together separable from the sternal portion by a slight cellular interval along a line representing the posterior border of the muscle below described as anterior part of the deltoid [epicoraco-humeral]." In a note on this last sentence, Coues says, "These portions together are in the ordinary position, and have much the appearance of a deltoid; in fact they resemble one much more than the muscle below described as anterior-deltoid [epicoraco-humeral], does."

Meckel says—"Ex artus anterioris musculis P. major, revera maximus, præcipue longissimus est, triangularis, a clavicula acromiali et primi ossis sternalis ramo transverso fere ad symphysin ossium pubis extensus, fere totam thoracis abdominisque longitudinem explet. Margine interno cum opposito confluit, præterea dimidio anteriore, minore a costarum sternalium anteriorum sex fine interno ortus, angulo superiore et externo toti ossis brachii spinæ anticæ inseritur tendine lato et brevi, hic simul cum musculo cutaneo unitus.

Cuvier and Laurillard figure the pectoralis on Plate 267 as, I, grand pectoral portio sternale (sterno-humérien), which includes our clavicular deltoid; and I'idem portio costale et même ventrale, the latter being the P. quartus as described above. (For remarks on the pectoral muscles *vide* M. deltoideus.)

M. DELTOIDEUS.

ECHIDNA: *Clavicular and scapular portions*, Mivart, Westling, Leche.

ORNITHORHYNCHUS: *Clavicular portion, regarded as part of P. major*, Meckel, Owen, Coues, Leche, Westling, Cuvier and Laurillard; *Scapular portion*, all authors.

M. DELTOIDEUS.

ECHIDNA.

Origin. (*a*) *Acromio-clavicular portion.* This portion of the deltoid arises from the ventro-anterior face of the clavicle; from the greater part of the ventral face of the lateral arm of the inter-clavicle, and from the external border of the acromion. (Fig. 3, *Dlt. C.*).

Insertion. The muscle is quadrilateral in outline and runs outwards and posterior. Narrowing as it approaches its insertion it becomes cleft, in a plane parallel to the surface, into superficial and deep portions which embrace the tendon of insertion of the scapular portion of the muscle. The superficial layer of the muscle is inserted by tendon on the postero-external border of the distal two-thirds of the pectoro-deltoid ridge; while the deeper layer continuous (internally) with the superficial, has an insertion (for the most part fleshy) on the posterior face of the humerus close to and parallel with the distal part of the pectoro-deltoid ridge. In the centre of this horse-shoe-shaped insertion is placed the tendon of the scapular deltoid.

Relations. At its origin the inner portion of the muscle is hidden from view by the sterno-mastoid. The outer third of the origin is placed ventral to the insertion of the trapezius on the clavicle; while the origin from the acromion lies between the insertion of the trapezius on the one hand, and the origin of the infraspinatus on the other. The postero-internal border of the muscle is superficial to the P. major and deep part of the panniculus; the muscle also hides in great part the epicoraco-humeral, supraspinatus, and the insertion of the infraspinatus. At its insertion the muscle is related to the origin of the supinator longus and brachialis internus, and the thin tendon of origin of the external head of the humeral part of the triceps. (Fig. 4, *Dlt. C.*)

Origin. (*b*) *Scapular portion.* (Fig. 10, *Dlt. S.*).—This muscle arises from the external edge of the anterior third of the vertebral border of the scapula, and from the upper third of the external edge of the spine of the scapula.

Insertion. The muscle, long and slender, runs downwards, outwards and posterior, to be inserted, by a narrow well developed tendon, on the posterior surface of the humerus in a depression close to the distal one-third of the pectoro-deltoid ridge; the tendon being surrounded, as mentioned above, by the horse-shoe-shaped insertion of the clavicular part.

Relations. The muscle is partly hidden at its origin by the insertion of the posterior portion of the trapezius; while it overlies the subscapularis (very slightly) and the infraspinatus.

M. DELTOIDEUS.

ORNITHORHYNCHUS.

Origin. (*a*) *Acromio-clavicular portion.*—The muscle arises from the ventral surface of the transverse portion of the interclavicle throughout its length (excepting the small area adjoining the median portion from which the P. major derives a few fibres of origin); and from the ventro-external surface of the acromion. (Fig. 5, *Dlt. C.*).

Insertion. The muscle, in outline a parallelogram, runs outwards and posterior. On approaching its insertion it is cleft from without inwards into a superficial and deep layer. The superficial and larger division is inserted fleshy on the distal three-fourths of the pectoro-deltoid ridge; the deep division is inserted parallel with, and just internal to, the proximal half of the upper division, on the posterior face of the humerus; a tubercle on which the scapular deltoid is inserted intervening between the two divisions. (*Dlt. C.* x. Fig. 8.)

Relations. The fleshy fibres of origin are intimately related, internally, to the episterno-cleido-mastoid, while externally the origin is placed ventral to the insertion of the anterior part of the trapezius on the clavicle and acromion. As noted above, the antero-internal border is separated from the P. major by a cellular interval.

Origin. (*b*) *Scapular portion.*—This muscle arises from the anterior two-fifths of the external edge of the vertebral border, and slightly from the adjoining external surface of the scapula; and from the upper one-third of the outer border of the spine. (Fig. 12, *Dlt. S.*).

Insertion. The muscle, arising fleshy, runs downward and outwards. As it approaches its insertion it suddenly develops a narrow tendon, and disappearing beneath the outer border of the clavicular deltoid, is embraced between the layers of that muscle, and then becomes inserted on a tubercle situated about the mid-point of the pectoro-deltoid ridge. (Fig. 8, *Dlt. S.*).

Relations. At its origin a few fibres are placed superficial to the tendon of insertion of the posterior trapezius, but the fibres which arise from the vertebral border of the scapula are hidden by the trapezius. The origin from the spine is closely related to the insertion of the anterior trapezius. The muscle hides from view the infraspinatus and part of the origin of the long head of the triceps.

Innervation. Clavicular portion: N. axillaris and possibly a minute twig from the N. supracoracoideus. Scapular portion: N. axillaris. (Both animals).

Westling—*Echidna*: "N. axillaris; ausserdem giebt der Ramus cutaneus n. supracoracoidei einen sehr feinen Faden zum M. deltoideus I. ab." In *Ornithorhynchus* Westling refers to her figure (Fig. 17, *rs.*), and states that among the branches given off from this chord is—"einen (N. suprascapularis?) für den M. infraspinatus, den obern Theil des M. pectoralis major (*i.e.*, clavicular deltoid) und den M. supraspinatus gemeinsamen Nerven, und einen (N. axillaris) für die hintere Portion der M. deltoideus."

ECHIDNA.

WESTLING: "M. deltoideus ist in zwei nur bei der Insertion ein wenig vereinte Theile getheilt; der eine entspringt vom Acromion und dem ganzen mit der Clavicula verwachsenen lateralen Theil des Episternum; der mediale Theil dieser Portion wird vom M. sterno-mastoideus bedeckt und liegt kopfwärts vom M. pectoralis; inserirt an einer vom Tuberculum majus ausgehenden Crista."

Westling then goes on and gives a description of the scapular portion and says—"Insertion: ein lateraler Höcker auf der Crista deltoideua, mittelst einer langen Sehne, die zum Theil die erste Portion an ihrer Insertion durchbohrt." As regards the innervation, she says—"N. axillaris; ausserdem giebt der Ramus cutaneus n. supracoracoidei einen sehr feinen Faden zum M. deltoideus I ab."

LECHE follows Westling.

MIVART describes two parts, a clavicular and a scapular portion, and states that the latter is "inserted into a depression in the deltoid crest of the humerus, its tendon being implanted in the midst of the fibres of insertion of the first described [clavicular] portion of the muscle."

ORNITHORHYNCHUS.

OWEN says—"The deltoid is divided into an anterior and posterior portion. The anterior portion arises from the anterior extremity of the coracoid, and is inserted into the summit of the deltoid crest of the humerus. [This is really the epicoraco-humeral]. The posterior part arises from the anterior and superior apex of the scapula, and is inserted into the lower half of the deltoid crest."

LECHE says the clavicular portion of the deltoid is wanting, its place being taken by the clavicular portion of the P. major. He describes a scapular portion.

MECKEL describes the clavicular portion as being part of the P. major; he describes the true epicoraco-humeral as the "Pars deltoides anterior," and he describes the posterior portion of the deltoid, "sine dubio deltoides pars posterior."

Cuvier and Laurillard take the clavicular portion to be part of the P. major, and the posterior portion as "deltoide," or "sous-acromio-humérien" (Plate 266).

Coues describes the clavicular portion of the deltoid as part of the P. major (see *ante*), and describes as "anterior part of the deltoid," the true epicoraco-humeral; he describes a scapular portion.

Westling makes the following remarks on the pectoral and deltoid:—"The anterior portion of the deltoid presents a noteworthy similarity to the clavicular portion of the M. pectoralis of the *Ornithorhynchus*, which part as such is absent in the *Echidna*. Its origin, position and innervation point to an homology between these muscles (*i.e.*, between the anterior portion of the deltoid of the *Echidna* and the clavicular portion of the pectoralis of *Ornithorhynchus*). I must, however, leave the point undecided for further investigation whether, since the nerve supply to the P. major of *Ornithorhynchus* is furnished by a different nerve trunk, has the latter muscle originated through a blending of separate muscles, or, is the condition found in *Ornithorhynchus* the primary one, the deltoid having been differentiated from the pectoralis.

Remarks on the P. major, P. quartus, and Clavicular Deltoid.

Up to the present time, as far as we are aware, the clavicular portion of the deltoid in *Echidna* has been clearly differentiated from the pectoralis major since Mivart's paper appeared in 1866; although he did not base his conclusions on the nerve supply to the muscles. In *Ornithorhynchus*, on the other hand, the clavicular portion of the deltoid has always been taken as representing the clavicular portion of the P. major. The view that we have arrived at is as follows. That the muscle described by Mivart and others in *Echidna* as the clavicular portion of the deltoid, is the true clavicular deltoid, whilst the muscle described in *Ornithorhynchus* as the clavicular portion of the P. major is in reality the clavicular portion of the deltoid. We base our conclusions on the following points:—Origin, insertion, relations, and nerve supply; the developmental not being available.

The origins and insertions of the muscles in *Echidna* and *Ornithorhynchus* are practically identical. The relations vary slightly, inasmuch as the postero-internal border of the deltoid in *Echidna* is placed, in part, distinctly superficial (ventral) to the P. major (Fig. 3, *Dlt. C.*), while in *Ornithorhynchus* the two muscles are in the same plane, with a distinct cellular interval between their borders. Lastly, and most important of all, the nerve supply to the muscles in both animals is identical, and is derived from the representative of the circumflex nerve (N. axillaris), which nerve also supplies the scapular portion of the deltoid, about the homology of which there is no dispute.

As regards the muscle described by us above as pectoralis quartus, it appears that this name has not been used in connection with this muscle by any previous writer with the exception of Smith in his description of the pectoral muscles in *Ornithorhynchus*, which we have quoted above. Galton mentions *en passant* in a description of the pectoral muscles of *Dasypus* (8), that in *Ornithorhynchus* and *Echidna* "the posterior abdominal portion was naturally differentiated from the pectoral factor of the muscle," but does not call it P. quartus. Windle (23) does, however, appear to regard this muscle as P. quartus. In attempting to decide the point whether this muscle is P. quartus, or merely a posterior portion of the P. major, we can say that the origin, insertion, and relations are very similar to those described for P. quartus in other animals. But in examining the nerve supply we have found that both in *Echidna* and *Ornithorhynchus* the muscle is supplied by a branch which comes from the nerve to the P. major, *i.e.*, the external anterior thoracic. But according to Windle (23) the P. quartus should be supplied by the posterior pectoral nerve, *i.e.*, the lateral cutaneous nerve of the thorax (N. of Wrisberg, Patterson); or less commonly as pointed out by Bermingham (1) by the middle pectoral, *i.e.*, the internal anterior thoracic. It will be seen by referring to our figure of the brachial plexus of the *Echidna* (Fig. 13) that the nerve to the P. quartus, after leaving the nerve to the P. major, gets a communication from the second intercostal nerve, which in turn communicates with the lateral cutaneous nerve of the thorax. It is, therefore, quite possible that although the muscle is chiefly supplied by the external anterior thoracic, it may, however, get some supply from the lateral cutaneous nerve. And indeed this would seem to be the case, for we find, in looking through some MS. notes of Professor Wilson, the following passage—"I have found the P. quartus wholly supplied in *Ornithorhynchus* by the lateral cutaneous nerve of the thorax." Furthermore, Smith has found the P. quartus in *Ornithorhynchus* supplied by a nerve coming from two roots, one from the external anterior thoracic, the other from the lateral cutaneous nerve of the thorax.

Westling also found that there was a connection between the nerve to the P. major and the lateral cutaneous nerve. She says—"Vom C. vii. und viii. und von dem vom D. i. und ii. enstandenen Stamme geht ein sehr starker Nerv (*vide* Fig. 17) aus, der den untern Theil des M. pectoralis major versieht und sich ausserdem in Haut- oder Hautmuskelnerven vertheilt; wahrscheinlich ist es ein N. thoracicus anterior."

Westling also remarks, in giving an account of the brachial plexus in *Echidna*, "der Nerv zu letzterm Muskel [M. pectoralis] verbindet sich mit dem einen der Hautmuskelnerven (Fig. 15, 54) die aus den hintern Wurzeln des Plexus brachialis entstehen."

Taking the above facts into consideration, it appears to us that we are quite justified in regarding the muscle under discussion as a pectoralis quartus; and if a further explanation of the nerve supply were wanted, we think that the following points from Professor Wilson's notes would aid us in comprehending the true nature of the P. quartus. Professor Wilson says—"I think it most probable that various severally distinct muscular sectors in the posterior region of the Mammalian thoracic, or from the abdominal, wall, have received the common name of pectoralis quartus; and that a whole series of transition forms exists between a condition, (*a*) in which a true pectoralis quartus appears as simply a posterior sector of the general pectoral mass arising from the mesio-ventral line, and wholly or largely distinct from a humeral panniculus as in *Didelphys* and *Phalangista* ; and a condition (*b*) such as I find in *Notoryctes* in which the P. quartus is only represented by a thickened portion of the humeral panniculus overlapping, it may be, the latissimus dorsi. The intermediate conditions (*c*) exhibit variously differentiated abdomino-humeral pannicular, or laterally placed "pectoralis quartus," slips. And in this connection may be quoted Professor Cunningham's opinion in reference to axillary muscles generally, that "in the region of the axilla there is not the same sharp well-defined subdivision between the panniculus and the deeper stratum that exists elsewhere."

P. MINOR.

Although the pectoralis minor has been mentioned by some observers, such as Meckel, Owen, Cuvier and Laurillard, and Coues, it does not appear that there is any muscle present that really represents a true pectoralis minor. The muscles that have been put forward as representatives of the P. minor, are the costo-coracoid, the sterno-epicoracoid, and the epicoraco-humeral. We shall see, however, when considering these various muscles, that other and more probable homologies have been assigned to them. (*Vide* also remarks by Humphry under M. epicoracoideus.)

M. EPICORACO-HUMERALIS.

ECHIDNA : *M. supracoracoideus*, Fürbringer, Westling ; *Epicoraco-humeral*, Mivart, Leche.

ORNITHORHYNCHUS : *Anterior part of deltoid*, Meckel, Owen, Coues ; *Supracoracoideus*, Westling, Furbringer ; *Epicoraco-humeral*, Leche ; *Moyen petit pectoral*, Cuvier and Laurillard.

ECHIDNA.

Origin. The muscle is displayed (covered by a well-marked layer of fascia), when the anterior part of the P. major and the clavicular deltoid are reflected. It arises from the whole of the ventral face of the epicoracoid (with the exception of a small area situated postero-internally, and giving origin to the epicoracoid head of the biceps). (Fig. 4, *Ep. II.*).

Insertion. The muscle runs outwards and posterior, narrowing as it approaches its insertion on a groove on the ventral surface of the greater tuberosity, and on the outer half of the ridge which runs from the greater to the lesser tuberosity on the antero-internal face of the humerus (and bounds the concavity [bicipital groove] between the two tuberosities).

Relations. At its origin the muscle on the left side is partially hidden by the interclavicle, while on the right side in addition it is hidden by the left epicoracoid. On the ventral surface of the tuberosity the tendon of insertion is placed external to the insertion of the supraspinatus and internal to that of the P. major, being partially hidden by the P. major and clavicular-deltoid; while the rest of the insertion is fleshy and is intimately related to the coraco-brachialis brevis.

ORNITHORHYNCHUS. (Fig. 7, *Ep. H.*).

Origin. The muscle arises from the ventral surface of the epicoracoid, a small space excepted, as in the *Echidna*, for the biceps origin.

Insertion. The muscle arising by fleshy fibres runs posterior and outwards over the ventral aspect of the capsular ligament of the shoulder joint, and becoming narrower as it approaches its insertion by fleshy fibres on the posterior face of the humerus, just internal to the insertions of the P. major and clavicular-deltoid, and by tendon on the ventral surface of the greater tuberosity; the insertion being between that of the P. major externally and of the supraspinatus and infraspinatus internally.

Relations. The muscle at its origin is partially hidden from view by the median and transverse portions of the interclavicle. The muscle on the left side is also overlapped and hidden by the right epicoracoid (this being the opposite condition to that in *Echidna*). As it runs to its insertion it has the epicoracoid head of the biceps closely connected with its postero-internal border, while it hides the insertions of the supra- and infraspinatus.

Innervation. *N. supracoracoideus* (Fig. 13, *et* 16, 22 *A.*). Westling gives the same innervation.

ECHIDNA.

WESTLING describes this muscle under the name of M. supracoracoideus, following Fürbringer's nomenclature for the supposed homologous muscle in Saurians. Westling gives the origin from the ventral surface and lateral border of the epicoracoid, and the insertion: "Tuberculum majus, oberhalb der Insertion des M. pectoralis und medial von derselben, und lateraler Rand der Vertiefung zwischen beiden Tuberculi bis zur Insertion des M. coraco-brachialis brevis hinab. Innervation: N. supracoracoideus."

Westling then goes on to remark that the muscle is present in Saurians, and that its origin in these is, as in the Monotremes, from a well developed coracoid, and its insertion is likewise similar; and quotes Fürbringer's opinion that the homology between these muscles in the Monotremes and Saurians is undoubted.

LECHE follows Westling, and describes the muscle with the pectoral group; and also in another place under "Muskeln am Oberarme."

MIVART was the first to describe the muscle in *Echidna*, under the name of "epicoraco-humeral." After giving the origin and insertion, he says, "the muscle answers neither by its origin nor insertion to either the P. minor or to the subclavius. It is evidently the muscle described and figured by Meckel as the anterior portion of the deltoid, but in the *Echidna* we have, in addition to this muscle, another which appears to be wanting in the *Ornithorhynchus* (judging from Meckel's figures), and which is evidently the anterior part, if not the whole, of the deltoid. This muscle may be the serial homologue of the pectineus or of the obturator externus, more probably the former, on account of its insertion."

ORNITHORHYNCHUS.

OWEN describes this muscle under the name of "anterior part of the deltoid," saying that it arises "from the anterior extremity of the coracoid and is inserted on the deltoid crest."

LECHE gives the same description for the muscle as in *Echidna.*
COUES describes it under the name of "anterior portion of the deltoid," protesting, however, "that it is overlaid and covered by the pectoralis, and would hardly recall a deltoid by any physical feature."

MECKEL says—"Infra pectoralis partem anteriorem parvus ponitur musculus, quem pro deltoidis parte antica habuerim, ab ossis coracoidei quadrati extremo antico extrorsum, ad summam ossis brachii cristam anticam descendens."

CUVIER and LAURILLARD figure it on Plate 266 as "grand pectoral, portion profonde dite moyen ou petit pectoral."

Remarks. With regard to this muscle, we may dismiss at once the suggestion that it is the homologue of the subclavius.

HUMPHRY (11) describes in *Cryptobranchus* "a broad thin muscle arising from the outer surface of the sternal or epicoracoid edge of the coracoid superficial to the biceps. It crosses the muscular fibres of the biceps superficially and transversely, and converges to be inserted into the summit of the upper part of the radial tubercle of the humerus, just above the pectoral. It may be called the epicoraco-humeral." In a note on the above, he says, "it corresponds, I think, with that described under the name in the *Echidna* by Mivart." In another place Humphry says, "in animals above fishes the coraco-humerals, or, as they are more generally called, coraco-brachials, are commonly divided into segments which vary in number and size with the number and size of the coracoid processes; and they are sometimes absent when these processes are abortive, as in Mole, *Cyclothurus* and Seal. They arrange themselves in two divisions. First, those which lie superficially with regard to the biceps brachii muscle and which pass to the radial tubercle of the humerus immediately above the level of the P. major and also extend beneath that muscle. These constitute a superficial or preaxial division. . . . "The fibres of the epicoraco-humeral part of this superficial, preaxial, or suprabicipital division of the coraco-humerals lie immediately beneath the pectoralis major in its whole course. I have remarked that in Cryptobranch its superficial fibres are blended with the under-surface of the pectoral, and that in Crocodile the fibres that correspond with it form part of the origin of the pectoral. It thus, to some extent, occupies the place of the pectoralis minor; and if we suppose it continued upon the under surface of the pectoral, and in variable degrees segmented from that muscle, it would quite correspond with the ordinary Mammalian pectoralis minor, the proper insertion of which appears to be the radial ridge or tubercle of the humerus. It is, however, in man, and some animals, arrested wholly, or (Rat) partially, at the coracoid, and is often quite segmented from the pectoralis major. Thus, I conceive the pectoralis minor to be formed from factors of the pectoralis major, which, or some of which, represents the epicoraco-humeral of Urodelans, Reptiles, and Monotremes, and that it also in part represents, indeed is the nearest representative of, the levator humeri of Birds."

M. SUBCLAVIUS { M. COSTO-CORACOIDEUS. / M. STERNO-EPICORACOIDEUS. }

ECHIDNA: *M. costo-coracoideus*, *M. sterno-coracoideus*, WESTLING: *Subclavius*, Mivart.

ORNITHORHYNCHUS: *Subclavius* (?), *P. minor* (?), Meckel, Owen, Coues.

ECHIDNA.

Origin. (*a*) *M. costo-coracoideus.*—This muscle arises from the sternal three-quarters of the anterior border of the first rib. (Fig. 4, *A. Cc.*).

Insertion. The muscle is fan-shaped in outline, and runs forward, the fibres converging to a small tendon by which the muscle is inserted on the dorsal surface of the coracoid bone immediately adjoining the coraco-presternal arthrodia; while some of the inner fibres are attached to the postero-external part of the dorsal surface of the epicoracoid.

Relations. The dorsal aspect of the muscle is hidden in part by the sterno-coracoid, which lies internal to it; while it is placed dorsal to the origins of the coraco-brachialis longus et brevis; and its insertion lies between the sterno-epicoracoid internally and epicoraco-brachial externally.

Origin. (*b*) *M. sterno-epicoracoideus.*—This muscle springs from a small portion of the inner (sternal) end of the dorsal surface of the first rib; from the outer border of the dorsal surface of the presternum; and slightly from the posterior part of the dorsal surface of the interclavicle. (Fig. 4, *A. St. C.*).

Insertion. Running forward the muscle is inserted on the anterior half of the dorsal surface of the epicoracoid.

Relations. This muscle is closely related at its origin to the inner fibres of the costo-coracoid. At its insertion it lies dorsal and internal to part of the epicoraco-brachial.

Ornithorhynchus.

Origin. (*a*) *M. costo-coracoideus.*—This muscle arises from the inner (sternal) two-thirds of the anterior border of the first rib. (Figs. 7 *et* 5, *Cc.*).

Insertion. The origin is fleshy and the muscle fan-shaped, the fibres converging as the muscle runs forward to be inserted on the whole of the dorsal rim of the coracoid adjoining the coraco-presternal arthrodia. The inner fibres of the muscle can with little difficulty be separated from the main mass, and they are seen to be inserted on the inner portion of the rim above-mentioned, and also by a tendon on the postero-external portion of the epicoracoid. The direction of the fibres of this muscle is not the same as that of the external intercostals, whose fibres run forwards and outwards.

Relations. At its origin the muscle reaches externally to the origin of the serratus from the first rib. The muscle lies, as in *Echidna*, dorsal to the epicoraco-brachial, and its internal border is somewhat covered by the M. sterno-epicoracoideus.

Origin. (*b*) *M. sterno-epicoracoideus* springs from a small area on the dorsal surface of the first rib, close to its articulation with the presternum; from the prominent ridge on the dorsal surface of the presternum (this ridge forming the rim of the coraco-presternal arthrodia).

Insertion. Running forwards and slightly inwards the muscle is inserted on the postero-internal portion of the dorsal surface of the epicoracoid.

Relations. The muscle, as in *Echidna*, lies in a plane dorsal to the costo-coracoid, and hides from view the inner part of that muscle. At its insertion its external border is closely related to the origin of the epicoraco-brachialis and insertion of the costo-coracoid.

Innervation. *Echidna*; iv. et v. cervical nerves. *Ornithorhynchus*; iv. et v. et vi. cervical nerves.

Westling—*Echidna*: Nn. thoracici anteriores, from v. et vi. cervical nerves: *Ornithorhynchus*, N. subclavius, from v. et (vi.?) cervical nerves. (Fig. 17, *Scl.*).

Echidna.

Westling says:—"M. costo-coracoideus (Fürbringer) is fan-shaped and arises fleshy from almost the whole anterior border of the first rib; its fibres converge to a tuberosity on the hinder part of the dorsal face of the coracoid, on which it is inserted closely connected with the M. coraco-brachialis." Westling then remarks —"Nach Fürbringer kann man diesen Muskel sowohl mit dem gleich-benannten beim Krokodile als auch mit dem M. subclavius der höhern Säugethiere vergleichen."

Of the M. sterno-coracoideus (Fürbringer), Westling says, it arises from the dorsal face of the manubrium sterni and the sternal end of the first rib, and is inserted on to the dorsal face of the epicoracoid, "medial" from the origin of the epicoraco-brachial. Westling remarks—"Dieser Muskel steht wie der vorhergehende in näherer Beziehung zu dem M. subclavius der Marsupialien und Placentalien, und ist auch bei den meisten Sauriern gut entwickelt" (and refers to Fürbringer).

Leche follows Westling.

Mivart says—"I could find no muscle evidently representing a pectoralis minor; but there is a small and thin muscle which arises from the anterior border of the first rib for the greater part of its length, and which is inserted into the coracoid immediately behind (or rather above) the origin of the coraco-brachialis. I am inclined, however, to regard this muscle as the representative of the subclavius. Meckel is silent as to both, but Owen says that both a pectoralis minor and a subclavius are inserted into the coracoid in the *Ornithorhynchus*."

ORNITHORHYNCHUS.

OWEN—"The pectoralis minor is attached to the coracoid, and the subclavius is likewise inserted as in some other quadrupeds into this bone, which is no longer a subordinate process of the scapula in the Monotremes."

The above opinion is only a paraphrase of what we are now about to quote from Meckel, and Mivart is therefore in error in saying that Meckel is silent on these muscles.

MECKEL—"Scaleni, forsan et pectoralis minor, imo et subclavius, duobus, ni gravissime fallor, referuntur musculis, parvis, longitudinalibus, planis, superiore et inferiore, vicinissimis. [Sterno-coracoideus] Superior, major a sterni manubrio ortus oblique extrorsum ad faciei internæ claviculæ coracoideæ quadratæ vel anterioris partem internam posticam adscendit. [Costo-coracoideus] Eodem tractu, sed a primæ costæ cartilagine inferior, minor ad claviculæ ejusdem coracoideæ faciem internam decurrit. Uterque partem scapularem deprimit, decursu igitur et actione pectoralem minorem sistit . . . . Ne quis putet, me, et subclavium huc trahentem, sententiam meam de osse quadrato coracoideo ipsum impugnare, moneo, in plurimis animalibus, etiam mammalibus, subclavium et a scapula et quidem processu coracoideo oriri."

COUES says—"Pectoralis minor? Besides the serratus another plane of muscle connects the shoulder apparatus with the top of the thorax; it has somewhat the situations and relations of an 'intercostal' betwixt first rib and the bone above. It is divisible into two parts. One of these, costo-coracoid, is larger and thicker than the other; it arises from the first rib, from the origin of the serratus magnus slip to the sternal articulation, and is inserted mainly into the base and inner surface of the coracoid. A smaller, thinner plane, manubrio-epicoracoid, expands upon the internal surface of the epicoracoid plate. The first of these may be pectoralis minor; the second, subclavius?"

CUVIER and LAURILLARD do not show these muscles in any of their figures.

FUERBRINGER describes, under the name of M. costo-coracoideus in the Crocodile, a muscle, part of which agrees with the costo-coracoid above described. "Breiter ansehnlicher Muskel an der Unterseite der Brust, der sich aus zwei Portionen zusammensetzt von denen die laterale von dem Vorderrande der letzten Halsrippe (Rippe des 9 Wirbels) und die mediale von dem Vorderrande der 1 sternocostalleiste entspringt. Beide Partien vereinigen sich zu einer homogenen Schichte, die breit am ganzen Hinterrande des Coracoids inserirt." Fürbringer later on notices this resemblance and also its resemblance to the subclavius of mammals (p. 788).

In his description of the Mm. sterno-coracoideus internus superficialis et profundus, Fürbringer says, "die Mm. sterno-coracoidei der Monotremen ihrerseits stehen, wie bei der Darstellung der Schultermuskeln der Säugethiere ausführlich nachgewiesen werden soll, wieder zu dem M. subclavius der Marsupialia und Placentalia (besonders durch Vermittelung von dessen zu Scapula und Processus coracoideus erstreckten Varietaten) in nähere Beziehung."

M. BICEPS.

ECHIDNA: *Two parts described*, Westling, Leche; *one part only*, Mivart.
ORNITHORHYNCHUS: *Two parts described*, all authors.

ECHIDNA.

Origin. (*a*) *Epicoracoid head.*—This muscle arises by fleshy fibres from the postero-internal surface of the ventral aspect of the epicoracoid. Running outwards and posterior as a thin band of muscle it passes superficial to the tendon of the rectus at its insertion, and the belly then comes into contact with the anterior border of the coracoid portion. (Fig. 4, *Bc. i.*).

Origin. (*b*) *Coracoid head.*—This arises from the ventral face of the coracoid, from a concave surface situated between the coraco-epicoracoid arthrodia and the coraco-sternal arthrodia; also from about one-third of the proximal portion of the upper surface of the coraco-brachialis longus. (Fig. 4, *Bc. ii.*).

Insertion. The two portions of the biceps run out in company, coursing over a large bare surface on the antero-internal face of the humerus. The epicoracoid belly then develops a well-marked tendon, and becoming hidden by the coracoid belly it runs outwards, and twining round the humerus it is inserted on the middle third of the ulna. The coracoid portion on approaching the forearm also develops a strong tendon which is inserted on the radius distal to the insertion of the smaller belly on the ulna.

Relations. The epicoracoid portion at its origin is in contact with the epicoraco-humeral; it then passes superficial to the rectus tendon (inserted on the coracoid). The two parts together hide the coraco-brachialis brevis, and as they wind round the humerus they come into relation with the tendon of insertion of the clavicular deltoid.

ORNITHORHYNCHUS.

Origin. (*a*) *Epicoracoid head* arises from a small area on the postero-internal portion of the ventral surface of the epicoracoid. Running outwards and posterior over the insertion of the rectus, the muscle passes across the coraco-brachialis brevis, and comes into contact with the anterior border of the coracoid belly, and passing round the humerus, distal to the insertion of the deep panniculus, it develops a tendon which soon after fuses with the tendon of the coracoid portion. (Figs. 7, 9, *Bc. i.*).

(*b*) *Coracoid head* arises by an attenuated tendon (common to it and the coraco-brachialis longus) from the external border of the distal extremity of the coracoid. Running outwards a thick rounded muscular belly develops closely adherent to the ventral surface of the coraco-brachialis longus beneath. (Figs. 7, 9, *Bc. ii.*)

Insertion. Winding round the humerus the coracoid belly now develops a tendon, and becoming fused with the epicoracoid portion, the conjoined tendon now comes to lie between the radius and ulna, and is inserted on the middle third of the latter bone.

Relations. Both portions of the muscle cross the tendons of insertion of the latissimus dorsi on the antero-internal face of the humerus.

Innervation. N. musculo-cutaneus from the iv. v. vi. vii. cervical nerves in both animals.

WESTLING—*Echidna*: N. musculo-cutaneus from the v. et vi. cervical nerves: *Ornithorhynchus*, N. musculo-cutaneus. (Fig. 17, *Cl.*).

ECHIDNA.

WESTLING describes two bellies, a smaller one springing from the epicoracoid and inserted on the ulna, and a larger from the coracoid, springing in common with the coraco-brachialis longus, and inserted on the radius. Westling proceeds to remark that in *Ornithorhynchus* the biceps has two bellies, and that in most Saurians the biceps arises from the coracoid only and not from the scapula, and is inserted on to the radius and ulna, and refers to Fürbringer's figure of *Uromastrix spinipes.*

LECHE follows Westling, but says, "Nach welcher soll ei nur am Radius inseriren (?)."

MIVART says—"The biceps has but a single head, thus differing from the *Ornithorhynchus* [and refers to Meckel]. It is thick and fleshy near its origin, but towards its insertion expands in the direction of the long axis of the forearm. It arises mainly from the strong tendon of the coraco-brachialis, but also in part from the coracoid; and some fibres take origin from the epicoracoid. It is inserted into the radius in part, but also into the ulna as far back as the coronoid process. . . . This insertion into both radius and ulna takes place in the Pig (Meckel and Huxley), and according to Meckel it is inserted either wholly or in part into the ulna in many animals."

ORNITHORHYNCHUS.

OWEN—"The biceps brachii arises by two heads; one arises from the sternal extremity of the coracoid [epicoracoid], the other also arises from the coracoid; the common tendon is inserted into the middle of the radius."

COUES divides the two heads under the names epicoraco-radialis and coraco-radialis, "this latter becomes penniform by insertion into the tendon of the other head of the biceps; posteriorly the muscular fibres nearly reach the radius. The common insertion of the two is by a broad flat tendon into the middle third of the radius."

MECKEL says—"Margini musculi, supra secundo loco descripti, et pro deltoide antico habiti, intimo apponitur musculus longe tenuior, sed longior, ex parte intima faciei externæ ossis coracoidei majoris, anterioris versus ipsius extremum inferius, oriundus. Decurrit infra cristam ossis brachii pectoralem et tendine terete inseritur radii superficiei flexoriæ circiter in media ipsius ab utroque extremo distantia. Infra hunc musculum ab imo extremo inferiore atque externo claviculæ coracoideæ posterioris, hic cum coraco-brachiali sueto more arctissime junctus, oritur musculus decuplo crassior, sed brevior, extremo anteriore recti abdominis ab eodem separatus. Infra ipsum decurrit tendo ipsius externus et inferior tendini ejusdem unitus radio circiter medio inseritur, ut uterque unum reversa sistat musculum, bicipitem, qui et decursu et actione bicipitem hominis nonnullorumque mammalium refert."

CUVIER and LAURILLARD, in Plate 268, fig. 3, give a figure of the biceps, with the letter (*r*) affixed, "biceps ou long fléchisseur de l'avantbras (scapulo-radien, portion coracoidienne et portion bicipitale)."

M. CORACO-BRACHIALIS et M. EPICORACO BRACHIALIS.

ECHIDNA: *M. coraco-brachialis longus et brevis*, Mivart, Leche, Westling; *M. epicoraco-brachialis*, Westling, Leche. Described but not named by Mivart.

ORNITHORHYNCHUS: *M. coraco-brachialis superior et inferior*, Owen, Meckel; *Coraco-brachialis and epicoraco-brachialis (the latter including the coraco-brachialis brevis)*, Coues.

ECHIDNA.

Origin. (*a*) *M. coraco-brachialis longus.* (Fig. 4, *Cb. L.*).—This muscle arises from the postero-internal portion of the ventral aspect of the coracoid, and from the posterior border of that bone.

I n s e r t i o n. The muscle runs outwards, upwards and posterior to be inserted close to the inner condyle of the humerus, and on the distal two-thirds of a ridge which reaches from this condyle to the distal extremity of the pectoro-deltoid ridge.

R e l a t i o n s. The origin is tendinous and thin, but towards the insertion the muscle becomes of considerable bulk. Ventro-anteriorly the coracoid belly of the biceps is closely connected with the muscle, while postero-internally the muscle lies close to the costæ.

O r i g i n. (*b*) *M. coraco-brachialis brevis.* (Fig. 4, *Cb. B.*).—This muscle lies deeper than the longus. It arises from the posterior angle and border of the coracoid in common with part of the coraco-brachialis longus.

I n s e r t i o n. Running as a wide sheet of muscle upwards and outwards, it is inserted on the ventrally projecting summit of the greater tuberosity, and into a line leading from thence to the lesser tuberosity, this line bounding distally a broad shallow depression (bicipital groove) on the antero-internal face of the bone between the tuberosities. (Fig. 18, *Bc. G.*).

R e l a t i o n s. The muscle is hidden from view by the coracoid belly of the biceps, and at its insertion it is related to that part of the epicoraco-humeral inserted on the ridge bounding the bicipital groove.

O r i g i n. (*c*) *M. epicoraco-brachialis.* (Fig. 4, *A. Ep. br.*).—The muscle arises from the outer half of the dorsal surface of the epicoracoid, and from the adjoining dorsal concave surface of the coracoid.

I n s e r t i o n. The muscle runs posterior and outwards, to be inserted on the summit of the lesser tuberosity, close to the insertion of the subscapularis.

R e l a t i o n s. At its origin from the epicoracoid the muscle is related to the insertion of the sterno-coracoideus and costo-coracoideus; both muscles, however, lying in a plane dorsal to this muscle. At its origin from the coracoid it is closely related to the coraco-brachialis brevis.

ORNITHORHYNCHUS.

Origin. *M. coraco-brachialis longus.* (Figs. 7, 9, *Cb. L.*).—This muscle arises by a tendon in common with the coracoid head of the biceps from the external portion of the distal extremity of the coracoid.

Insertion. Running outwards a thin belly of muscle develops, and after passing superficial to the tendons of the two parts of the latissimus dorsi, the muscle is inserted by a narrow tendon, on a ridge running from the internal condyle towards the distal extremity of the pectoro-deltoid ridge, and lying between the antero-internal and antero-external faces of the humerus; being placed distal to the anterior part of the latissimus dorsi.

Relations. The muscle at its origin is superficial to the coraco-brachialis brevis, but on account of its narrowness it does not hide from view the brevis, as in *Echidna.*

Origin. (*b*) *M. coraco-brachialis brevis.* (Figs. 7, 9, *Cb. B.*).—This muscle arises from the concave outer border of the coracoid lying between the glenoid cavity and the origin of the coraco-brachialis longus from the distal extremity of the coracoid, and also from the ventral face of the bone immediately adjoining this concave border.

Insertion. Running outwards, the muscle is inserted on the antero-lateral face of the humerus on a ridge which runs from the greater to the lesser tuberosity, being placed immediately distal to the edge of the deep depression between the two tuberosities. Its insertion is bounded internally by the epicoraco-brachialis and teres major; externally and distally by the posterior part of the latissimus dorsi; while the epicoraco-humeral is placed external at the proximal end of the humerus.

Relations. At its origin the fibres of this muscle are intimately connected with the fibres of the epicoraco-brachialis; it likewise comes into relation with the insertion of the costo-coracoideus on the dorsal part of the distal extremity of the coracoid. Both parts of the biceps and the coraco-brachialis longus lie superficial to and partly hide it from view.

Origin (*c*) *M. epicoraco-brachialis.*—This muscle arises by fleshy fibres from the outer two-thirds of the dorsal surface of the epicoracoid, and by a few fibres from the ligament which binds the antero-external angle of this bone to the dorsal surface of the interclavicle; also by some fibres from the coracoid adjoining the coraco-epicoracoid arthrodia.

Insertion. Running outwards and posterior, the muscle approaches the lesser tuberosity. A small fleshy belly with a well marked tendon is differentiated from the main mass of the muscle, and is inserted on the summit of the sesamoid bone in close relation with the tendon of the subscapularis. The remainder of the muscle now in part coalesces with the coraco-brachialis brevis, and in part is inserted by a distinct tendon on the antero-internal face of the lesser tuberosity, immediately adjoining the sesamoid bone, the insertion being surrounded by the subscapularis, teres major, and coraco-brachialis brevis; the latter muscle hiding the insertion from view.

Innervation. *Echidna:* Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus; M. epicoraco-brachialis, from the cord formed by the iv., v., vi. and vii. cervical nerves, from which the musculo-cutaneus also springs. *Ornithorhynchus:* Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus (in two divisions); M. epicoraco-brachialis, from the N. musculo-cutaneus, and from a cord formed from the iv., v. and vi. cervical nerves.

WESTLING—*Echidna:* Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus. "Der mit dem M. coraco-brachialis nahe verbundene M. epicoraco-brachialis wird nicht direct vom N. musculo-cutaneus, sondern von einem Nerven aus denselben Cervicalnerven wie dieser, innervirt."

WESTLING in *Ornithorhynchus* found the biceps, coraco-brachialis, and epicoraco-brachialis supplied by the musculo-cutaneus nerve.

ECHIDNA.

WESTLING says—"The M. coraco-brachialis is well developed and can easily be divided into three portions at its insertion, but it is more or less fused at its origin." The parts are—(1) M. coraco-brachialis longus, arising from the coracoid and inserted on the internal condyle and the anterior surface of the humerus. (2) M. coraco-brachialis brevis, arising from the posterior angle of the coracoid and inserted on the tuberculum minus and the anterior surface of the humerus, in the depression between the two tuberosities. (3) The epicoraco-brachialis (Coues), which arises from the dorsal face of the epicoracoid, and is inserted between the M. subscapularis and the M. coraco-brachialis brevis on the tuberculum minus. Westling further remarks that the M. epicoraco-brachialis is supplied by a nerve from the N. musculo-cutaneus which springs from the Nn. cervicales v. and vi.

Leche follows Westling.

Mivart says, of the coraco-brachialis—"This muscle is very largely developed, and consists of at least two distinct parts, one long, and the other short. Both portions have a common origin and arise from the distal end of the coracoid, and chiefly from that part of it which looks towards the first rib. The long part passes downwards and is inserted into the internal condyle on the anterior surface of the bone. There is a good deal of tendinous fibres at the common origin; but that border of the long portion which is next the biceps is especially tendinous. The short portion is inserted into the whole anterior face of the lesser tuberosity and into part of the wide bicipital groove, and is covered by a long portion. A similar division of the coraco-brachialis appears to exist in *Ornithorhynchus* (Meckel)."

"Besides this double coraco-brachialis there is a small third portion, unless, indeed, it should be reckoned a distinct muscle. This arises from the external part of the deep or inner surface of the epicoracoid, and is inserted, by a distinct tendon, into the lesser tuberosity of the humerus, close and somewhat superficial to the insertion of the subscapularis. At its innermost part it is ntimately united with the adjacent portion of the short part of the coraco-brachialis. It appears to me not improbable that it may answer to the muscle which in the common fowl arises from the inner surface of the coracoid, and is inserted into the lesser tuberosity of the humerus."

ORNITHORHYNCHUS.

OWEN says, "there are also two muscles to which the name coraco-brachialis may be applied, a superior one and an inferior one."

COUES says—"Two perfectly distinct muscles besides the one above called anterior deltoid [epicoraco-humeral] proceed from the coracoid opposite to the humerus; they have together been considered as coraco-brachialis, but the name is properly applicable to only one of them." He then proceeds to describe the coraco-brachialis proper. After this Coues describes the epicoraco-brachialis: "Much larger than the other and with different origin, course, relations and insertions; lying partly upon and partly under the whole coracoid apparatus, and upon the posterior aspect of the proximal moiety of the humerus. Viewed at first from the outside, superficially, it appears to arise from the coracoid proper, and to descend thence upon the humerus. But its real origin is much more extensive, from the whole, or nearly all, of the under (internal) surface of the epicoracoid lamella, as a thin expanded sheet whose contour is determined by that of the bony plate just named. It gains the outside by curving around the coracoid proper, reminding one of the escape of the iliacus over the pelvic brim, or of the obturator internus over the border of the ischium. It has a broad fleshy insertion into the expanded surface of the humerus, upon the aspect of that bone above noted, as far down as the insertion of the latissimus."

WESTLING says that in the *Ornithorhynchus*, according to Coues, the M. coraco-brachialis is only differentiated into two muscles, and that in Saurians there are a M. coraco-brachialis longus and a brevis, whose origins and insertions are similar to those of the *Echidna*.

LECHE says that in *Ornithorhynchus* the epicoraco-brachialis and coraco-brachialis brevis are blended into one strong muscle.

MECKEL—"Anterior, longe major, transversus, et a partis scapulæ coracoideæ facie interna fere tota, nec non ab osse quadrato, infra cavitatem scapulæ glenoideam extrorsum tendit et infra humeri caput foveæ profundissimæ in ipsius facie posteriore pone latissimi dorsi tendinem inseritur. Hic, ni fallor, aut teres minor, aut, quod rectius duxerim, coraco-brachialis superior est." [Meckel's figure, Pl. v. 22, shows this muscle as the C. brachialis brevis.] "Musculus alter, posterior, certo coraco-brachialis, longior, sed tenuissimus, ex parte coracoidea extremo inferiore tendine angusto ortus, ante summum latissimum decurrens, infra eundem ossis brachii faciei anticæ, paullulum supra condylum flexorium jungitur. [In Pl. v. 25 this muscle is called coraco-brachialis inferior.]

Cuvier and Laurillard, in Pl. 268, fig. 4, show part of the coraco-brachialis (coraco-humérien), while in Pl. 266, fig. 2, the coraco-brachialis is shown partially hidden by biceps, but no reference number is given.

Humphry says—"The deeper, post-axial, or suboccipital, coraco-humerals arise from the coracoid beneath the biceps, as best seen in Reptiles. They may be traced, in these animals, taking origin from the under and hinder surface of the coracoid and spreading upon the undersurface of the scapula, where a portion of these forms the subscapularis. In Mammals this muscle is quite segmented from the others. They are inserted into the ulna edge of the humerus; it is inserted into the ulnar tubercle. The one next below the subscapular—the coraco-brachialis medius—is generally present and is inserted into the middle of the shaft. The passage through it of the external cutaneous, or musculo-cutaneous, nerve indicates a tendency to division; and in several Mammals (Rabbit, Proboscis Monkey and Jerboa) the upper segment is inserted separately into the ulnar tubercle, forming a superior coraco-brachial. In Amphibians, Reptiles and Monotremes there is commonly a third segment, an inferior coraco-brachialis, which extends to the ulnar condyle; and the brachial artery, with the median nerve, passes between it and the middle coraco-brachial."

Westling says—"M. epicoraco-brachialis scheint mir in Bezug auf Ursprung und Insertion mit Fürbringer's M. subcoracoideus (einem Theil des M. subcoraco-scapularis) bei Chamæloniden Aehnlichkeit zu zeigen," and also "Die Saurier besitzen einen M.

coraco-brachialis longus und einen M. coraco-brachialis brevis, welche sowohl betreffs des Ursprungs wie der Insertion mit denselben bei Echidna übereinstimmen."

As regards the epicoraco-brachialis, we think that there are sufficient grounds for regarding it as a "coraco-brachialis." In the *Echidna* it is a very distinct separate muscle, and its nerve supply is from a branch, not from the musculo-cutaneous, but from the cord common to it and the musculo-cutaneous nerve. But in *Ornithorhynchus* the muscle is not so distinctively a separate muscle, and although the chief nerve to it corresponds to the nerve in *Echidna*, at the same time the true musculo-cutaneous nerve gives it a distinct twig. It will be seen by referring to Westling's figure (Fig. 17, *Cl.*) of the brachial plexus in *Ornithorhynchus*, that she found the muscle supplied from the musculo-cutaneous nerve alone. She says . . . "ein Nerv, der sich in die beiden Portionen des M. biceps brachii, den M. coraco-brachialis und den M. epicoraco-brachialis vertheilt."

M. INFRASPINATUS.

ECHIDNA et ORNITHORHYNCHUS: *M. infraspinatus*, all authors.

ECHIDNA.

O r i g i n. This muscle has an extensive origin from the outer face of the scapula. The surface of bone from which it arises is bounded as follows: dorsally by the anterior part of the outer rim of the vertebral border (excepting the small area from which the clavicular deltoid arises); anteriorly by the inferior part of the spine and the outer border of the acromion; while posteriorly by the ridge from which the teres minor arises, and the upper two-thirds of the glenoid border.

I n s e r t i o n. The muscle runs downwards and outwards to be inserted by a narrow tendon, as well as by muscular fibres, on the posterior face of the humerus, just internal to the proximal third of the pectoro-deltoid ridge; the insertion being hidden by the clavicular deltoid, and being in immediate relation with the insertion of the upper layer of the deep panniculus.

Relations. At its origin from the vertebral border of the scapula the muscle is intimately related to, and covered by, the scapular part of the deltoid, while anteriorly the acromial part of the deltoid arises close to it. The teres minor, long head of triceps, and the anterior border of the subscapularis arise close to it posteriorly. As the muscle leaves the acromion the supraspinatus comes into intimate relation with it, and as it runs to its nsertion it courses over the capsular ligament and hides from view the origin of the teres minor.

ORNITHORHYNCHUS. (Fig. 8, *I. S.*).

Origin. The infraspinatus arises from a concave space on the external face of the scapula. This space is bounded dorsally by the origin of the scapular deltoid from the anterior part of the vertebral border and upper part of the spine of the scapula; anteriorly by the lower one-third of the spine, posteriorly by the anterior border of the origin of the subscapularis, and upper half of the glenoid ridge with the origin of the long head of the triceps; the more ventral convex portion of the external face of the scapula does not, however, give origin to this muscle.

Insertion. Arising by fleshy fibres the muscle runs downwards and outwards, and becoming narrower as it approaches its insertion, it sinks under cover of the clavicular deltoid, and winding over the capsular ligament of the shoulder joint, it is inserted chiefly by tendon on the inner portion of the ventral surface of the greater tuberosity, and by a few fleshy fibres on a small area of the posterior surface of the humerus, immediately internal to the proximal end of the delto-pectoral ridge, the insertion being placed between the insertions of the epicoraco-humeral and the supraspinatus.

Innervation (*vide post*, supraspinatus).

ECHIDNA.

WESTLING describes the origin "from the dorsal face of the scapula close to the spine (the anterior border), between the deltoid ii, and the subscapularis and triceps." In remarking on the nerve supply she says, "ein Theil des Ramus supra- und infraspinatus des N. supracoracoideus durchsetzt den M. supraspinatus und dringt in den medialen Rand des M. infraspinatus ein; hauptsächlich wird jedoch der Muskel durch mehrere Aestchen vom N. axillaris, die in die Lateralfläche eintreten, versorgt."

LECHE follows Westling, but quotes the latter part only of Westling's statement about the nerve supply.

MIVART describes the origin and insertion as given above, and remarks that "the muscle in the Ornithorhynchus which is figured by Meckel (tab. vii. No. 13) and named by him deltoides, appears to be the same as that which I have named infraspinatus in the Echidna." The muscle referred to is in Pl. VI. not Pl. VII., and is the posterior portion of the deltoid and is quite accurately figured and named by Meckel: there is, however, a mistake in this plate (see below).

ORNITHORHYNCHUS.

OWEN remarks, that "the infraspinatus and the teres major cover the whole of the external surface of the scapula."

LECHE does not mention this muscle under *Ornithorhynchus.*

COUES writes—"Infraspinatus (and teres minor? or the latter wanting?) occupies, and arises fleshy from, the whole of the scapular plate below the spine and spinous elevation, this is, between the last named and the origin of the scapular head of the triceps."

MECKEL—"Extrorsum tres sequuntur musculi . . . secundus infraspinatus, medius, longe major a media scapulæ facie externa tuberi ossis humeri antico inseritur infra et extrorsum a modo dicto."

CUVIER and LAURILLARD figure this muscle (in Pl. 266, fig. 2, *m*) under the name "sous-épineux (sous-scapulo-trochitérien)," but in fig. 1, Pl. 266, *m*, is really part of the subscapularis.

MECKEL (in Pl. VI. 14) figures as infraspinatus what is only part of the subscapularis. This is plainly seen to be a mistake, as the long head of the triceps is seen arising from the glenoid ridge in front of (dorsal to) the muscle represented as infraspinatus. In Pl. v. 20, the infraspinatus is rightly named and figured.

M. SUPRASPINATUS.

ECHIDNA: *M. supraspinatus*, all authors.
ORNITHORHYNCHUS: *M. supraspinatus*, all authors.

ECHIDNA.

Origin. The supraspinatus is a large well developed muscle. It arises from the ventral two-fifths of the inner surface of the scapula and acromion. Its origin is bounded anteriorly by the acromio-trachélien; dorsally by a slight ridge to which the omohyoid is attached; posteriorly by the subscapularis as it winds round the posterior border to encroach on the inner face of the scapula; the muscle does not, however, arise from the ventral portion of the inner face of the scapula immediately adjoining the coracoid.

Insertion. Winding round the sharp lower edge of the scapula between the acromion and the glenoid cavity, the muscle then becomes intimately related to the capsular ligament, and continues on posteriorly and somewhat outwards to become inserted by a well marked tendon into that portion of the greater tuberosity immediately contiguous to the articular head of the bone; the insertion being placed between the epicoraco-humeral and infraspinatus, and being hidden from view by the clavicular deltoid. (Fig. 4, *Ss.*).

Relations. The muscle in running to its insertion becomes closely related on its inner aspect to the epicoraco-humeral, and externally to the infraspinatus.

ORNITHORHYNCHUS.

Origin. The supraspinatus is a very small muscle arising by fleshy fibres from the internal face of the scapula, from a depression situated close to the sharp ventral border of the scapula that runs between the acromion and the glenoid cavity.

Insertion. Winding round this ventral border, the small muscle runs posteriorly and outwards to be inserted, fleshy, on the ventral aspect of the inner part of the greater tuberosity. (Fig. 8, *Ss.*).

Relations. At its origin the muscle is placed immediately ventral to the origin of the omo-hyoid. As it runs to be inserted it enters an angle formed by the infraspinatus and epicoraco-humeral, being partially hidden by the latter muscle.

Innervation. *Echidna* et *Ornithorhynchus*: M. supraspinatus, N. supracoracoideus; M. infraspinatus, N. supracoracoideus chiefly; while the N. axillaris also sends a small branch to the M. infraspinatus.

Westling notices this double nerve supply for the infraspinatus in *Echidna*; and remarks "hauptsächlich wird jedoch der Muskel durch mehrere Aestchen vom N. axillaris, die in die Lateralfläche eintreten, versorgt." In the two specimens of *Echidna* dissected by us, however, the chief nerve supply was undoubtedly from the N. supracoracoideus.

Westling further says, under N. supracoracoideus—"Der N. supracoracoideus verhält sich in der nun geschilderten Weise auf beiden Seiten der mir zu Gebote stehenden Exemplare von Echidna. Bei Ornithorhynchus hat Fürbringer eine ähnliche Anordnung des N. supracoracoideus gefunden; der wichtigste Unterschied in Bezug auf Echidna ist, dass der M. infraspinatus beim Schnabelthiere am öftesten ausschliesslich vom genannten Nerven versehen wird. Der N. axillaris sendet jedoch bisweilen Fädchen in besagten Muskel und kann selbst ganz und gar den Ramus supra- und infraspinatus N. supracoracoideus ersetzen; ein solcher Ausnahmsfall ist in meiner Abhandlung über Ornithorhynchus beschrieben worden."

We doubt the accuracy of the latter part of this statement.

Echidna.

Westling gives the origin from the ventral face of the scapula and the clavicular border, between the acromion and shoulder joint and its insertion into the greater tuberosity.

Leche follows Westling.

Mivart notices that "the muscle has a very extensive origin, arising as it does from almost the whole of the inner surface of the scapula not occupied by the serratus magnus." He further calls attention to the fact, "that Owen has pointed out that the supraspinous fossa is on the inner surface of the scapula."

Ornithorhynchus.

Owen says—"The subscapularis is a narrow muscle, and narrower in reality than at first sight it appears to be, since the supraspinatus, from the inflection of the spine and acromion, arises from the same aspect of the scapula and appears to form the anterior fasciculus of the subscapularis; its distinct insertion into the anterior tubercle of the head of the humerus points out its true nature."

Coues gives an exact description of this small muscle.

Leche merely remarks "that there is a similar muscle in *Ornithorhynchus* as in *Echidna*," and refers to Coues.

Meckel—"Extrorsum tres sequuntur musculi, . . . ex his primus, anticus, minimus, sine dubio supraspinatus, a praecedente, longe majore, tectus ab acromii facie inferiore ad capitis ossis humeri basin tendit, fortiter os attollens."

Cuvier and Laurillard figure this muscle (Pl. 266, fig. 2, without a reference number), as a small band running down between the epicoraco-humeral (l^2) and the infraspinatus (m).

Mivart remarks—"In the Ornithorhynchus this muscle must be considerably smaller than in the Echidna, owing to the situation of the subscapularis in that genus."

M. subscapularis.

Echidna: *Subscapularis*, all authors.

Ornithorhynchus: Owen and Meckel describe only the portion arising from the internal face as subscapularis; part of the teres major of Coues.

ECHIDNA.

O r i g i n. The subscapularis is large and extensive in its origin. It arises from a triangular-shaped area on the external surface of the scapula. This area is bounded dorsally by the posterior three-fourths of the outer margin of the vertebral border; anteriorly by the origin of the infraspinatus and upper half of the glenoid ridge with the origin of the long head of the triceps; posteriorly by the (actual) posterior border. But in addition to this the muscle arises from the (actual) posterior border and the inner face of the scapula immediately adjoining this posterior border; this latter origin does not, however, reach quite up to the posterior extremity of the vertebral border, nor yet quite down to the coracoid. (Fig. 10, *S. Sc.*).

I n s e r t i o n. The muscle, triangular in outline and very bulky, runs downwards, backwards and somewhat inwards, to become inserted by a tendon on the ventral surface and antero-internal border of the lesser tuberosity.

R e l a t i o n s. The muscle at its origin is partially hidden from view by the posterior part of the trapezius, and the dermo-dorsi cervicalis. Posteriorly it is related to the teres major and a slip to the latissimus from the scapula; while that portion of its origin that extends round from the (actual) posterior border to the inner face of the scapula comes into relation with the insertion of the serratus magnus and origin of the omo-hyoid and supraspinatus. At its insertion the muscle is close to the epicoraco-brachialis and the teres minor, inserted distally on the posterior face of the humerus adjoining the lesser tuberosity.

ORNITHORHYNCHUS. (Fig. 12, *S. Sc.*).

The subscapularis has a very extensive origin from both the external and internal faces of the scapula. It arises from a triangular-shaped surface on the external face of the bone. This is bounded dorsally by the origin of the teres major from the posterior one-third of the vertebral border, and by that portion of the vertebral border between the origin of the teres major and the scapular part of the deltoid ; anteriorly by the origin of the infra-spinatus and upper two-thirds of the glenoid border and upper part of the triceps tendon ; posteriorly by the upper half of the posterior border. In addition to this the muscle arises by a still more extensive origin from the inner surface of the scapula, the area being bounded dorsally by a ridge close to the vertebral border on which is inserted the serratus magnus ; anteriorly by the true anterior costa on which is inserted part of serratus magnus, and posteriorly by the upper half of the (actual) posterior border of the scapula.

Insertion. The muscle runs downwards and inwards to be inserted on the distal extremity of the lesser tuberosity, and on a "sesamoid bone"* situated on the summit of the lesser tuberosity, close to the shoulder joint, being closely related to the insertion of the epicoraco-brachial antero-internally, and teres minor on the posterior face of the humerus.

Innervation. *Echidna* et *Ornithorhynchus:* N. subscapularis, from iv., v., vi. cervical nerves.

WESTLING: the same for *Echidna*.

ECHIDNA.

WESTLING describes this muscle as arising from the hinder and upper (vertebral) part of the dorsal surface of the scapula, and its insertion into the summit of the tuberculum minus humeri.

LECHE follows Westling.

MIVART says—"This large muscle has an anomalous situation, inasmuch as it is confined to the outer surface of the scapula. It arises, indeed, from the whole of the outer surface posterior to the origin of the long head of the triceps." He remarks, that, "in the Ornithorhynchus this muscle takes origin in part from the outer surface of the scapula, but mainly from the inner face in the usual mode."

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* This so-called sesamoid bone corresponded exactly in position and relations to the epiphysis of the lesser tuberosity of the humerus of a young Echidna, in the writer's possession. (*Vide* fig. 18, *L.T.*).

Ornithorhynchus.

Owen says—"The subscapularis is a narrow muscle and narrower in reality than at first sight it appears to be, since the supraspinatus from the inflection of the spine and acromion, arises from the same aspect of the scapula, and appears to form the anterior fasciculus of the subscapularis."

Coues, as stated above, describes for the subscapularis what is really teres minor, while under the heading of teres major we find a description of the subscapularis. Thus in the description of the teres major we have the following:—"the upper portion is still larger and has more extensive and complicated origin from both sides of the scapula, which is thus, as it were, embraced by this muscle. The outer origin is from the postero-external aspect of the scapula, and from the origin of the lower teres to that of the scapular head of the triceps; the inner origin is thinner and more extensive and fleshy from the whole surface of bone between the insertions of the two digitate sets of levatores scapulæ. . . . It is inserted much higher up, in immediate relation with the shoulder joint, into the posterior tubercle of the humerus, alongside the insertion of the muscle above called subscapularis [teres minor]. N.B.—Its tendon contains an articular sesamoid bone."

Leche gives, for a description of the subscapularis, Coues' description of the teres minor; while under the heading "teres major," we get Coues' description of the second part of the teres major, *i.e.*, of the subscapularis proper.

Meckel says—"Subscapularis, scapulæ ipsius facie interna ad ossiculum, summo tuberi interno ossis humeri nonnisi capsula junctum tendit." Again Meckel describes, as the second part of the teres major, what is really part of the subscapularis. "Alter, ab eo tectus (*i.e.*, teres major), a dimidio posteriore scapulæ superficiei externæ ortus, ante praecedentem ad faciem posticam ossis humeri tendit, infra caput ei insertum."

Cuvier and Laurillard figure (in Pl. 268, fig. 4 *n.*) this muscle under the name of "sous-scapulaire (scapulo-trochinien)," the muscle occupying the internal face of the scapula in its proper position.

M. TERES MAJOR.

ECHIDNA: *Teres major, single*, all authors.

ORNITHORHYNCHUS: *Teres major, double = Teres major proper + External part of subscapularis*, Meckel and Owen; *Teres major double = Teres major proper + External and internal parts of M. subscapularis*, Coues; *a single muscle, the teres major proper*, Cuvier and Laurillard.

ECHIDNA.

Origin. The teres major arises from a small area on the posterior end of the vertebral border of the scapula.

Insertion. The muscle, cylindrical in shape, runs downwards and outwards to be inserted into the distal part of a triangular flattened surface, whose base is continuous with the lesser tuberosity, and whose apex merges into the sharp internal border of the humerus.

Relations. At its origin the muscle is intimately connected with the slip from the scapula to the latissimus dorsi. The muscle in its course is hidden from view and cannot be seen till the subscapularis in front and the slip to the latissimus posteriorly are drawn apart. (Fig. 10). At its insertion the tendon contains a small sesamcid bone.

ORNITHORHYNCHUS. (Fig. 12, *T. M.*).

Origin. The teres major arises from the posterior third of the external margin of the vertebral border, and from the immediately adjoining face, of the scapula.

Insertion. The muscle runs as a fleshy belly downwards and somewhat outwards, and becoming narrower as it approaches its insertion, by a well marked tendon, about the mid-third of the inner border of the humerus, immediately distal to the insertion of the subscapularis.

Relations. At its origin the muscle overlies the subscapularis as it arises from the outer surface of the scapula. It is intimately connected with the fine tendon of insertion of the costal part of the serratus, and also with the rhomboid insertion. The tendon of the posterior part of the trapezius overlies it, as also does the dermo-dorsi cervicalis. At its insertion its tendon lies between the short head of the triceps arising from the posterior face of the humerus, and the insertion of the coraco-brachialis brevis and epicoraco-brachialis on the antero-internal face.

Innervation. *Echidna* et *Ornithorhynchus*: from the cord formed from the iv., v., and vi. cervical nerves, and from which the subscapular nerves also spring. (Figs. 13, 16; 35).

Westling: idem for *Echidna*.

ECHIDNA.

Westling describes the origin from the posterior angle of the scapula with the scapular portion of the latissimus dorsi, and its insertion distally from the tuberculum minus between the insertion of the M. coraco-brachialis brevis and the origin of the triceps, on a ridge on the humerus.

Leche follows this description.

Mivart gives a similar description, remarking that "this muscle appears to be considerably larger in the Ornithorhynchus," and refers to Meckel.

ORNITHORHYNCHUS.

Owen remarks—"The infraspinatus and the large teres major cover the whole external surface of the scapula."

Coues says—"Double; both portions of great size, and perfectly distinct. The lower, or teres major proper, arises fleshy from the posterior extremity of the scapula for about one-third of an inch; it lies at first upon the serratus magnus, and then along the superior border of the latissimus, forming a great pyramidal muscle running between the last and the upper teres, rapidly narrowing to a rather long, stout, flattish tendon that passes behind (mesiad of) the scapular head of triceps, to be inserted in the posterior ridge of the humerus, one-half inch or more above the insertion of the latissimus." Coues then goes on to describe "the upper portion," which is really the true subscapularis.

LECHE follows Coues, and accordingly describes the teres as divided into two parts.

MECKEL also describes two muscles, a "superficialis posterior, longior, sed angustior, a marginis superioris scapulæ parte posteriore ortus," and "alter ab eo tectus, a dimidio posteriore scapulæ superficiei externæ ortus," etc., this being part of the subscapularis.

CUVIER and LAURILLARD figure this muscle single, as the "grand rond (scapulo-humerien)," Pl. 266, fig. 1; and on Pl. 268, fig. 4, the subscapularis and teres are so clearly shown that it is evident that they did not mistake the subscapularis for part of the teres major.

M. TERES MINOR.

ECHIDNA: *Teres minor*, Fewkes; *Subscapularis accessorius*, Westling, Leche; *described by Mivart, but not named.*

ORNITHORHYNCHUS: *Subscapularis*, Coues.

ECHIDNA.

Origin. The teres minor arises on the external face of the scapula from a slight ridge which runs from the dorso-anterior border of the glenoid cavity upwards and posteriorly to meet the glenoid ridge.

Insertion. The origin is tendinous, and the muscle running ventrally and posteriorly over that part of the external face of the scapula adjoining (dorsal to) the glenoid cavity, lies on the capsular ligament, and then passes inwards to be inserted on that part of the posterior face of the humerus situated between the proximal (ventral) extremity of the supinator ridge and the lesser tuberosity.

Relations. At its origin the muscle is hidden from view by the infraspinatus, and it arises between this latter muscle anteriorly and the long head of the triceps posteriorly. At its insertion the origin of the internal head of the triceps bounds it distally, while proximally and internally is the insertion of the subscapularis.

ORNITHORHYNCHUS.

Origin. The teres minor arises by a well developed tendon from a ridge, on the external face of the scapula, which runs from the dorso-anterior border of the glenoid cavity posteriorly and dorsally to meet the glenoid crest at the junction of its upper two-thirds with its ventral one-third.

Insertion. Running over the excavated area on the external surface of the scapula immediately anterior to the lower part of the glenoid crest, the muscle comes into relation with the capsular ligament, and running posteriorly it is inserted on the posterior border of the ventral aspect of the lesser tuberosity, lying immediately between the sesamoid bone, on which the sub-scapularis is inserted, and the origin of the internal head of the triceps from the proximal end of the posterior face of the humerus.

Relations. At its origin the muscle is hidden by the infra-spinatus, while the origin of the long head of the triceps is immediately posterior to it.

Innervation. *Echidna* et *Ornithorhynchus:* from the cord formed from the iv., v., vi. cervical nerves; and in *Echidna* also from the N. axillaris.

WESTLING: idem for *Echidna.*

ECHIDNA.

WESTLING says—"The teres minor is absent as a separate muscle; and in *Echidna* and *Ornithorhynchus*, according to Sabatier, it is quite fused with the infraspinatus." Under the title of subscapularis accessorius (Testut) a description is given of the muscle above described by us as teres minor, and in a note Westling says, "von Fewkes M. teres minor benannt." The innervation is given as from "N. axillaris und ein Nerv, der aus demselben Stamm wie besagter Nerv aber mehr proximal als dieser, entsteht."

LECHE follows Westling, and accordingly states that the teres major is absent in the Monotremes.

Mivart says, under teres minor "this muscle appears to be wanting in the Echidna, unless it is represented by the muscle which I have described as the second part of the deltoid." Later on, however, he describes, without naming, "a small delicate muscle closely connected with the outer surface of the capsular ligament, arising from the external surface of the scapula, just anterior to the lowest part of the origin of the scapular head of the triceps."

Ornithorhynchus.

Owen does not mention the teres minor, nor does he describe or mention the small muscle under discussion.

Coues says, under the head of "subscapularis," "this is what would be for most animals the usual position of the infraspinatus, and might be taken for the latter, were it not for its widely distant insertion into the other side of the head of the humerus." He then goes on to describe the muscle as "a small subterete fascicle arising fleshy from that part of the scapula which lies between the glenoid and head of the triceps."

Leche, following Coues, describes this muscle under the head of subscapularis. "Bei Ornithorhynchus ist er kleiner und entspringt von dem, zwischen Cavitas glenoidalis und Triceps-Ursprung gelegenen Theil der Scapula"; but he does not mention this muscle under the heading of M. subscapularis accessorius, where he describes the corresponding muscle of the Echidna.

Meckel does not appear to describe this muscle at all.

Cuvier and Laurillard do not figure it in any of their Plates.

Remarks. With the exception of Fewkes (5) no observer has regarded this muscle as a teres minor; and as we have not been able to see Fewkes' paper, we are unable to say on what grounds he bases his opinion. Westling adopts the name M. subscapularis accessorius, and refers to Testut. The conclusions drawn by the latter author on the origin of this muscle in animals does not, however, give support to Westling's homology, inasmuch as Testut says that the M. subscapularis accessorius arises between the M. teres major and the long head of the triceps.

This origin shows the subscapularis accessorius to belong to the the group of muscles that lie ventral to the glenoid ridge. But when we examine the origin of the teres minor in Monotremes, we find that it is placed between the infraspinatus and the long head of the triceps which arises from the glenoid ridge, that is to say, that its origin is dorsal to the glenoid ridge, and therefore the muscle can have no connection with the subscapular group of muscles.

As regards its insertion, an apparent objection arises, inasmuch as the muscle, instead of being inserted on the posterior aspect of the humerus close to the greater tuberosity, is inserted on the posterior aspect of the humerus close to the lesser tuberosity. But this unusual insertion is not so irregular when we consider that the proximal end of the humerus is flattened and widened to a very great extent, and the distance between the two tuberosities is very considerable, and the insertion of this muscle stretches for some distance over this space without, however, reaching the greater tuberosity. Lastly, the muscle is supplied (in *Echidna*) from two sources. The larger nerve of supply coming from the cord common to it and the N. axillaris, whilst from the latter a small branch is given off which runs to communicate with the larger nerve above mentioned. Westling also mentions this arrangement of the nerve supply in *Echidna;* though we, ourselves, did not find it in *Ornithorhynchus*; there being no communication in this form from the N. axillaris. The nerve supply, therefore, in our opinion, though not conclusive, is strongly in favour of our view that the muscle is really a teres minor.

M. TRICEPS.

ECHIDNA et ORNITHORHYNCHUS: *Triceps*, all authors.

ECHIDNA.

The triceps arises by four heads.

O r i g i n. (*a*) *Scapular portion.*—This arises from the ventral half of the glenoid ridge, and from a ridge on the coracoid just immediately posterior to the glenoid cavity.

Insertion. The origin is by a well marked tendon, and the muscle runs upwards and outwards. As it approaches its insertion the fibres, which spring from the upper part of the glenoid ridge, become superficial, while those from the lower part of the glenoid and the coracoid become deep, and thus two distinct layers are formed, the upper one being inserted on the inner two-thirds of the posterior border of the olecranon, while the deeper one is inserted on the whole posterior border of the olecranon and also on the summit (*i.e.*, dorsal surface) of the olecranon. (Fig. 10, *Trc. S.*).

Relations. At its origin the muscle is related to the infra-spinatus and teres minor anteriorly, and subscapularis posteriorly.

Origin. (*b*) *External humeral head.*—This arises by a thin tendon from a spot situated between the articular head of the humerus proximally, and the origin of the supinator longus and brachialis internus distally.

Insertion. The muscle, small and narrow, runs to be inserted on the external extremity of the dorsal surface of the olecranon in conjunction with the insertion of the proximal one of the internal heads (*c*).

Origin. (*c*) *Proximal internal humeral head.*—This arises from an area on the proximal third of the internal portion of the posterior surface of the humerus. This area is bounded externally by the ventral third of the supinator ridge with the supinator longus and brachialis internus arising from it distally by the origin of the fourth head of the triceps; internally by the sharp internal border of the humerus and the insertion of the teres major, and ventrally by the insertion of the teres minor.

Insertion. The muscle is inserted on the whole length of the summit (dorsal surface) of the olecranon.

Origin. (*d*) *Distal internal humeral head.*—This arises from an area on the distal part of the internal portion of the posterior surface of the humerus. This area is bounded ventrally (proximally) by the origin of the third (*c*) head of the triceps; externally by a line parallel and close to the supinator ridge;

distally by a line running from the supinator ridge to the internal condyle and placed just proximal to the supra-condyloid foramen; internally by the sharp inner edge of the humerus.

Insertion. The muscle is inserted in conjunction with the proximal part (*c*) on the summit of the olecranon.

Relations. The musculo-spiral nerve passes from the internal border of the humerus between the proximal and distal "internal humeral heads," and then passes beneath the outer head.

Ornithorhynchus.

The triceps arises by four heads.

Origin. (*a*) *Scapular portion.*—This arises from the ventral three-fourths of the glenoid border of the scapula. The origin is fleshy for the most part, but becomes tendinous near the glenoid cavity. (Fig. 12, *Trc. S.*).

Insertion. The muscle runs towards the olecranon, becoming twisted on its axis. As it approaches its insertion it becomes split into three layers; an upper, middle and deep. The upper layer is inserted on the internal one-fourth of the posterior edge of the olecranon, the middle on the external two-fifths of the posterior edge of the olecranon, and the deep on the whole length of the summit (dorsal surface) of the olecranon.

Relations. At its origin the muscle is placed between the infraspinatus and teres minor anteriorly, and subscapularis posteriorly.

Origin. (*b*) *External humeral head.*—This arises by two narrow tendons, one from the proximal (ventral) extremity of the supinator ridge close to the articular head of the humerus; the other more externally close to the insertion of the infraspinatus.

Insertion. The two heads run separate for a short distance and then coalesce, and the muscular fibres run towards the olecranon, where the muscle is inserted on the external one-fourth of the posterior edge and summit of the olecranon.

Origin. (*c*) *Proximal internal humeral head.*—This muscle arises from the proximal half of the internal portion of the posterior surface of the humerus; while (*d*) *distal internal humeral head* arises from the distal half of the posterior surface.

Insertion. Both portions of the muscle are inserted on the anterior border of the summit (dorsal surface) of the olecranon. A bundle of fibres differentiated from the inner border of the "proximal internal portion of the muscle" (*c*) is inserted separately at the inner extremity of the olecranon.

Innervation. N. musculo-spiral.

WESTLING—*Echidna:* branch from N. radialis profundus.

ECHIDNA.

WESTLING describes the triceps as arising from (1) the glenoid border of the scapula; (2) from the humerus in two layers, the superficial from the proximal part, the deeper from the distal part of the humerus; (3) a narrow portion associated with the superficial (of 2) and arising by a tendon just distal to the articular head of the humerus. Westling then goes on to say, "zwischen diesem Zipfel [3] und dem übrigen Theil der oberflächlichen Schichte gehen die Arteria brachialis und ein Ast des N. radialis superficialis hindurch. Der Ursprung der tiefern Schichte streckt sich weit distalwärts, wodurch deren distalen Fasern eine völlig horizontale Richtung erhalten und parallel mit dem M. epitrochleo-anconeus (M. antanconeus, Coues) werden, nur durch die Nn. ulnaris und medianus von diesem Muskel getrennt. Sowohl der scapulare wie der humerale Theile inseriren fleischig an der ganzen Breite des Olecranon."

LECHE follows Westling.

MIVART describes the origin from the glenoid border of the scapula, and says that this portion is inserted by muscular fibres on to the whole breadth of the olecranon. "The humeral portion covers the entire posterior surface of the shaft of the humerus, whence alone it takes its origin, with the exception of a small and more or less distinct slip, which arises by a marked tendon from beneath the posterior part of the greater tuberosity immediately external to the origin of the supinator longus. It is inserted in common with the scapular portion, but it forms an arch (extending from the inner condyle to the olecranon), beneath which pass the inferior profunda artery and the ulnar and median nerves. The musculo-spiral nerve passes between the tendon above-mentioned and the rest of the humeral part of the triceps."

ORNITHORHYNCHUS.

OWEN does not describe this muscle.

LECHE refers to Coues, and mentions that Coues' description differs from Meckel's.

Coues calls the long head the rectus humeri, and describes its origin from the scapula.

From the humerus he describes an internal head, vastus internus humeri, and an external head, vastus externus humeri.

MECKEL says—"Extensores antibrachii, flexibus longe fortiores, maximam massæ muscularis brachii partem sistunt. Ex quinque revera componuntur capitibus, fere omnino, etiam in insertione, distinctis. Horum duo inferiores et posteriores extremo superiore per lineæ circiter spatium uniti, a brachii facie extensoria, hic anteriore, orti, ad olecrani partem inferiorem ejusque basin tendunt. Alter alterum ita tegit, ut ille nonnisi summæ faciei anteriori, hic dimidio ipsius superiori uniatur. Tertius, ante hos positus, a scapulæ margine inferiore, statim ante cavum glenoideum oritur et, primo in extremo inferiore nonnihil tectus, medio olecrano inseritur. Quartus, hunc statim excipiens, ex eodem margine medio oritur, ipsum tegit, et cum primo in fine infimo nonnihil confluit. Quintus, ipsi vicinissimus, a scapulæ margine inferiore ortus, apici olecrani inseritur."

CUVIER and LAURILLARD, in Pl. 265 (and in other plates), show this muscle: T. triceps (scapulo-olécranien), portion scapulaire; T.′ idem, portion humérale externe.

M. TRAPEZIUS.

ECHIDNA et ORNITHORHYNCHUS: *M. trapezius*, two parts, all authors.

ECHIDNA.

O r i g i n. (*a*) *Anterior division.*—This part of the trapezius arises by a thin aponeurotic tendon, attached to a well-marked curved depression (linea temporalis) on the parietal bone; slightly from the occipital bone in the mid-line, and also from a tendinous raphe, in the mid-dorsal line, common to it and its fellow of the opposite side. (Fig. 10, *Tr. A.*)

I n s e r t i o n. The muscle runs outwards, posterior and downwards, to be inserted, (*a*) on the anterior one-third of the vertebral border of the scapula; (*b*) on the inner border of the acromion; (*c*) on the outer third of the clavicle. The muscle is not inserted on to the spine of the scapula, though it is attached to it by fascia.

R e l a t i o n s. At its origin the tendon of the muscle is but a thin sheet, but as the muscle runs outwards it becomes thick and fleshy, and at its insertion tendinous fibres are but little seen except in the region of the acromion. The dermo-dorsi cervicalis and the dermo-brachio-cephalic bands of the panniculus lie superficial to the muscle at its origin. When the trapezius is reflected it is seen that as we approach the ventral border of the muscle (which lies superficial to the sterno-mastoid), cleavage takes place in a plane parallel to the surface from within outwards, so that a superficial and a deep layer are formed, and the ventral border of the rhomboid lies between these two layers.

The muscle lies superficial to the rhomboid. On approaching its insertion it covers the insertion of both portions of the acromio-trachelien, and becomes related to the insertion of the posterior portion of the trapezius, scapular origin of the clavicular deltoid, the origin of the infraspinatus, and the outer origin of the acromio-clavicular part of the deltoid.

O r i g i n. *Posterior portion of the trapezius.*—This arises from the spine of the sixth dorsal vertebra, and from the dorsal spines posterior to this to about the 13th, the exact number being indefinite inasmuch as the aponeurosis of the trapezius merges posteriorly into the general dorso-lumbar aponeurosis. The muscle also arises by four distinct slips from the 9th to the 12th rib inclusive. (Figs. 10 et 11, *Tr. P.*)

Insertion. The muscle runs forward and outwards, the aponeurosis giving way (about the level of the 7th rib) to muscular fibres which are inserted on the anterior three-fourths of the external margin of the vertebral border of the scapula.

Relations. Its costal origin is closely related to the origin of the dermo-dorsi-cervicalis. It lies superficial to the latissimus dorsi, and as it approaches its insertion it hides the origins of the slip to the latissimus from the scapula, of the subscapularis, and of the clavicular deltoid. (Fig. 10).

Ornithorhynchus.

Origin. (*a*) The *anterior part of the trapezius* arises from the posterior of the two well-marked depressions on the parietal bone, whose direction is from without posterior and inwards to the median line, and from a ligamentous raphe common to it and the rhomboid, attached in the mid-line of the occipital crest; the posterior limit of the origin of the muscle corresponding to about the distal extremity of the spine of the axis.

Insertion. The muscle, quadrilateral in outline, runs outwards and posterior over the lateral aspect of the head and neck, the tendon of origin giving place to a thick fleshy sheet of muscle which is inserted, (*a*) on the anterior extremity of the vertebral border; (*b*) along the inner border of the spine and acromion; (*c*) on the outer one-fourth of the anterior surface of the clavicle.

Relations. At its origin the brachio-cephalic band of the panniculus arises from the parietal bone immediately anterior to the trapezius, and overlies it, as does also the aponeurosis connected with the termination of the dermo-dorsi cervicalis band of the panniculus. The muscle lies superficial to the rhomboid and hides it anteriorly but not posteriorly.

Origin. (*b*) *Posterior part of the trapezius* arises from the spines of the 5th to about the 13th dorsal vertebra, the exact number not being defined since the tendon of origin blends with the general dorso-lumbar aponeurosis attached to the spine in this region. Besides the spinal origin the muscle arises by fleshy digitations from the dorsal surface of the 10th and 11th ribs, the digitations from the 10th rib being about 1·5 cm. from the median line, while that from the 11th rib lies more external. (Fig. 12, *Tr. P.*)

I n s e r t i o n. The spinous portion, which arises by tendon, soon develops into a sheet of fleshy fibres, and is then joined by the costal portions. The whole muscle now runs forward and slightly outwards, becoming narrower as it approaches the scapula, where it is inserted by a thin flat tendon on the anterior extremity of the vertebral border of the scapula; an aponeurosis, stretching from the vertebral border of its tendon, also serving to attach it to the vertebral border of the scapula.

R e l a t i o n s. At its origin from the ribs the muscle is intimately connected with the dermo-dorsi cervicalis band of the panniculus, and the erector spinæ (sacro-lumbalis), while beneath it lie the costal fibres of origin of the latissimus dorsi. The origin from the spinous processes overlies the greater part of the vertebral origin of the latissimus. As the muscle approaches the scapula it hides from view the costal portions of the serratus magnus, and then overlies in part the teres major and subscapularis, and part of the scapular deltoid. (Fig. 12).

I n n e r v a t i o n. N. accessorius, *Ornithorhynchus* and *Echidna*.

WESTLING: same for *Echidna*.

ECHIDNA.

WESTLING describes this muscle as divided into two portions, an anterior arising from the temporal and parietal bones as well as from a fascia common to it and its fellow of the opposite side; "inseririt an einem Theile des vertebralen Randes der Scapula, an einem Sehnenstrang längs der Spina Scapulæ (nicht an der Spina selbst), am Acromion und am aüssersten (acromialen) Theile der Clavicula."

The posterior portion arises by tendon from the dorsal vertebræ and the 10th-12th rib, and is inserted on to the greater part of the vertebral border of the scapula.

LECHE follows Westling in her description of the first part, but in the description of the posterior portion he says, "von den Ruckenwirbeln wird der 11-12 Rippe."

MIVART says—"This muscle, as in the *Ornithorhynchus* [quoting Meckel and Owen], consists of two parts. The posterior part is triangular and arises from the last eleven dorsal, and the first lumbar, vertebræ." The anterior part, he says, is inserted into the whole length of the spine and acromion, and also into the more anterior part of the vertebral margin of the scapula, and into the outermost end of the clavicle.

ORNITHORHYNCHUS.

OWEN—"The trapezius is divided into two muscles; the posterior portion is an oblong slender triangle arising by a broad tendon from the tenth and eleventh vertebræ and ribs; and inserted by a short strong tendon behind the extremity of the spine of the scapula; the anterior portion arises from the occiput and tendinous raphe connecting it with its fellow of the opposite side, and is inserted into the spine of the scapula and into the outer half of the clavicle."

COUES describes the anterior and posterior part of the muscle. "The latter part," he says, "arises from the 10th and 11th ribs by two fleshy digitations situate respectively 1′ and $1\frac{1}{2}$′ from the back-bone; and from a broad, oval dorsal aponeurosis common to it and its fellow."

LECHE follows Meckel, and says that the anterior part arises from the occiput and ligamentum nuchæ, and that the hinder part arises from the 10th and 11th spinal processes and corresponding ribs.

MECKEL—"Cucullaris in duos, ni graviter fallor, dividitur musculos. Alter, inferior, triangulum refert valde oblongum atque tenuem, vertebra dorsali et costa decima et undecima, tendine lato oritur, dimidio inferiore latissimum tegens, sursum tendit atque tendine brevi, forti scapulæ inseritur marginis superioris fini antico." He then goes on to describe the anterior portion.

Cuvier and Laurillard, in Pl. 265, figure the trapezius as (a) trapèze ou cucullaire, portion occipitale ; (a^1) idem, portion cervicale ; (a^2) idem, portion dorsale ; and they call the whole "dorso-sous-acromien."

M. latissimus dorsi et M. dorso-epitrochlearis.

Echidna : *Anterior, posterior, and scapular portions : the latter = M. dorso-epitrochlearis*, Mivart. *Scapular and anterior portions ; posterior portion = M. dorso-antibrachialis*, Westling, Leche.

Ornithorhynchus : *Superficial and deep portions*, Owen ; *Latissimus dorsi, one muscle only, and a dorso-epitrochlearis*, Coues ; *one muscle only*, Meckel.

Echidna.

The latissimus dorsi is differentiated into three portions :— anterior and posterior dorsal, and scapular.

Origin. (a) *Posterior dorsal portion.*—This muscle arises by fleshy bundles from the 8th to the 14th rib inclusive. The fasciculi from all these ribs are well developed, except from the 14th rib, which has but a few fibres arising from it. No fibres arise from the last rib, the 15th. (Fig. 11, *Lt. D.P.*)

Insertion. The digitations run forwards and outwards and coalesce to form a broad sheet of muscle, which becomes narrower as it approaches the olecranon, and also becomes cleft into two layers. One of these, the superficial and larger division, representing the M. dorso-epitrochlearis, runs downward and is attached by tendon to the sheath of the M. flexor carpi ulnaris, which is inserted on the pisiform bone. The deeper and smaller layer is inserted on the ventral face of the inner portion of the internal condyle ; being placed superficial to the insertion of the anterior division of the latissimus now to be described.

Origin. (b) *Anterior dorsal portion.*—This part of the latissimus arises from the 1st-10th or 11th spine of the dorsal vertebræ. The origin from the 1st-3rd is by fleshy bundles, and by the dorso-lumbar aponeurosis from the rest.

Insertion. The muscle runs outwards and a broad sheet of muscle is developed. As the muscle approaches the internal condyle it becomes rapidly narrower, and its anterior border is now joined by a thick belly of muscle (the scapular portion of the latissimus) which arises from the posterior extremity of the vertebral border of the scapula. (Fig. 10, *Lt. D.S.*) The conjoined muscles continue on and are inserted by a well-marked flattened tendon on the posterior border of the inner part of the internal condyle; the median, ulnar, and deep radial nerves winding from within outwards over the dorsal face of the tendon. (Fig. 10, *Lt. D.A.*)

Relations. At its origin the posterior dorsal portion is intimately related to the origins of the posterior part of the trapezius, the dermo-dorsi cervicalis, and sacro-lumbalis. The anterior portion is likewise intimately related to the origin of the trapezius from the vertebræ. The scapular slip is closely connected at its origin with the origin of the teres major and insertion of the costal serratus. Both the anterior and posterior dorsal portions are triangular in outline, the anterior and posterior borders of the latter being very thin, and while the posterior border of the former is also thin, the anterior border is quite 1 cm. thick where the scapular slip joins it.

Ornithorhynchus.

Origin. (*a*) *Vertebral portion.*—This muscle arises from the spines of the 1st-9th dorsal vertebra inclusive; the origin being fleshy from the 1st-6th inclusive, but by aponeurosis from the 6th-9th spine. (Fig. 12, *Lt. D.A.*)

(*b*) *Costal portion.*—This arises by fleshy bundles from the 4th 12th rib inclusive. The fasciculus attached to the 12th rib is about 2·5 cm. from the mid-dorsal line, while each fasciculus anterior to this gradually approaches nearer to the median line. The costal bands run forward and outwards, coalescing to form a broad triangular sheet of muscle. (Fig. 12, *Lt. D.P.*)

Insertion. The portion of the latissimus arising from the spines of the vertebræ forms a triangular superficial muscle, which hides from view the antero-internal portion of the muscle formed by the coalescence of the costal fasciculi. As the vertebral and costal portions of the muscle run outwards and forwards they become rapidly narrower. From the ventral border of the costal portion there is now given off a fasciculus of muscle, which running outwards and downwards winds round the ulnar border of the forearm to reach its dorsal surface, where it becomes intimately connected with the fascia of the M. flexor carpi ulnaris. This fasciculus represents the M. dorso-epitrochlearis. (Figs. 9, 10, *D. Ep.*) The remaining portion of the costal division develops a tendon, and running inwards and ventral to the tendon of the vertebral portion, becomes inserted on the antero-internal surface of the humerus just internal to the median third of the pectoro-deltoid ridge, and distal to the insertion of the coraco-brachialis brevis. The vertebral portion, which does not become so narrow, runs to be inserted by a well-marked flat tendon on a strongly developed ridge situated on the distal narrow portion of the antero-internal face of the humerus, reaching almost to the coraco-brachialis longus insertion on the ento-condylar ridge. (Fig. 9, *Lt. D.P.; Lt. D.A.*)

Relations. The digitations arising from the posterior ribs are intimately connected with the dermo-dorsi cervicalis, and the trapezius. The fibres of the sacro-lumbalis running over the ribs have the same direction as the fibres of the latissimus dorsi: no doubt this induced Owen to describe the latissimus as arising from the posterior ribs, lumbar region, and pelvis. At its insertions on the humerus the tendons are hidden from view by the biceps and coraco-brachialis longus.

Innervation. *Echidna:* Latissimus dorsi (*a*) scapular portion, from vi. cervical nerve; (*b*) anterior dorsal portion from vi. and vii. cervical nerves. (Fig. 13; 38-40.) *Ornithorhynchus:* anterior and posterior dorsal portions from vi. and vii. cervical nerves. (Fig. 16; 39-40.) *Echidna:* Dorso-epitrochlear, vii. cervical nerve. *Ornithorhynchus:* vii., viii., cervical nerves, and i. and ii. dorsal nerves.

Westling—*Echidna:* Scapular and anterior dorsal portions: "Die beiden Portionen des Muskels werden von zwei aus den M. cervicales v., vi. and vii. ausgehenden Nn. subscapulares versorgt. Ausserden sendet der aus denselben Plexusnerven zum M. dorso-antebrachialis ausgehende Nerv einen Ast zur grössern Portion des M. latissimus dorsi." *Ornithorhynchus* (*vide* Fig. 17, *L.D. L.C.*)

ECHIDNA.

WESTLING says—"M. latissimus dorsi besteht aus zwei Theilen. Die Hauptportion entspringt sehnig von den Proc. spinosi der 11 vordern Thoracalwirbel und in etwas von der Fascia lumbo-dorsalis; die kleinere dagegen entspringt gemeinsam mit dem M. teres major vom hintern Winkel der Scapula und von der Ursprungssehne des letztern Muskels. Zu Einem Muskel vereinigt inseriren die beiden Portionen am Condylus internus hum. Innervation: die beiden Portionen des Muskels werden von zwei aus den M. cervicales v., vi. und vii. ausgehenden Nn. subscapulares versorgt. Ausserdem sendet der aus denselben Plexusnerven zum M. dorso-antebrachialis ausgehende Nerv einen Ast zur grössern Portion des M. latissimus dorsi."

In a note on the origin of the "Hauptportion," Westling quotes Alix from Testut, "le muscle grand dorsal s'attacherait à toute la série épineuse de la région dorsale."

Later on Westling writes, under M. dorso-antebrachialis, "Zu den Muskeln des Oberarms dürfte auch in Folge seiner Homologa ein Muskel gerechnet werden können, welcher bis auf Weiteres den Namen Dorso-antebrachialis führen mag. Er entspringt fleischig von den Dorsaltheilen der 8-13 Rippe, verläuft mit convergirenden Fasern gegen den Condylus internus humeri, über welchem er nach dem Unterarme sich begiebt, um mit dessen Fascie und dem M. flexor carpi ulnaris sich folgendermassen zu vereinigen: ein Theil des letztgenannten Muskels befestigt sich an einer die innere Fläche des M. dorso antebrachialis bekleidenden Aponeurose, worauf die gemeinsame Sehne beider Muskeln am Os pisiforme inserirt. Vom M. latissimus dorsi wird der fragliche Muskel durch eine starke Fascie getrennt. Innervation: (1) der proximale Theil durch einen Nerven aus den Nn. cervicales v., vi. und vii., welcher Nerv auch einen Ast zur grössern Portion des M. latissimus dorsi sendet; (2) der distale Theil durch einen Ast des N. radialis profundus."

In a note to the above, Westling says: "Dieser Muskel ist es, welchen Fewkes M. dermo-flexor antebrachii benannt hat."

Westling then considers the homology of what we have described as the dorso-epitrochlear and the posterior portion of the latissimus. She admits that the dorso-epitrochlear "hat eine deutliche Übereinstimmung mit dem bei manchen Thieren vorkommenden M. dorso-epitrochlearis," and goes on to say: "Der proximale Theil ist wiederum einem bei Galeopithecus von Leche nachgewiesenen Muskel, dem M. dorso-brachialis, ähnlich, der mit einem Flatterhautmuskel der Chiroptera homolog ist." Her conclusions are: "Aus dem oben Gesagten dürfte hervorgehen, dass der M. dorso-brachialis bei Galeopithecus wie dem M. dorso-epitrochlearis entspricht. So viel, ich weiss, kommt bei keinem andern Säugethiere als bei Echidna ein ähnlicher Muskel vor, nicht einmal bei Ornithorhynchus, der einen M. dorso-epitrochlearis mit Ursprung wie gewöhnlich vom M. latissimus dorsi besitzt."

TESTUT—"Le muscle dorso-epitrochléen chez les animaux." "Nous trouvons, chez l'Echidné, un muscle analogue qui a été parfaitement décrit par M. Alix; c'est un faisceau volumineux, prenant naissance sur les 10^e, 11^e, 12^e, 13^e et 14^e côtes, se dirigeant vers le coude, glissant entre l'épitrochlée et l'olécrâne et se terminant à la partie moyenne de l'avant-bras, sur un tendon qui vient se fixier sur le pisiforme. Ce tendon uni en dedans à celui du muscle cubital antérieur, s'unit en dehors à l'aponéurose antibrachiale et, par l'intermédiare de cette aponéurose, il se continue avec l'aponéurose palmaire."

LECHE follows Westling.

MIVART says—"There are two distinct muscles which seem to me together to represent the latissimus dorsi. The posterior one of these is very elongated, and is triangular in shape from its origin as far as the elbow. It arises, by digitations, from six ribs (namely, from the eighth to the thirteenth), and, becoming narrower, passes beneath the interior condyle. A little below the middle of the forearm it becomes intimately united with the surface of the flexor carpi ulnaris. The anterior muscle is wider, but shorter than the preceding; it arises from the spines of the first eleven dorsal vertebræ, and also somewhat from the fascia lumborum. It is inserted into the inner condyle of the humerus, in union with what appears to be the dorso-epitrochlear."

Dorso-epitrochlear (?) of Mivart.—"There is a long narrow muscle arising from the posterior extremity of the vertebral margin of the scapula, and from the posterior and outer side of the tendon of origin of the teres major. It passes downwards and becomes intimately connected with the second part of the latissimus dorsi, in common with which it is inserted, by a very strong tendon, into the internal condyle of the humerus. This muscle appears to me to represent the dorso-epitrochlear. Its origin is very similar to that of the last-named muscle in the Hyrax, though its insertion is certainly different, and it might perhaps be regarded as a separate portion of the teres major."

ORNITHORHYNCHUS.

OWEN says—"The latissimus dorsi, a very long and broad muscle, arises from the spines of all the dorsal and lumbar vertebræ, and from the eleven posterior ribs; it is inserted by a broad and strong tendon into the distal half of the ulnar margin of the humerus. At its anterior part this muscle may be separated into a superficial and deep stratum."

LECHE says—"Bei Ornithorhynchus entspringt er dagegen von allen Brust- und Lendenwirbeln sowie von den 8 oder 11 hintern Rippen; inserirt an der Mitte des ulnaren Humerus-Randes; zerfällt im Insertionstheile in eine, oberflächliche und eine tiefere Schicht (Meckel). Eine etwas abweichende Schilderung giebt Coues."

COUES says—"Latissimus dorsi—notable for its extensive costal, and correspondingly slight spinal origin. It arises by aponeurosis for about six dorsal vertebræ (4th-9th), beginning at a point just opposite the shoulder, to which therefore the upper border passes directly transverse; most of this spinal portion is thicker than the costal. The latter origin is by a series of fleshy slips from the 7th to the 14th ribs, in a slightly irregular curved line, the convexity of which is forward . . . . Insertion by a short wide, thin flat tendon in an oblique line upon the humerus, half way up the pectoral crest, and thence along the ento-condylar ridge to the elbow."

"*Dorso-epitrochlearis.* The forearm slip from the latissimus is very well developed. It is given off obliquely from the lower border of the muscle, a little more than an inch from its humeral insertion, and mounts upon the back of the forearm, crossing the limb over the most prominent ridge of the latter. It appears to end in fascia over the middle of the back of the forearm, but may be traced, without unduly forcing the dissection, to pretty definite insertion into the ulna itself, at about the middle of the bone. The slip is of a nearly uniform width of about a third of an inch, and is thin and flat; it has the usual action."

MECKEL—"Latissimus dorsi, musculus longissimus et latissimus, a processibus spinosis vertebrarum dorsalium lumbariumque omnium, nec non costarum inferiorum undecim parte posteriori et media ortus, ad dimidium marginis ulnaris ossis humeri inferius tendit, cui tendine lato, crasso et forti, inseritur."

CUVIER and LAURILLARD, in Pl. 266, fig. 1, show the latissimus dorsi as (I.) grand dorsal and (I′) idem, portio costale; "Cuvier la désige aussi par opposition à la portion antérieure et supérieure, qu' il appelle portion spinale." [Note to the figure.]

With regard to the divisions of the latissimus dorsi we do not hesitate to say that the view taken by Mivart, that the scapular portion of the latissimus (in *Echidna*) is the representative of the dorso-epitrochlear, is entirely wrong.

Concerning that portion of the muscle described by Mivart as "posterior dorsal," we quite agree with him, that this is part of the true latissimus dorsi, and we do not agree with the conclusions arrived at by Westling with regard to this muscle and the dorso-epitrochlear; still less do we agree with Fewkes, who regards this portion of the latissimus as part of the panniculus, *i.e.*, M. dermo-flexor antebrachii.

M. RHOMBOIDEUS.

ECHIDNA et ORNITHORHYNCHUS: *M. rhomboideus*, all authors.

ECHIDNA.

Origin. The rhomboid is imperfectly divided into anterior and posterior portions. The anterior and larger portion arises by an aponeurotic tendon from the linea temporalis on the parietal bone, and from the median raphe as far back as the 5th cervical vertebra.

Insertion. The muscle runs outwards and posterior under cover of the trapezius, and is inserted along the anterior three-fourths of the vertebral margin of the scapula.

Origin. (*a*) *Posterior portion.*—This part, imperfectly differentiated from the anterior, is represented by a narrow band of muscular fibres arising from the median raphe (in intimate connection with its fellows of the opposite side) in the region of the 5th and 6th cervical spines.

Insertion. Running upwards and outwards it is inserted on the inner margin of the posterior portion of the vertebral border of the scapula; being placed between the anterior part of the rhomboid and the insertion of the costal portion of the serratus magnus.

Relations. The anterior rhomboid at its origin lies under cover of the trapezius, and has a similar thin aponeurotic tendon of origin. As it runs posteriorly it becomes fleshy and a thick sheet of muscle is developed which is continued to its insertion; tendinous fibres being developed only at the junction of the insertion of the anterior and posterior parts. From the manner in which the posterior portion is connected with its fellow of the opposite side, this part strongly resembles the transverse cervical muscle of some animals.

ORNITHORHYNCHUS.

Origin. The rhomboid may likewise be divided into anterior and posterior parts. The anterior portion arises from a curved depression on the parietal bone immediately postero-external to the depression from which the trapezius takes origin; and from the median raphe (lig. nuchæ, Meckel) common to this muscle and the anterior part of the trapezius, and which is attached to the mid point of the occipital crest: the posterior limit of this cervical origin reaching to about the spine of the 4th cervical vertebra. The posterior portion is represented by a narrow fasciculus differentiated from the anterior part, and which arises from the median raphe in the region of the 5th cervical spine.

Insertion. The fibres of the anterior part of the muscle run outwards and posterior, while the posterior fibres run outwards and somewhat forward, the whole muscle being inserted on the posterior half of the vertebral border of the scapula (with the exception of a small area close to the distal extremity of this border occupied by the costal serratus and slip to the latissimus).

Relations. The rhomboid is hidden anteriorly by the anterior part of the trapezius. Its insertion is related to the teres major externally, costal serratus posteriorly, and cervical portion of the serratus internally, while anteriorly is the acromio-trachelien.

Innervation. *Echidna*: ii., iii., cervical nerves. *Ornithorhynchus*: iii., cervical nerve.

WESTLING: same as above.

ECHIDNA.

WESTLING describes the origin from the parietal bone and the dorsal middle line of the neck, and the insertion into the greater part of the vertebral border of the scapula parallel to the insertion of the posterior portion of the trapezius. The nerve supply from ii. and iii. cervical nerves.

LECHE follows Westling.

MIVART describes the origin from the occiput and mid-line of the back of the neck, and the insertion as Westling does.

ORNITHORHYNCHUS.

OWEN says—"The rhomboid is a single muscle, but thick and long, and inserted into the narrow base of the scapula."

COUES describes the rhomboid as, "single, of large size and thick," and states its origin, and its insertion, as "broad and fleshy into the apex behind, and about one-third along the posterior border of the scapula."

MECKEL—"Rhomboideus, unus tantum sed crassus, valde longus, cucullari tamen tenuior, a marginis scapulæ superioris dimidio inferiore ad occiput tendit, a cucullari tectus spatio satis amplo inseritur."

CUVIER and LAURILLARD give, in Pl. 266, fig. 1, a figure of the rhomboid, and describe it in three parts, (c) rhomboide de la tête, (c^1) du cou, (c^2) du dos, and they call the whole "dorso-trachélien."

M. LEVATOR SCAPULÆ ET M. SERRATUS MAGNUS.

ECHIDNA: *M. levator scapulæ, et M. serratus magnus*, Westling, Leche, Mivart.

ORNITHORHYNCHUS: *Costo-scapularis, serratus magnus s. anticus, et levatores anguli scapulæ*, Coues; *Serratus anticus*, Meckel; *Grand dentelé*, Cuvier and Laurillard.

M. LEVATOR SCAPULÆ.

ECHIDNA.

Origin. This muscle arises from the tips of the transverse processes of six cervical vertebræ, viz., from the axis to the 7th inclusive.

Insertion. The muscular bellies from these origins spread out to form fan-shaped muscles, which are inserted on the greater part of the suprascapula, and along a narrow curved area of the inner face of the scapula adjoining the whole length of the vertebral border and the upper two-fifths of the spine.

Relations. At its origin the acromio-trachelien hides the muscle from view; at its insertion the muscle is related to the insertions of the serratus, rhomboid, and dorsal part of the acromio-trachelien.

M. SERRATUS MAGNUS.

Origin. This muscle arises from the first four ribs, the origin from the first rib being placed about ·6 cm. from the spinal extremity of the rib, while the origins from the other ribs are placed successively further out.

Insertion. The four slips are collected into one belly of muscle, which is inserted on to the posterior one-sixth of the vertebral border of the scapula; the insertion being closely related to, and placed between, the origin of the teres major and scapular part of the latissimus, and the insertion of the posterior portion of the levator scapulæ internally.

Relations. At its origin the muscle is related to the digitation of the external oblique, while the slip from the first rib is related to the costo-coracoideus and scalenus. In its course the latissimus dorsi passes superficial to it, and hides it from view.

M. LEVATOR SCAPULÆ.

ORNITHORHYNCHUS.

This muscle is divided into two portions, a dorsal stratum, and a ventral stratum.

Origin. (*a*) *Dorsal portion.*—This arises by six digitations from the tips of the transverse processes of six cervical vertebræ (2nd-7th).

Insertion. The terete bands run towards the scapula and coalesce to form a single muscle, which is inserted on the posterior half of the inner edge of the vertebral border of the scapula. The bands from the second and third cervical vertebræ are intimately connected with the ventral bands from these vertebræ, while the bands from the more posterior vertebræ are connected with the serratus magnus.

Relations. At its insertion the muscle is related to the serratus magnus, rhomboid, acromio-trachelien and to the subscapularis.

Origin. (*b*) The *ventral portion* arises by five digitations from the transverse processes of five cervical vertebræ (2nd-6th).

Insertion. The terete bands run to the scapula; the bands from the second and the third vertebræ are inserted on the inner half of the vertebral border of the scapula, while the remaining bands are inserted on the whole length of the anterior costa, and that portion of the supraspinous fossa lying between the insertion of the ventral part of the acromio-trachelien and the true anterior costa.

Relations. At its origin the muscle is placed between the scalenus and the dorsal portion of the levator scapulæ.

M. SERRATUS MAGNUS.

Origin. This muscle arises by three digitations from the first three ribs at a point about half way between the spine and the sternum. (Fig. 7, *S.M.C.*)

Insertion. The three bands run towards the scapula and, coalescing, are inserted by a fine tendon on the inner edge, close to the posterior extremity, of the vertebral border of the scapula.

Relations. At its origin the muscle is related to the digitations of the external oblique, and the slip from the first rib is also related to the scalenus and costo-coracoideus. At its insertion it is related to the rhomboid, levator scapulæ and teres major.

Innervation. *Echidna:* levator scapulæ, from iii. cervical nerve; serratus from v. and vi. cervical nerves. *Ornithorhynchus:* levator scapulæ and serratus, iii., iv., v., vi. cervical nerves.

WESTLING—*Echidna*: ii., iii. and vi. cervical nerves.

ECHIDNA.

WESTLING gives the origin from the transverse processes of the 2nd-7th cervical vertebræ, and from the 1st-5th ribs. Insertion on to the median half of the ventral surface and vertebral border of the scapula.

LECHE follows Westling.

MIVART says of serratus magnus and levator anguli scapulæ—"These muscles together form one large and thick layer arising from the first four ribs and from the transverse processes of all the cervical vertebræ from the seventh to the axis inclusive."

ORNITHORHYNCHUS.

OWEN does not mention these muscles.

COUES describes these muscles separately, as costo-scapularis, serratus magnus s. anticus, and levatores anguli scapulæ.

The costo-scapularis is described by Coues as arising from the first three ribs.

LECHE does not mention these muscles.

MECKEL—"Serratus anticus in musculos duos, omnino separatos, secessit. Horum superior, fere quadratus, sex fasciculis vertebris colli inferioribus quinque et dorsi primæ inseritur, a margine scapulæ postico ortum ducens."

"Inferior, multo longior, sed angustior, triangularis ab apice scapulæ inferiore fasciculis tribus ad costas tres proficiscens, versus extremum anterius faciei earum externæ inseritur."

CUVIER and LAURILLARD, on Pl. 266, figure these muscles in fig 1, "*g*" grand dentelé (scapulo-costien). The letter (*g*) close to the letter *o* (teres major) is the costal part of the muscle, but the other *g* appears to us to be really on the deep part of the acromio-trachelien, as also shown in fig. 2.

M. STERNO-MASTOIDEUS et M. EPISTERNO-CLEIDO-MASTOIDEUS.

ECHIDNA: *M. sterno-mastoideus*, all authors.

ORNITHORHYNCHUS: *Sterno-mastoid*, Owen; *Nutator capitis*, Meckel; *Sterno-mastoid et Cleido-mastoid (?)*, Coues; *Cleido-mastoidien, et Sterno-mastoidien ou trachélien*, Cuvier and Laurillard.

M. STERNO-MASTOIDEUS. (Fig. 1, *S.M.*)

ECHIDNA.

Origin. When the superficial layer of the panniculus and the fascia beneath are reflected from the sternal region, the sterno-mastoid is displayed. The muscle, closely connected with its fellow of the opposite side, has an origin from the mid-line of the mesosternum, as far back as the ventral extremity of the fourth rib, and extending forward over the presternum and posterior half of the median portion of the interclavicle.

Insertion. From this origin the muscle runs forward and outwards as a broad band, hiding from view portion of the P. major and clavicular deltoid, then running superficial to the omo-hyoid and acromio-trachelien the muscle is inserted, under cover of the anterior part of the trapezius, on the temporal bone dorsal and immediately anterior to, the retro-temporal foramen.

M. EPISTERNO-CLEIDO-MASTOIDEUS. (Fig. 7, *E.C.M.*)

ORNITHORHYNCHUS.

Origin. (*a*) *Superficial portion.*—This arises from the inner half of the anterior surface of the clavicle, and the anterior surface of the median portion of the interclavicle between the inner extremities of the clavicles.

Insertion. From this origin, which is tendinous, the muscle runs forwards and outwards and dorsally over the posterior portion of the mandible and the zygomatic process, to be inserted on the dorso-anterior border of that part of the squamosal that stands out as a well-marked process from the skull.

Origin. (*b*) *Deep portion* (*cleido-mastoideus*).—This is seen as a thin band springing from the mid-point of the anterior surface of the clavicle.

Insertion. It runs under cover of the external border of the superficial portion, and winding round the posterior extremity of the mandible, is inserted immediately posterior to the superficial portion on the squamosal.

Relations. At its origin its outer border is placed close to the insertion of the anterior trapezius on the clavicle.

Innervation. *Echidna:* N. accessorius and a branch from ii. cervical nerve. *Ornithorhynchus:* N. accessorius.

WESTLING —*Echidna:* N. accessorius and branch from ii. cervical nerve.

ECHIDNA.

WESTLING gives the origin from the episternum, manubrium sterni, and greater part of the sternum; and the insertion by means of a tendon on the cranium anterior to and above the meatus. She then states that the M. cleido-mastoideus is absent.

Leche follows Westling.

Mivart describes the origin and insertion, and then remarks—"It is an interesting fact that the sterno-mastoid does not arise from the anterior border of the shoulder-girdle, but as it were follows its own normal point of attachment (the manubrium) backwards behind the episternum.

Ornithorhynchus.

Owen describes the muscle as double on both sides.

Coues was unable to describe the origin of the muscle, as the head of his animal was injured. He remarks—"The sterno-mastoid is double on each side, unless one portion is cleido-mastoid."

Leche follows Coues, and expresses his opinion that the muscles are but cleft sterno-mastoids.

Meckel describes the muscle under the name of nutator capitis.

Cuvier and Laurillard figure as (b^1) the cleido-mastoidien ou trachélien, and this is the superficial belly. On Pl. 268, fig. 2 (b), is called sterno-mastoidien ou trachélien, and is evidently the deeper (dorsal) belly of the muscle.

M. acromio-trachelien.

Echidna: *Levator claviculæ*, Westling, Mivart, Leche.

Ornithorhynchus: *Levator scapulæ*, Meckel; *Atlanto-acromialis*, *vs Atlanto-scapularis*, Coues; *Acromio-trachélien*, Cuvier and Laurillard.

Echidna.

Origin. (*a*) *Dorsal portion of acromio-trachelien.*—This muscle has a small origin from the ventral aspect of the atlas; its chief origin being, however, from the basioccipital, and from the mastoid region. That portion of its origin from the atlas and occiput is connected with the tendon of origin of the muscle on the opposite side by a delicate aponeurosis stretching ventral to the atlas.

Insertion. The muscle runs posteriorly and outwards, then dorsally to be inserted on the anterior three-fourths of the inner aspect of the vertebral border of the scapula. The insertion is placed between the rhomboid externally, and serratus magnus internally; the first-named muscle hiding the insertion from view.

Origin. (*b*) *Ventral portion.*—This is smaller and is placed at its origin superficial to the portion just described. It arises from the ventral surface of the atlas close to the median line, and from a tendon which stretches between this spot and the transverse process of the axis, and forms an arch from which the muscular fibres spring.

Insertion. The muscle runs posteriorly and externally to be inserted on the whole of the inner surface of the acromion and ventral third of the spine of the scapula; also on the dorsal surface of the inner one-fourth of the clavicle; being placed under cover of the insertion of the anterior part of the trapezius.

ORNITHORHYNCHUS.

Origin. (*a*) *Dorsal portion.*—This arises by a thin flat tendon from the external border of the distal extremity of the hypapophysis of the atlas.

Insertion. The muscle runs posteriorly and outwards, becoming much broader and passing superficial to the prevertebral region is inserted on the upper part of the spine and anterior half of the vertebral border of the scapula; the insertion being placed between the serratus magnus internally, rhomboid posteriorly, and the anterior part of the trapezius antero-externally.

Origin. (*b*) *Ventral portion.*—This is placed superficial to the dorsal portion, and arises by a narrow flat tendon from the ventral surface and distal extremity of the hypapophysis of the atlas; being intimately related with the tendon of the dorsal portion, and also with the scalenus which arises from the hypapophysis.

Insertion. The muscle runs posteriorly and outwards, spreading out like a fan to be inserted on the lower two-thirds of the spine and the immediately adjacent inner surface of the scapula, and on the inner border and surface of the acromion and the distal part of the dorsal face of the clavicle; the trapezius being placed antero-externally, and the serratus magnus postero-internally, and omohyoid ventro-internally to the insertion.

Innervation. *Echidna:* Dorsal portion, ii. cervical nerve; ventral portion, iii. cervical nerve. *Ornithorhynchus:* Both portions, iii. cervical nerve.

WESTLING—*Echidna:* "Die beiden Theile des Muskels werden von den Aesten der 2 und 3 Halsnerven."

ECHIDNA.

WESTLING, under levator claviculæ, says—"This muscle is well developed and is divided into two portions, which are intimately related along the mid-line at their origins. One portion arises from the ventral surface of the atlas and the transverse process of the following vertebra, and is inserted on the acromion and the clavicle. The other portion arises from the basis cranii "caudal vom Ohre und dem Foramen jugulare," and is inserted on the anterior part of the vertebral border of the scapula. The nerve supply to both portions of the muscle is from the ii. and iii. cervical nerves; the same nerves supplying the rhomboid.

LECHE follows Westling.

MIVART says, under levator claviculæ (?)—"There are two flat and rather thin bands of muscular fibre which are closely connected at their origin, and together appear to represent this muscle." He then describes the muscles; the superficial one being thin, which is inserted on the clavicle.

ORNITHORHYNCHUS.

OWEN does not mention this muscle.

COUES says—"We have two distinct muscles, both arising from the spine of the atlas hypapophysis, but with separate scapular attachments; each of these is a single belly." He then describes the two parts under the names "atlanto-acromialis" and "atlanto-scapularis." Of the latter muscle he says, "it has somewhat the appearance of an enlarged and distinct fasciculus of the levator proper, with which it is inserted, fleshy on to the antero-internal surface and upper border of the scapula near its apex."

Leche follows Coues and Meckel, and describes two portions under the names "P. ventralis," inserted on the crista scapulæ, and "P. dorsalis," inserted on the basis scapulæ.

Meckel says, "levator scapulæ in duos divisus videtur." He then gives a full description of the two parts.

Cuvier and Laurillard, in Pl. 266, fig. 2, show the superficial one of these muscles as "*d*" the omo- ou acromio-trachélien, and it appears to us that the letter (*g*) quite close to (*d*) is on the deeper part of these muscles, although (*g*) is taken as part of the serratus magnus, and is called grand dentele (scapulo-costien).

M. OMO-HYOIDEUS.

Echidna et Ornithorhynchus: *Omo-hyoid*, all authors except Meckel; *Omo-mylo-hyoideus*, Meckel.

Echidna.

Origin. The omo-hyoid arises from a ridge on the inner face of the scapula immediately distal to the dorsal border of the origin of the supraspinatus.

Insertion. Passing forwards and inwards under the acromio-trachelien and sterno-mastoid, then under the large sub-maxillary gland, the muscle approaches the hyoid. It now splits into a superficial and a deep layer. The deep (dorsal) layer is the smaller, and is inserted on the basihyal; the superficial (ventral) is continued on and is inserted chiefly into a median raphe common to it and the stylohyoid; some of the fibres, however, are lost in the aponeurosis covering this region.

There is no tendinous intersection in this muscle.

Ornithorhynchus.

Origin. The muscle arises from the inner surface of the scapula from a small area situated between the origin of the supraspinatus and the ventral extremity of the true anterior costa.

Insertion. Running forwards and inwards a tendinous intersection crosses the muscle, running from within outwards and posteriorly. This is not seen distinctly until the muscle is reflected, and then it is further seen that anterior to the intersection the muscle is cleft into two layers. The deeper (dorsal one) is inserted on the basihyal, while the superficial (ventral) one is continued on and is inserted into a tendinous intersection common to it and the mylohyoid and stylohyoid; some of the fibres being, however, continuous without interruption with those of the mylohyoid, while a few fibres are inserted on the ceratohyal.

Echidna.

Westling gives the origin from the scapula between the supraspinatus and the acromio-trachelien, and says that as in *Ornithorhynchus* it has no tendinous intersection. Its anterior extremity is split into two layers, the dorsal one of which is inserted on the larynx and the hyoid "die ventrale vereinigt sich mittelst Aponeurose mit den übrigen Zungenbeinmuskeln, um sich an die Basis der Zunge zu heften."

Leche follows Westling.

Mivart describes this muscle.

Ornithorhynchus.

Owen merely mentions that "the omohyoid and the mylohyoid have a common insertion into the hyoid."

Coues says the "mylohyoid and omohyoid are connected, if not continuous, at the hyoid bone; there is trace of a tendinous intersection, but the hyoid insertion (in the side of the body of the bone) of the two is identical, and some at least of the muscular fibres are not interrupted." In another place he says, "the omohyoid is continuous with the mylohyoid at its hyoid point of insertion, and there is no division into two bellies by a tendinous intersection, nor any confining of the muscle in its continuity by an aponeurotic pulley. Above it is partly divisible into two fasciculi, the smaller internal one of which is inserted lower down on the hyoid than the other, and is distinct from mylohyoid."

LECHE says—" Bei Ornithorhynchus entspringt er vom Os coracoideum und von der Scapula; spaltet sich wie bei Echidna; die dorsale Schichte inserirt an der Innerfläche des Unterkiefers, die ventrale am Basihyale."

MECKEL—" Musculi ossis hyoidis . . . . ex illis primus est omo-mylohyoideus. Hoc nomine venire debet musculus satis longus et latus, a parte scapulæ coracoideæ et quidem a marginis ipsius superioris dimidio minore externo oriundus. Initio simplex, infra ramo transverso ossis Tformis tectus adscendit, mox in stratum superficiale et profundum fissus. Profundum corpori hyoidis affigitur, superficiale extrorsum et antrorsum versum maxillæ inferioris faciei internæ, paullo ante ipsius extremum posticum inseritur. Quamvis musculus hic maxillæ inferiori inseratur, minime haec ipsius pars pro mylohyoideo haberi debet, quum praeter ipsum verus, mylohyoideus adsit, nec insertio, in faciem externam facta, conveniat. Caput fortiter deprimere, et os aperire valet.

" Cl. Blainvillius, nulla omo-hyoidei adesse vestigia monens, hunc musculum cum sterno-thyroideo atque hyoideo confudisse videtur."

CUVIER and LAURILLARD, in Pl. 266, fig. 2 (*e*), omohyoidien.

TESTUT says—" Du reste, nous voyons dans quelques espèces animales le muscle omohyöidien lui-même envoyer quelques faisceaux au-dessus de l'os hyöide; chez l'Ornithorhynque notamment, d'après Cuvier et Duvernoy, le muscle omohyöidien est un double muscle qui s'attache au corps de l'os hyoide et à la face interne et postérieure de la mâchoire inférieure." Testut further says that Macalister has seen a fasciculus of the omohyoid pass into the mylohyoid, after having passed over (without becoming attached to) the hyoid. Wood has noticed the union of the mylohyoid with the stylohyoid.

NERVES.

ECHIDNA. (Figs. 13, 14).

N. accessorius (4). The spinal accessory is a large nerve, and after emerging from the jugular foramen it runs posteriorly and gives off a small branch (3) which joins a twig from the second cervical nerve, to supply the sterno-mastoid muscle (2). Continuing on its course the main trunk of the nerve receives a branch from the second cervical nerve (5), and also from the third cervical (6), and piercing through the anterior part of the trapezius it supplies it (8), and ends in the posterior portion of this muscle (7).

N. hypoglossus (13). After emerging from the skull this nerve runs towards the median ventral line, where it supplies the hyoid muscles and gives off a large branch which runs posteriorly, and receives branches from the first (13A) and second (14) cervical nerves, after which it gives off a twig to supply the omohyoid (15); and running towards the median ventral line it reaches almost to the presternum.

N. phrenicus (17) springs from the third cervical nerve. Passing posterior it obtains branches from the fourth cervical (17A) and the fifth cervical, and also two thin twigs from the nerve to the subclavius (21).

N. cervicalis i., is small, and after giving off a branch (13A) to the descending part of the hypoglossus, ends in muscular branches.

N. cervicalis ii., considerably larger than the first, gives off a branch (5) (14) to the descending part of the hypoglossus, and a branch to the spinal accessory; also one which joins a branch from the spinal accessory to the sterno-mastoid (2); a twig to a branch from the third; and some twigs which run to the auricular region; while the nerve terminates about the mid-ventral line, by breaking up into numerous fine cutaneous branches. Besides these branches the second nerve gives off a large branch which, after supplying the "dorsal part of the acromio-trachelien (11)," joins with a branch from the third cervical nerve to form the nerve to the rhomboid (9).

N. cervicalis iii. This divides into two branches. The anterior of these sends off immediately a branch which, after supplying the ventral portion of the acromio-trachelien (12), continues on, and joining the branch from the second nerve, forms the nerve to the rhomboid (9). The anterior division runs outwards and breaks up into numerous twigs which supply the side of the neck and communicate with branches from other nerves (6, 10).

The posterior division of the third nerve, after giving origin to the phrenic, sends a large branch to the levator scapulæ portion of the serratus magnus (20); then a branch to the fourth cervical nerve, and then numerous cutaneous and communicating twigs to the side of the neck (6, 10).

N. cervicalis iv. This divides into two divisions. The anterior runs outwards to the lateral aspect of the neck, where it is joined by branches from the third nerve, and after this it sends branches posteriorly over the clavicular region. The posterior division runs posteriorly, and after communicating with the phrenic it joins the fifth cervical nerve.

Plexus brachialis. The brachial plexus is formed by v., vi., vii., and viii. cervical, and i dorsal nerves, together with branches from the iv. cervical and ii. dorsal nerves After the branch from the fourth nerve has joined the fifth, there spring from the junction the following branches:—(*a*) A twig to the phrenic (21A). (*b*) The nerve to supply the costo-coracoid (21) and sterno-epicoracoid muscles (21*b*). This nerve runs posteriorly and inwards, giving off two twigs to the phrenic in its course; and having entered the costo-coracoid it supplies this muscle and ends in the sterno-epicoracoid. (*c*) The N. supracoracoideus (22) is a large trunk which takes an antero-ventral course, and emerging between the epicoraco-humeral and the supraspinatus, and having sent a branch to supply the latter (25) muscle and the infraspinatus (26), it then supplies the epicoraco-humeral (22A); it gives off a minute twig which runs towards the median line and emerges between the pectoralis major and the clavicular part of the deltoid. The remainder of the nerve stem pierces the clavicular deltoid (and may possibly give this muscle a minute branch), and then becomes cutaneous, "ramus cutaneus N. supracoracoideus" (*vide* further remarks on this nerve, *post*). (*d*) A cord (51) which joins cords from the vi. and vii. cervical nerves. (*e*) A cord (52) which joins one of the divisions into which the vi. nerve divides.

N. cervicalis vi. Before this nerve divides it sends a small branch to join a twig from the fifth nerve to supply the serratus.

The sixth nerve splits into two divisions, the dorsal one of which (53) joins the dorsal cord formed by the iv. and v. nerves; and the result is a stout trunk which gives off the following numerous branches:—

32, 32A. Nn. to subscapularis.

35. N. to teres major.

31. N. to teres minor.

27. N. axillaris.

28. N. to clavicular deltoid.

29. N. to scapular deltoid.

30. Twig to infraspinatus.

33. Cutaneous branches to arm.

34. N. radialis superficialis to forearm (extensor surface).

Just before this dorsal portion of the sixth joins the cord from the iv. and v. nerves, it gives out two branches; one of these merely runs to the seventh nerve, the other (38) passes posteriorly and gives off three branches, one (38A) to the scapular part of the latissimus; the second (39) to the anterior dorsal part of the latissimus; while the third goes to join a branch (39B) from the seventh nerve to supply the anterior dorsal part of the latissimus (39A), and the posterior dorsal part of the same muscle (40).

N. cervicalis vii. This nerve divides into two cords. The anterior one of them, after receiving the communication from the dorsal part of the vi., divides into two parts. One of the latter is now joined by the ventral division of the vi. nerve, and the resulting cord is joined by the ventral division formed by the junction of the iv. and v. nerves. As a result, we have a stout cord which gives off the following branches:—

50. N. to epicoraco-brachialis.

36. N. to pectoralis major, which gives off in turn

37. N. to P. quartus, which receives a branch of communication from the second intercostal.

47. N. musculo-cutaneus.

48. N. to biceps.

49. N. to M. coraco-brachialis longus.

49A. N. to M. coraco-brachialis brevis.

42. Cord to median nerve.

The second part of the anterior cord of the vii. nerve first gives a branch which communicates with the nerve to the latissimus dorsi. The cord then continues its course and gives off a large cutaneous branch (45) to the forearm (flexor surface). Then

40A. N. to the dorso-epitrochlear.

44. N. musculo-spiralis.

44A. Branch to triceps (scapular head).

44B. Branch to triceps (humeral heads).

46. N. ulnaris.

43. Cord to median nerve (41).

The posterior of the two divisions, that the seventh nerve divides into, runs to join the cord formed by the viii. cervical and i. and ii. dorsal nerves. The resulting cord (54) then divides into two main divisions (56, 57); both these divisions now break up into numerous branches, some of which are joined by twigs from the intercostal nerves, and thus is formed a very complicated network distributed over the lateral and ventral aspects of the thorax and abdomen.

This cord (54) and its numerous branches we take to be the "lateral cutaneous nerve of the thorax," of Patterson [16], who considers it to represent the "nerve of Wrisberg." In a careful dissection of the Opossum *(Trichosurus vulpecula)* recently made by us, no nerve of Wrisberg was present; the second intercostal and the third intercostal sent branches down the arm and forearm, which did not, however, communicate with any branches distributed to the arm from the brachial plexus. The "lateral cutaneous nerve of the thorax" was present and communicated with the 3rd, 4th, 5th, 6th intercostal nerves, and also supplied the P. quartus. It came off a cord formed by the viii. cervical and first dorsal nerves, and it ended by breaking up into numerous branches, which were distributed to the abdomino-humeral panniculus.

Fürbringer discusses the supracoracoid nerve in his paper, "Zur vergleichenden Anatomie der Schultermuskeln" (pp. 718-719). He draws attention to the fact that in Saurians, where there is no true supraspinatus muscle, the supracoracoid nerve pierces the pectoral girdle through the foramen coracoideum, and supplies the supracoracoid muscle. In Mammals, however, the suprascapular nerve, which comes from the same division of the brachial plexus, pierces the scapula through the incisura (foramen) scapulæ, and supplies the supraspinatus and infraspinatus muscles, there being no supracoracoid muscle present. Lastly in the *Ornithorhynchus*, where there is neither foramen coracoideum or foramen scapulæ, the nerve trunk answering to the N. supracoracoideus and suprascapularis proceeds to the anterior part of the space between the coracoid and the scapula, and divides into a ventral and a dorsal branch; the ventral branch then supplies the M. supracoracoideus (M. epicoraco-humeralis); while the dorsal branch supplies the Mm. supraspinatus and infraspinatus, "ersterer ist ein unzweifelhaftes Homologon des N. supracoracoideus der Amphibien, Reptilien und Vögel, letzterer stimmt im Wesentlichen vollkommen mit dem N. suprascapularis der placentalen und marsupialen Säugethiere überein. Nach diesem Verhalten muss zwischen N. supracoracoideus und N. suprascapularis eine gewisse Homologie statuirt werden. Diese Homologie ist aber keine complete, denn der N. supracoracoideus versorgt ventrale, der N. suprascapularis dorsale Muskeln: der erstere hat also nähere Beziehungen zu den Rr. inferiores des Plexus brachialis, der letztere zu den Rr. superiores."

In Westling's description of this nerve in *Ornithorhynchus*, she remarks that Fürbringer describes a dorsal and ventral branch, and she goes on to say—" Diesen dorsalen Ast habe ich nicht gefunden und weiss nicht, welchen Muskeln Fürbringer die Namen Supra- und Infraspinatus giebt." In the description of the N. supracoracoideus in the *Echidna*, however, Westling gives a full account of all the branches, which account agrees with what we ourselves have found.

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EXPLANATION OF PLATES.

NERVES.

i.-viii. Nn. cervicales, 1-8.
i,C.-vii,C. Nn. costales, 1-7.
i,D.-2,D. Nn. dorsales, 1-2.
Cv. = cervical nerve.
1. Cutaneous branch from 2 Cv. to auricular region.
2. From 2 Cv. to M. sterno-mastoideus.

3. From N. accessorius to M. sterno-mastoideus.
4. N. accessorius.
5. From 2 Cv. to N. accessorius.
6. From 3 Cv. to N. accessorius.
7. N. to trapezius (posterior) from N. accessorius.
8. N. to trapezius (anterior) from N. accessorius.
9. N. to rhomboid formed by branches from 2 Cv. and 3 Cv.
10. Cutaneous branches to neck from 2 Cv. and 3 Cv.
11. Nerve to M. acromio-trachelien (dorsal portion).
12. ——————————— (ventral portion).
13. N. hypoglossus.
13A, et 14. From 1 Cv. et 2 Cv. to descending part of N. hypoglossus.
15. N. to M. omo-hyoid from descending part of N. hypoglossus.
16. Descending part of the N. hypoglossus.
17. N. phrenicus.
17A. communication with N. phrenicus from 4 Cv.
18. Division of 4 Cv. to 5 Cv.
19. Branches from N. phrenicus, and from 4-8 Cv., to sympathetic ganglia in neck.
20. Branches from 3 Cv. to levator scapulæ.
20A, 20B. Branches from 5 Cv. and 6 Cv. to serratus.
21. N. to M. costo-coracoideus.
21A. Branch from 21 to N. phrenicus.
21B. N. to M. sterno-epicoracoideus.
22. N. supracoracoideus.
22A. N. to M. epicoraco-humeralis.
23. Cutaneous twig to median line between clavicular deltoid and P. major.
23A. Cutaneous branch of N. supracoracoideus which pierces deltoid.
24. Twig (to clavicular deltoid ?).
25. N. to M. supraspinatus.
26. N. to M. infraspinatus.
27. N. axillaris.
28. N. to deltoid (clavicular portion).
29. N. to deltoid (scapular portion).
30. Twig to M. infraspinatus.
31. N. to teres minor and with twig from N. axillaris.
32, 32A. Nn. to M. subscapularis (these communicate).
33. Cutaneous branches to forearm.
34. N. radialis superficialis.
35. N. to teres major.
36. N. to pectoralis major.
37. N. to pectoralis quartus from 36.
37A. Branch to 37 from second intercostal.
38. N. to latissimus dorsi.
38A. N. to scapular portion of latissimus.
39 et 39A. N. to anterior dorsal portion of latissimus.
39B. Branch from 7 Cv.
40. N. to posterior dorsal portion of latissimus.
40A. N. to M. dorso-epitrochlearis.
41. N. medianus.
42. Outer (?) head of N. medianus.
43. Inner (?) head of N. medianus.
44. N. musculo-spiralis.

44A. N. to M. triceps (scapular portion).
44B. ——————— (humeral portion).
45. N. cutaneus medius (Westling).
46. N. ulnaris.
47. N. musculo-cutaneus.
48. N. to M. biceps (both heads).
49. N. to M. coraco-brachialis longus.
49A. N. to M. coraco-brachialis brevis.
50. N. to M. epicoraco-brachialis.
50A. Twig from M. musculo-cutaneus to M. epicoraco-brachialis (*Ornithorhynchus*).
51. Ventral cord from 4 Cv. et 5 Cv. to ventral cord from 6 Cv. et 7 Cv.
52. Dorsal cord from 4 Cv. et 5 Cv. to join 53 (dorsal cord from 6 Cv).
54. Lateral cutaneous nerve of the thorax (= N. of Wrisberg ?) and formed by 55 from 7 Cv. and 58 from 8 Cv. et 1 D. et 2 D.
56 et 57. Principal divisions of 55, to supply abdomino-humeral panniculus.

Muscles.

Ab. F. Fascia covering the abdominal muscles.
Bc. i. Epicoracoid portion of M. biceps brachii.
Bc. ii. Coracoid ,, ,, ,, ,,
Cb. B. M. Coraco-brachialis brevis.
Cb. L. ——————— longus.
Cc. M. costo coracoideus.
D. D. C. M. dermo dorsi-cervicalis.
D. Ep. M. dorso-epitrochlearis.
Dlt. C. Clavicular portion of M. deltoideus.
Dlt. Cx. Deep portion of the insertion of *Dlt. C.*
Dlt. S. Scapular portion of M. deltoideus.
E.C.M. M. episterno-cleido-mastoideus.
Ep. H. M. epicoraco-humeralis.
Ex. O. M. obliquus externus abdominis.
I. S. M. infraspinatus.
Lt. D.A. M. latissimus dorsi, anterior dorsal portion.
Lt. D.P. ——————— posterior portion.
Lt. S. ——————— scapular portion.
Pn. M. panniculus carnosus.
Pn. A. ——————— abdominal portion.
Pn. D. ——————— upper division of deep layer.
Pn. D'. ——————— deep ———————
Pn. D''. ——————— middle ———————
Pn. S. M. panniculus carnosus, superficial layer.
Pn. S. E. ——————— external part of superficial layer.
Pn. S. M. ——————— median part of superficial area.
Pt. M. M. pectoralis major.
Pt. Q. M. pectoralis quartus.
Pt. Q. i. ——————— (deep part of insertion).
Py. M. pyramidalis.
Rct. M. rectus abdominis.
Rct.' ——————— deep portion
Rh. M. rhomboideus.
S. L. M. sacrolumbalis.
S. M. M. sterno-mastoideus

S. Sc. M. subscapularis.
S. S. M. supraspinatus.
T. M. M. teres major.
Ti. Tendinous intersection in P. major.
Tr. A. M. trapezius, anterior portion.
Tr. P. ——— posterior portion.
Trc. S. M. triceps, scapular portion.
Trc. H. ——— humeral portion.

DESCRIPTION OF FIGURES.

Fig. 1. —(*Echidna*). The abdominal panniculus (*Pn. A.*) is seen running forward and dividing into a superficial (*Pn. S.M.*, *Pn. S.E.*) and a deep layer (*Pn. D. i.*); this latter part runs to be inserted on the greater tuberosity, and constitutes a "dermo-flexor brachii." The clavicular deltoid (*Dlt. C.*) is seen superficial to the pectoralis major (*Pt. M.*). *Gl.* is a large gland, superficial to the sterno-mastoid (*S.M.*). The P. quartus (*Pt. Q*) is seen quite distinct from the P. major (*Pt. M.*) and lying superficial to its postero-external border.

Fig. 2. —(*Echidna*). The deep portion of the panniculus (*Pn. D. i.*) shown in fig. 1 is raised, and its deep layer is shown (*Pn. D. ii.*). Between these two layers lie the P. quartus (*Pt. Q.*) and P. major (*Pt. M.*).

Fig. 3. —(*Echidna*). The deep layer of the panniculus (*Pn. D. i.*) is pinned back, and the cleft tendon of insertion of the P. quartus is shown (*Pt. Q.*, *Pt. Q. i.*) embracing the tendon of insertion of the P. major (*Pt. M.*). The edge of the latter muscle is shown to be placed deeper than the postero-internal edge of the clavicular deltoid (*Dlt. C.*) The P. quartus is seen arising in part from the metasternum (*Mt.S.*), but chiefly from the aponeurosis of the external oblique (*Ex. O.*). The pyramidalis (*Py.*) is shown to be inserted on the metasternum, and the rectus is seen cleft into a superficial (*Rct.*) and a deep layer (*Rct'.*). *Cl.* is the clavicle; *I. Cl.* the interclavicle or episternum.

Fig. 4. —(*Echidna*). The P. major, P. quartus, and deep panniculus are reflected; and the manner in which the latter muscle embraces the other two is shown. The clavicular deltoid (*Dlt. C.*) is raised, and we thus see the epicoraco-humeral (*Ep. H.*), and the supraspinatus (*S. S.*). The epicoracoid head and the coracoid head of the biceps have been cut through, and the relation of the former to the tendon of the rectus (*Rct.*) is shown. The coraco-brachialis brevis is seen inserted into the humerus. The relation of the two parts of the biceps as they run to be inserted is shown to the right of the figure.

Fig. 4A.—(*Echidna*). Outline from Westling. Tafl. ii., fig. 6. *Ep.* epicoracoid. *Ep. St.* episternum. *M. St.* manubrium sterni. *R i.*, *R ii.*, Ribs i. and ii. *Cc.* M. costo-coracoideus. *S.Sc.* M. subscapularis. *S. Sp.*, M. supraspinatus. *St. C.* M. sterno-coracoideus. *Ep. br.* M. epicoraco-brachialis. *Sp. C.* N. supracoracoideus. *Sp. C'.* branch to the M. supracoracoideus (epicoraco-humeral). *Sp. S.* branch to M. supraspinatus and M. infraspinatus. *r. c.* ramus cutaneus.

Fig. 5. —(*Ornithorhynchus*). The clavicular portion of the deltoid (*Dlt. C.*) is shown marked off from the anterior part of the P. major (*Pt. M.*) The tendinous intersection (*Ti.*) mentioned in the description of the muscle is shown, and the direction of the fibres of the muscle which are inserted in this intersection. The P. quartus is shown quite distinct from the P. major. The thick fascia (*Ab F.*) covering the abdominal muscles, and in which the branches of the intercostal and lateral cutaneous nerves of the thorax ramify, is shown reflected. The abdominal portion of the panniculus is seen as a single layer (*Pn. A.*), while anteriorly it is shown divided into superficial (*Pn. S.*) and deep portions (*Pn. D. i.*, *Pn. D. ii.*). The costo-coracoideus muscle (*Cc.*) is represented arising from the first rib.

Fig. 6. —(*Ornithorhynchus*). This figure shows the deep layer of the panniculus (M. dermo flexor brachii) running to its insertion on the humerus. It is seen divided into three strata. A superior (*Pn. D. i.*) closely connected with the insertion of the P. major, and lying superficial to that muscle; a middle (*Pn. D. iii.*) stratum connected with the termination of the P. quartus (*Pt. Q.*) on the P. major; and a deep stratum which joins the P. major forming an inverted Λ; a tendinous intersection marks their junction (x). The P. quartus is seen not to be cleft as in *Echidna*. (*Vide* fig. 3.)

Fig. 7. —(*Ornithorhynchus*.) The P. major (*Pt. M.*) is shown reflected from the clavicular deltoid (*Dlt. C.*), and beneath the site of the P. major is seen the epicoraco-humeral (*Ep. H.*). The two portions of the biceps are seen (*Bc. i.*, *Bc. ii.*), and a small portion of the long coraco-brachialis (*Cb. L*) is shown lying beneath (*Bc. ii.*). The coraco-brachialis brevis is a wide muscle, and is seen between (*Bc. i.* and *Bc. ii.*) and between (*Bc ii.* and *Cc.*) The costo-coracoid (*Cc.*) is shown arising from the first rib. The nerve supplying the P. major (36) with its branch (37) to the P. quartus is seen; and also the cutaneous branch of the N. supracoracoideus (*Sp. C.*) is represented.

Fig. 8. —(*Ornithorhynchus*). The clavicular deltoid is pinned up, and its nerve of supply (28) from the N. axillaris (27) is shown; also the branch from (27) to the scapular deltoid (29). The N. supracoracoideus is seen giving off a branch (22A) to the epicoraco-humeral (*Ep. H.*), muscle; a branch (25 and 26) to supply the supraspinatus (*S.S.*) and infraspinatus (*I. S.*) muscles. A small cutaneous branch (23) is represented in the figure as running towards the median line: it comes to the surface between the clavicular deltoid and the P. major. A large branch (23A and 24) is seen entering the deltoid, to

which muscle it may give a very small branch, and it then comes to the surface and ramifies on the clavicular deltoid. The deep layer of the insertion of the deltoid is shown (*Dlt. Cx*) and between this deep layer and the superficial layer (*Dlt. C.*) is seen the insertion of the scapular portion of the deltoid (*Dlt. S.*).

Fig. 9. —(*Ornithorhynchus*). The P. major and panniculus (*Pn. D. ii.*) are seen inserted on the humerus. The two parts of the biceps (*Bc. i.*, *Bc. ii.*) are reflected, and the broad coraco-brachialis brevis is shown. The posterior portion of the latissimus dorsi (*Lt. D.P.*) is shown with the dorso-epitrochlear arising from it (*D. Ep.*), and the insertion of this portion of the latissimus is seen to be nearer the proximal end of the humerus than that of the anterior portion of the latissimus (*Lt. D. A.*).

Fig. 10. —(*Echidna*). The posterior portion of the trapezius (*Tr. P.*) is seen inserted on the vertebral border of the scapula, in close connection with the insertion of the anterior portion (*Tr. A.*). The origin of the scapular deltoid is seen (*Dlt. S.*) The scapular portion of the triceps hides the course of the subscapularis (*S.Sc.*), scapular part of the latissimus (*Lt. D. S.*), and the anterior dorsal portion of the same muscle (*Lt. D. A.*).

Fig. 11. —(*Echidna*). The origin of the posterior portion of the latissimus is seen (*Lt. D. P.*), also the origin of the trapezius (*Tr. P.*) and the dermo-dorsi-cervicalis part of the panniculus (*D. D. C.*). The sacro-lumbalis is shown (*S.l.*).

Fig. 12. —(*Ornithorhynchus*). The trapezius (*Tr. P.*) is seen arising from the vertebræ and from the ribs, and in close connection with the latter origins are the slips of origin of the dermo-dorsi cervicalis (*D.D.C.*). The posterior portion of the latissimus (*Lt. D. P.*) and the dorso-epitrochlear (*D. Ep.*) arising from it, and inserted on the sheath of the flexor carpi ulnaris, are represented, while the anterior portion of the latissimus (*Lt.D.A.*) is seen to be superficial to the posterior portion, and to be inserted at the distal part of the humerus. The scapular and humeral parts of the triceps are seen; also the scapular part of the deltoid (*Dlt. S.*); the teres major (*T.M.*), subscapularis (*S. Sc.*), and the costal portion of the serratus magnus (*Ser. M.*), and part of the rhomboid (*Rh.*). *E. S.* is an erector spinæ: *D. L. P.* dorso-lumbar aponeurosis.

Fig. 13. —(*Echidna*).

Fig. 14. —(*Echidna*). This figure was drawn from another specimen, and it shows considerable variation from Fig. 13.

Fig. 15. (*Echidna*). This is taken from Westling. We have substituted numbers for the letters of the original figure.

Fig. 16. —(*Ornithorhynchus*).

Fig. 17. —(*Ornithorhynchus*) from Westling. C', branch to panniculus. C', branch to integument. *Cl.* N. to the M. biceps, M. coraco-brachialis, and M. epicoraco-brachialis. *dlt.* N.

to the anterior portion of the M. deltoid, and to the M. pectoralis major. *ld'*. N. to the M. latissimus dorsi. *md.* N. medianus. *Phr.* N. phrenicus. *Pt'*. N. to M. pectoralis major and to the integument or panniculus. *r.* the largest branch from N. radialis. *r'* N. to the integument from which a branch *Lc'* springs to supply M. latissimo-condyloideus. *r''* N. to scapular belly of the M. triceps. *r s.* nerve cord which supplies branches to M. subscapularis and M. infraspinatus. *Scl.* N. to the M. subclavius. *S.M.* N. to serratus magnus. *SS.* Nn. subscapulares. *u.* N. ulnaris.

Fig. 18. —Humerus of *Echidna* (right side). The antero-internal and antero-external surfaces are shown. The sharp supinator ridge (*Sp. R.*) is seen running up from the external condyle (*Ex. C.*) *M. S.* indicates the musculo-spiral groove. The large bicipital groove (*Bc. G.*) is also shown. *Ex. B.* is the external border continued into the pectoro-deltoid ridge (*P. D.*) at the proximal end and the supinator ridge at the distal end. *A. B.* would represent the anterior border of the bone. *G.T.*, *L.T.* greater and lesser tuberosities. *F.Sc.* Foramen supracondyloideum (The outline of this figure and the next are from Westling).

Fig. 19. —This shows chiefly the boundaries of the posterior surface. The supinator ridge is seen to terminate before it reaches the proximal extremity of the humerus (in *Ornithorhynchus* it does not), and the dotted line running between the supinator ridge and the external border indicates that the pectoro-deltoid ridge, though apparently continued into *A.B.*, should morphologically be considered to take the direction of the dotted line in Fig. 19, that is, across the musculo-spiral groove to the supinator ridge (*Sp. R.*).

NOTES AND EXHIBITS.

Baron von Mueller communicated a list of mosses collected at Tamworth by C. T. Musson, Esq., in 1890, and named by Herr Adalbert Geheeb, 1894.—*Ptychomitrium commutatum*, C Müller; *Leskea calochlora*, C.M.; *Bryum argenteum*, L., var., *niveum; B. subleptothecium*, C.M.; *Funaria hygrometrica*, Hedwig; *Zygodon Preissianus*, Hampe; *Brentelia pendula*, Hooker; *Thuidium erectum*, Hampe.

Mr. Hedley read the following note:—"From the throat of a *Rallus pectoralis* Mr. J. A. Thorpe of the Australian Museum extracted the snail I now exhibit. This is a specimen of *Chloritis jervisensis*, Quoy and Gaimard, a species common in this neighbourhood, whose almost adult and uninjured shell measures 18 mm. in diameter, and which weighed, shell and animal together, 1·26 grammes. When found by Mr. Thorpe, to whom I am indebted for both facts and specimen, the snail was quite dead; as a test I immersed the animal in strong spirits without inducing contraction; since, however, its consumer had been killed forty hours earlier, the suffocation of the mullusc was to be expected. The bird was shot at Randwick, near Sydney, on the 19th May, 1894, by Mr. Newcombe, Deputy Registrar-General. In enumerating "Means of Dispersal," Darwin observes (Origin of Species, 6th ed. p. 372): 'A bird in this interval [eighteen hours] might easily be blown to the distance of 500 miles, and hawks are known to look out for tired birds, and the contents of their torn crops might thus readily get scattered.' In view of the above incident, this suggests a means whereby the geographical range of *jervisensis* might be considerably extended."

Mr. Lucas exhibited two small fishes from Central Australia (near the McDonnell Ranges), which had been forwarded to him by Mr. C. French, F.L.S., of Melbourne. Both specimens were immature, but both belong to well-known fresh-water genera. One is *Therapon fasciatus*, Cast., described originally from the Swan River. There are specimens in the Macleay Museum from the Hodgkinson River. This young individual shows the strong spines of the præoperculum and the præorbital which distinguish this species from *T. percoides*, Günther. The other fish is a very young *Chatoessus*, and seems to correspond better with *C. erebi*, Günther, than with *C. richardsoni*, Castelnau. The latter is the form characteristic of the waters of the Murray System. It would seem that both fishes are coast river and not Murray species. It is to be hoped that the Horn Expedition will bring back abundant material by means of which further light may be thrown on the distribution of Australian fresh-water fish, and especially on the limits of the Murray Province.

Mr. Rainbow showed living trap-door spiders (*Idiops* sp.), with their nests, from Burrilda, N.S.W.

Dr. Cox exhibited a very fine series of complete specimens—fructification and host—of several species of fungi (*Sphæria*, *Isaria* or *Cordyceps*) infesting caterpillars and other insect larvæ, obtained at the Kurrajong Heights by Mr. Henry Selkirk, and he communicated an interesting Note embodying the collector's observations thereon.

Mr. Waite exhibited the snake and the fishes described or referred to in the papers by Mr. Ogilby and himself; also, on behalf of Mr. Skuse, the larva of a large moth (*Pielus* sp.) infested with *Isaria*, from Peak Hill, N.S.W.

Mr. Etheridge exhibited three boomerangs, and the specimen of *Glossopteris* from Mudgee, in illustration of the second and the last of the papers above-mentioned.

Mr. Fletcher exhibited specimens of two species of phyllopod entomostraca (*Lepidurus*) from Tamworth (collected by Mr. C. T. Musson) and Dandaloo on the Bogan (collected by Mr. Alleyne Fletcher), and he pointed out that as only three Australian species—two from S.A. and one from Tasmania—had been described, the group would probably repay attention. He also showed flowers of another introduced Apocynaceous plant, *Mandevilla suaveolens*, Lindl., which had proved a deathtrap to insects; forwarded from Mudgee by Mr. J. D. Cox, who reports that hawk-moths are occasionally entrapped.

WEDNESDAY, JUNE 27TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

Dr. R. Gunson Thorpe, H.M.S. "Penguin," was introduced as a visitor.

Mr. H. G. Rienits, Mt. Victoria, N.S.W., was elected a member of the Society.

DONATIONS.

Zoological Society of London.—"Proceedings, 1893." Part 4: "Transactions." Vol. xiii. Part 8 (1894): "Abstracts," 17th April and 1st May, 1894. *From the Society.*

Royal Microscopical Society.—"Journal, 1894." Part 2. *From the Society.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 9-10. *From the Government Secretary.*

"Zoologischer Anzeiger," xvii. Jahrg, Nos. 445-446 (April-May, 1894). *From the Editor.*

Société d'Horticulture du Doubs, Besançon.—"Bulletin, n.s." No. 40 (April, 1894). *From the Society.*

K. K. Naturhistorisches Hofmuseum, Wien.—"Annalen." Bd. viii., Nr. 1-4 (1893). *From the Museum.*

Naturhistoriske Forening i Kjöbenhavn — "Videnskabelige Meddelelser for Aaret, 1893." *From the Society.*

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), No. 5. *From the Editor.*

Department of Mines and Agriculture, Sydney.—" Memoirs of the Geological Survey of N.S.W." GEOLOGY, No. 5 (1894). *From the Hon. the Minister for Mines and Agriculture.*

Société Royale Linnéenne de Bruxelles.—" Bulletin." xix^{me}. Année, No. 7 (April, 1894). *From the Society.*

" American Naturalist." Vol. xxviii., No. 329 (May, 1894). *From the Editors.*

American Geographical Society.—" Bulletin." Vol. xxv., No. 4, Part 2 (1893). Vol. xxvi. No. 1 (1894). *From the Society.*

" Johns Hopkins University Circulars." Vol. xiii., Nos. 108 and 111 (November, 1893, and April, 1894). *From the University.*

" Report of the Committee appointed to make Recommendation for the Protection of Native Fauna, Adelaide." *From the Committee.*

" Victorian Naturalist." Vol. xi., No. 2 (May, 1894). *From the Field Naturalists' Club of Victoria.*

Gesellschaft für Erdkunde zu Berlin.—" Verhandlungen." Bd. xxi. (1894), No. 4. " Zeitschrift." Bd. xxix. (1894), No. 1. *From the Society.*

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" Agricultural Gazette of N.S.W." Index to Vol. iv. (1993). Vol. v. Part 5 (May, 1894). *From the Hon. the Minister for Mines and Agriculture.*

Department of Agriculture, Brisbane.—" Bulletin," No. 2 (Second Series). *From the Secretary for Agriculture.*

Societas pro Fauna et Flora Fennica.—" Meddelanden." xvi. Haft (1891). *From the Society.*

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"Revue Scientifique du Bourbonnais, 1894." No. 75. *From the Editor.*

"Journal of Morphology." Vol. v., No. 3; Vol. viii., Nos. 1-2. *From Professor W. A. Haswell, M.A., D.Sc.*

University of Sydney.—"Calendar for the year 1894." *From the Senate.*

British Museum (Natural History).—"Catalogue of Birds." Vol. xxii. (1894). *From the Trustees.*

Royal Society of London.—"Proceedings." Vol. liv., Nos. 328-330; Vol. lv., Nos. 331-332. *From the Society.*

"Archiv for Mathematik og Naturvidenskab." xv. Bind, 4 Hefte (1892); xvi. Bind, 1-4 Hefte (1893). *From the Society.*

New Zealand Institute.—"Transactions and Proceedings." Vols. ii., iv., viii., ix., xii., and xiii. (1869-80). *From the Philosophical Institute of Canterbury.*

"Australasian Journal of Pharmacy." Vol. ix., No. 102. (June, 1894). *From the Editor.*

Société Belge de Microscopie.—"Bulletin." T. xx., No. 5 (1893-94). *From the Society.*

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Zoological Society of Philadelphia.—"Twenty-second Annual Report" (1894). *From the Society.*

Société Scientifique du Chili.—"Actes." T. iii. (1893), 3e Liv. *From the Society.*

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DESCRIPTION OF FIVE NEW FISHES FROM THE AUSTRALASIAN REGION.

By J. Douglas Ogilby.

(Communicated by Edgar R. Waite, F.L.S.)

In the following paper I have given descriptions of five species supposed to be new to science, two (*Gillichthys australis*, and *Clinus whiteleggii*) being from the coast of New South Wales, and one each from Queensland (*Ophioclinus devisi*), Lord Howe Island (*Petroscirtes icelii*), and New Zealand (*Eleotris huttoni*).

Gillichthys australis, sp.nov.

B. vi. D. 6. 1/7. A. 1/6. V. 1/5. P. 14. C. 12. L. lat. 28. L. tr. 8.

Length of head $3\frac{7}{8}$, height of body $4\frac{2}{5}$ in the total length; height of head $1\frac{3}{10}$, width of head $2\frac{4}{5}$ in its length. Eye moderate, lateral; its diameter $4\frac{1}{5}$ in the length of the head; snout obtusely rounded, its length three-fourths, inter-orbital space half the diameter of the eye. Lower jaw the longer; cleft of mouth large and oblique, the maxilla extending to one diameter of the eye behind the eye. Upper profile of head abruptly convex. A pair of large open pores about the middle of the interorbital space. A pair of small canines in front of each jaw. Dorsals subequal in height, separated by a moderate interspace, the distance between the base of the last spine and the origin of the soft dorsal equal to the base of the dorsal spines; all the spines more or less produced, the anterior the highest, not quite so high as the body: anal papilla small; the anal commences beneath the third and ends beneath the last dorsal ray; its fifth ray is the longest, and exceeds in height the dorsal rays: ventral reaching to the vent: pectoral rather pointed, reaching to the vertical from the origin of the anal, its length $1\frac{1}{5}$

in that of the head ; none of the rays silk-like : caudal rounded, $5\frac{1}{3}$ in the total length. Scales angular, striated, and finely ctenoid, not much smaller anteriorly ; occiput and opercle scaly, rest of the head naked ; throat and base of the pectoral scaly.

Colours.—Head above brown, below purple, the latter colour including the maxilla ; cheeks and opercles golden brown ; two purple bands from behind the eye to the upper angle of the opercle, where they join ; a third inconspicuous band partially crossing the cheek ; body and tail pale brown, the anterior portion blotched above with dark brown and red, uniform below ; the caudal portion with five slightly oblique transverse bands of a dark brown colour, more or less profusely studded with bright red spots. Dorsal fins gray marbled with dark reddish ; anal and ventrals closely dotted with black ; pectorals gray, with the base yellow ; caudal gray, with irregular transverse bands of blackish spots.

I was inclined at first to consider that the Goby described above was Günther's *Gobius macrostoma* (Catal. Fish. iii. p. 44), a name which was subsequently altered to *microphthalmus* (o.c. p. 550) the earlier title having been previously used by Steindachner. In view, however, of the slight difference in the length of our respective specimens (B.M. 44 mm., mine 38), and of the wide variation in some of the characters, it is necessary to apply a distinctive appellation to my fish.

The most important of the variations referred to above are—the number of scales between the origin of the soft dorsal and the anal fins—*microphthalmus* 10, *australis* 8 ; the much lower body in my species—*microphthalmus* $3\frac{3}{5}$, *australis* $4\frac{2}{5}$ in the total length ; the much larger eye—*microphthalmus* $\frac{1}{7}$, *australis* $\frac{3}{13}$ in the length of the head ; and the much more elongated maxilla, which in Günther's fish only extends to the vertical from the posterior margin of the eye ; this character is, of course, accentuated by the greatly increased size of the eye in my form, compared with *Gillichthys microphthalmus.*

The specimen was collected at Jervis Bay, among oysters, by Mr. Thomas Whitelegge, and measures 38 millimetres.

Type in the Australian Museum, Sydney.

Register number, I. 3171.

ELEOTRIS HUTTONI, sp.nov.

B. v. D. 6. 1/8. A. 1/9. V. 1/5. P. 19. C. 14. L. lat. 37. L. tr. 9.

Length of head $4\frac{1}{4}$, height of body $6\frac{7}{10}$ in the total length; height of head $1\frac{3}{4}$, width $1\frac{1}{2}$ in its length. Eye large, its diameter $3\frac{4}{5}$ in the length of the head; snout short, obtusely rounded, four-fifths of the diameter of the eye; interorbital space narrow and concave, its breadth less than a third of the same. Jaws equal; cleft of mouth very oblique, the maxilla scarcely reaching to the anterior margin of the orbit. Upper profile of head very slightly convex. Head without open pores or distinct series of warts. Jaws with a band of small hooked teeth, the outer row much enlarged. Dorsal spines weak, four-sevenths of the height of the body, and much lower than the rays, which are longest posteriorly: anal papilla moderate; the anal commences beneath the third dorsal ray and is continued to some distance behind the base of the second dorsal: ventral moderate, not reaching to the vent, two-thirds of the length of the head: pectoral large, subcuneiform, not quite so long as the head: caudal rounded, $5\frac{1}{3}$ in the total length. Scales on the body strongly ctenoid, on the occiput and opercle cycloid; rest of the head scaleless; occipital scales not reaching to between the posterior margins of the orbits, preceded by a closed pore; three series of scales between the dorsals.

Colours.—Uniform yellowish brown: vertical fins hyaline, the upper half of the first dorsal brownish orange; second dorsal with two or three irregular series of spots on its outer half; anterior rays of the anal brownish; other fins pale brown.

The specimen from which the above description was taken is in the collection of the Australian Museum, and is labelled "Waikato River, New Zealand;" it measures 65 millimetres.

From *E. gobioides*, C.V., which is more nearly allied to it than the second New Zealand species given by Hutton (Trans. N.Z. Inst., xxii., 1889, p. 280,) *E. radiata*, Q.G., it differs principally in having fewer dorsal rays (*huttoni* 8, *gobioides* 10), fewer scales between the origin of the soft dorsal and the anal (*huttoni* 9, *goboides* 10 or 11), a much lower body (*huttoni* $6\frac{7}{10}$, *gobioides* $5\frac{1}{2}$ in the total length), a smaller head (*huttoni* $4\frac{1}{4}$, *gobioides* $3\frac{3}{4}$ in the same), a greatly enlarged eye (*huttoni* $3\frac{1}{5}$, *gobioides* 6 in the head), and in the equal length of both jaws.

I have much pleasure in dedicating this species to Capt. Hutton, whose researches have tended so much to elucidate the history of the New Zealand fishes.

Type in the Australian Museum, Sydney.

Register number, I. 3162.

PETROSCIRTES ICELII, sp.nov.

B. vi. D. 31. A. 22. V. 3. P. 14. C. 11.

Length of head $5\frac{1}{3}$, height of body $8\frac{2}{5}$ in the total length. Eye large, with the supraorbital ridge prominent, its diameter $3\frac{1}{5}$ in the length of the head, and equal to that of the snout; interorbital space concave, five-sixths the diameter of the eye. Upper jaw overhanging; cleft of mouth wide, the maxilla extending to beneath the posterior third of the orbit. Dorsal profile of snout convex, of occiput flat. Head without tentacles. Body elongate. Maxillary teeth thirty, mandibulary thirty-two in number; upper canines scarcely longer than the incisors; the lower strong and curved, half a diameter of the eye. The dorsal fin commences above the gill-opening; it is without a trace of a notch, the rays being subequal in length, with free tips, and rather more than the height of the body: the anal fin commences beneath the twelfth dorsal ray, and is similar to but not so high as the dorsal: ventral inserted slightly in advance of the dorsal; its length $1\frac{2}{3}$ in that of the head: pectoral a little longer than the ventral: caudal rounded, with the tips of the rays free, equal in length to the head.

Colours.—Head horn colour, lips black, throat and body sandy; a broad, irregular black band traverses the whole length of the body, rather nearer to the dorsal than to the ventral surface; above the anal fin this band is crossed by five or six vertical bars, which extend more or less distinctly on to the dorsal and anal fins; a black spot at the base of the caudal fin. Incisor teeth in both jaws tipped with gold.

The type specimen of this distinct species was brought from Lord Howe Island by Mr. T. R. Icely, the visiting magistrate, after whom I am pleased to be in a position to name it. There are three other examples from the same locality in the Australian Museum Collection, all of which agree accurately with the type. This species is closely allied to *P. variabilis*, Cantor.

Length of type specimen 119 millimetres.

Type in the Australian Museum, Sydney:

Register number, I. 3127.

CLINUS WHITELEGGII, sp.nov.

B. vi. D. 2/28/2. A. 2/20. V. 1/2. P. 10. C. 12.

Length of head $4\frac{1}{5}$, height of body $6\frac{1}{10}$ in the total length. Diameter of eye $3\frac{2}{5}$ in the length of the head; snout obtuse, seven-eights, interorbital space concave, half of a diameter of the eye. Jaws equal; cleft of mouth very oblique, the maxilla extending to beneath the middle of the orbit. Nasal tentacle double, the outer and longer branch trifurcate; orbital tentacle small and triangular, with the basal portion slender. Upper profile of head abruptly sloping. A row of stout curved teeth and a symphyseal patch of smaller teeth in both jaws. The dorsal fin commences above the hinder margin of the preopercle; the second spine is widely separated from the first, and from the third, with which it is connected by a deeply notched membrane; the spines increase in height gradually to the last, which is five-sixths of the height of the body and equal to the first ray; last ray separated by an interspace from the penultimate, its membrane just reaching beyond the base of the caudal: the anal commences beneath the twelfth dorsal spine; its last ray has only a minute membrane: ventral rays subequal, not nearly reaching to the vent, four-sevenths of the length of the head: pectorals pointed, the sixth ray the longest, extending to the vertical from the first anal ray, two-thirds of the head: caudal small and emarginate, $8\frac{9}{10}$ in the total length. Scales minute, the head naked with numerous series of small open pores. Lateral line curving downwards above the vent.

Colours.—Deep purplish red above, the sides of the head mottled red and yellow; a dark spot in front and a dark vertical band below the eye; below the lateral line the ground colour is paler, and is crossed by several dark transverse bands: dorsal and anal fins transparent, the former with six, the latter with eight transverse purple bands, the rays banded gray and yellow; ventrals, pectorals, and caudal pale yellow with transverse series of small red spots.

This handsome and very distinct species was obtained by my friend, Mr. Thomas Whitelegge, under stones between tidemarks on the oyster beds at Jervis Bay. The length of the specimen is 55 millimetres.

I have great pleasure in naming it after its discoverer.

Type in the Australian Museum, Sydney.

Register number, I. 3175.

OPHIOCLINUS.

Ophioclinus, Casteln. Proc. Zool. Soc. Vic. 1873, ii. p. 69.
Scleropteryx, De Vis (*Museum name*).

Branchiostegals five. Body elongate and compressed, tæniiform. Snout short and rounded. Gill-membranes united, free from the isthmus. Eye lateral. Teeth in the jaws and on the vomer stout, conical; present or absent on the palatines*, no lingual teeth;

* Castelnau describes *O. antarcticus* as having "small, thick, blunt teeth on the palatine bones;" a very careful examination has, however, failed to detect the existence of palatine teeth in the present species.

pharyngeal teeth in two patches, conical. Dorsal fin long, almost entirely composed of spines; anal with one spine and many soft rays; ventrals rudimentary, jugular; no pectorals; caudal fin distinct, connected with the dorsal and anal. Minute, scattered, rudimentary scales, imbedded in the skin, present on the caudal region of the body only. A single, indistinct, median lateral line.

OPHIOCLINUS DEVISI, sp.nov.

B. v. D. 70/3 ca. A. 1/55 ca. V. 1/2. C. 12.

Length of head $6\frac{3}{4}$ to 7, height of body 15 to $15\frac{3}{4}$ in the total length; height of head rather less than its width. Eye large its diameter $5\frac{1}{4}$ to $5\frac{3}{4}$ in the length of the head; snout short and rounded, its length about seven-eighths of the diameter of the eye, interorbital space flat, $1\frac{1}{3}$ to $1\frac{1}{2}$ in the same. Lower jaw the longer; cleft of mouth oblique, the maxilla reaching to beneath the middle of the orbit: upper profile of snout convex, of occiput flat; opercular region elongate, tumid. Series of large open pores around the orbits, the margins of the preopercles, on the occiput, and the nuchal region. Teeth in the upper jaw stout and conical, in three series anteriorly, the outer of which is continued on the sides; in the lower jaw in a single series, much stronger than those of the maxillaries; a few scattered teeth on the vomer; pharyngeal teeth similar to those of the upper jaw, arranged in two arcuate patches. The dorsal fin commences a short distance behind the opercular flap; the spines are strong, and, with the exception of a few anterior ones which are short, subequal in height, about a half of that of the body: the distance between the snout and the origin of the anal is $2\frac{1}{2}$ in the total length; anal papilla little developed. A single lateral line along the middle of the body, straight.

Colours (in spirits).—Uniform reddish brown, the occiput and opercles with a yellowish tinge.

This interesting species belongs to the Xiphidiontid section of the *Blenniidæ*; the two specimens available for examination measure respectively 75 and 79 millimetres, the smaller of which is broken in two pieces; they form part of a collection obtained from the Queensland Museum some years since, and were labelled *Scleropteryx bicolor*; no description of a fish under this name ever appears to have been published by Mr. De Vis, nor do I consider it advisable to form a new generic name, as it approaches sufficiently close to Castelnau's *Ophioclinus*, and our knowledge of that genus is so limited. The specific name *bicolor* is, at least now, after having been so long in spirits, unsuitable, and I have, therefore, named it after its original collector; the species is a native of Moreton Bay.

The genus *Ophioclinus* appears to be most nearly allied to *Apodichthys* and *Anoplarcus*; from the former it differs in the absence of a continuous scaly covering, the presence of an obscure lateral line, the absence of pectorals, &c., while from the latter it differs in the formation of the gill-membranes and the dentition.

The presence of palatine teeth and of short filaments on the snout, as recorded by Castelnau, neither of which characters can be detected in this fish, possibly because of the bad state of my specimens, may eventually necessitate the formation of a genus, but such a course is at present premature. The neglect of Castelnau to even mention the pectorals is negative evidence as to their existence in his genus.

Type in the Queensland Museum, Brisbane.

Register number, I. 362.

WOOD MOTHS: WITH SOME ACCOUNT OF THEIR LIFE-HISTORIES.

Chiefly Compiled from the Notes of Mr. R. Thornton, of Wallsend, N.S.W.

By W. W. Froggatt.

Through the liberality of Miss Georgina King, of Homebush, the Technological Museum has recently acquired a very fine collection of Wood Moths, belonging to the genera *Leto*, *Charagia*, *Eudoxyla*, and *Cryptophasa*, collected and bred by Mr. Robert Thornton. Subsequently, Mr. J. H. Maiden handed over to me a number of notes on the specimens in this donation, written by the collector, which showed a keen sense of observation and a careful study of their habits.

Later on with the Curator's approval, I had the pleasure of visiting Mr. Thornton, who was good enough to show me his collections, as well as some larvæ in trees still under observation. This paper therefore is chiefly a compilation from his notes, or results of unrecorded personal observation, freely placed at my disposal.

Eudoxyla eucalypti, Hubn.

There are several specimens of this moth in the collection bred out of the branches and stems of "lignum vitæ" (*Acacia longifolia*). It is a common and very destructive species, found whereever the Acacias are plentiful, but having a decided preference for *A. longifolia* and allied species. I have bred a number of these moths from the Acacias at Rose Bay and other localities near

Sydney, where their larvæ annually kill a large number of trees. The species is very variable both in size and markings; the ground colour is brown, mottled with grey, with irregular black blotches on the forewings, but the black elongate horseshoe-shaped band between the forewings on the thorax is always well defined.

Sydney specimens are smaller and generally darker than those from Newcastle, which are more like Victorian examples. Professor McCoy has given a detailed account of this Goat-moth in his "Prodromus of the Zoology of Victoria," Dec. iii., p. 47.

EUDOXYLA EUCALYPTI (?)

A variety longer and more slender than the typical *E. eucalytpi* that we get about Sydney, the creamy white patches on either side of the shoulders shading into ferruginous-brown and again forming another white patch towards the tip of the wing, ending in a mottled patch nearer the tip. The mottled markings on the forewings are larger and more rounded than in the former species, while the hind wings are rich ferruginous-brown, with the darker mottled bands running parallel with the nervures and more distinct than in the typical form.

The females deposit their eggs at the foot of the tree near the ground; the larvæ feed down the roots; Mr. Thornton says he has traced a bore along a root for five feet. The larva is white with dark spots along the sides, and a large rough head. Length when mature 6 inches. When full grown, it bores through the side of the root upwards, spinning a stout felted tube from the root to the surface of the ground, where the top of the bag is much thickened. This felted tunnel varies in length according to the distance of the root from the surface, but we have several a foot in length.

The larva undergoes its metamorphosis in this lined tube, and when the moth emerges, the empty pupa case is left sticking out of the ground an inch or two.

A similar if not identical species attacked the roots of some golden wattles (*A. pycnantha*) growing in my father's garden at Bendigo, Victoria, some years ago, and it eventually killed them all. I used to hunt for the moths after finding the empty pupa cases, and I have a specimen over 25 years old. Professor McCoy considers that *E. eucalypti*, finding its bore below the surface of the earth, breaks through the root and prolongs the cocoon, which is otherwise confined to the hollow in the wood; but Mr. Thornton says that the larva of the reddish variety always lives on the roots, and that the smaller darker one is never found out of the trunk or branches.

Eudoxyla liturata.

This fine moth measures from 7 to 8 inches across the wings; its forewings, head, thorax, legs and tip of abdomen are light brown densely clothed with fine grey scales; a narrow black band forms an elongated V between the forewing in the centre of the thorax (this is sometimes rounded in front and often rather indistinct in places). Hind wings reddish-brown, the basal portion of the abdomen clothed with reddish down thickest on the sides. A male moth in the collection is not more than one-third this size, but the markings and coloration are the same.

The larva is found in the stems of several Eucalypts, but it shows a marked preference for that of *E. resinifera*, locally known as the "Grey Gum." The moth after leaving her chrysalid shell is generally found upon the trunk of the tree close to the ground; her eggs are laid in a scattered ring upon the bark, the young larvæ boring inwards soon after they are hatched. The larva forms no web over the entrance of its bore, like *Leto stacyi*; and though eating out an irregular oval cavity in the bark does not eat the outer surface of it away, leaving it a thin wall, which eventually dries up and falls away. The small hole by which it first entered is left open, and from it the castings formed in the bore are ejected.

The larva bores upwards as soon as the transverse tunnel reaches the centre of the stem, and it remains feeding in this bore for upwards of nine years, during which time it crawls backwards and forwards from the entrance, gnawing and enlarging the diameter, so that the passage of escape is always in proportion to the increasing bulk of the larva. For three months, from the beginning of June till the end of August, it remains in a quiescent or torpid state, without moving or feeding; at the end of this period it casts its skin, and again commences to feed, this operation being repeated every season, at any rate for the last few years of its larval existence. When the time comes for its metamorphosis into the chrysalid, it retreats to the apex of the bore, cutting off all communication with the intervening space between by placing a stout felted wad or button at the base, the tip of the abdomen of the chrysalid touching the top of the bore, the head pointing downwards and resting against the wad, and enveloped in a thick yellow viscid secretion.

Changing into a chrysalid in May, the perfect moth emerges early in the following November. Before the moth is ready to come forth, the expansion of the chrysalid dislodges the wad, which falls down the bore, thus liberating the chrysalid, which works its way out to the entrance, protruding through the hole about an inch or more before the skin splits and she crawls out.

The average depth of the bore is about eight inches, but it may sometimes reach to a foot; the diameter is about $1\frac{1}{4}$ inches; and the fully developed larva about eight inches in length. In spite of the thick protective wad, the chrysalid is frequently killed and devoured by ants. But by far its most destructive enemy is a large beetle, *Trogodendron fasciatum* (Fam. *Cleridae*), which Mr. Thornton says, kills a great number of them.

Mr. Thornton had a larva of this moth under observation for several years, and from time to time watched its movements by cutting out a section of the stem of the living tree, which he replaced and pegged back each time he examined it, afterwards breeding out the moth, which is now in the Australian Museum, from the observed larva.

LETO STACYI, Scott.

As Mr. A. Sidney Olliff has given a detailed description of this beautiful moth ("Notes on *Zelotypia Stacyi*, and an Account of a Variety." Proc. Linn. Soc. N.S.W., ii. ser. 2, p. 469, 1887), I confine my remarks to several points passed over by him, or differences in habits as compared with the genus *Eudoxyla*.

The larva, which has been watched for six years, does not bore upwards like the members of the preceding genus, but after eating out the bark in front of the place where it intends to make its bore, it covers the cavity with a fine bag or web of silk covered with small bits of bark, boring into the centre of the trunk, and then turning downwards towards the roots.

It feeds on the stem of the "Grey Gum," which, from specimens obtained from Mr. Thornton, has been identified by Mr. R. T. Baker, of the Technological Museum, as *E. resinifera*. Mr. Olliff states that the Grey Gum upon which it is found is *E. tereticornis*. Mr. Thornton says that, unlike any of the other larvæ, it strictly confines itself to one species of Eucalypt. Hence there would appear to be some slight mistake; though it may be that it attacks both trees.

The larva changes into the chrysalid in December, after having eaten off the web in front of the bore, and placed a thick felty wad or button just inside the opening of the bore; but as soon as the chrysalid skin has become hard and firm, it pushes the wad away and moves freely up and down the bore, which varies in depth from 10-12 inches. It can move up and down the passage very rapidly, the curious file-like rings on the lower edge of the abdominal segments being evidently adapted to helping its locomotion. When nearly mature it has the habit, particularly in the afternoons, of resting in the bore with the top of its head just level with the floor of the cross-bore, and plainly visible from the outside. The moths first appear early in March. Mr. Thornton has found that they never come out after three o'clock in the afternoon; and chrysalids under observation if not out at that hour can be safely left until the next day. He has bred and captured over 100 specimens of this fine moth, and has succeeded in mounting them very neatly without destroying the remarkable wrinkled structure of the forewings, which if mounted on an ordinary setting-board come out flat and uniform.

With this he has also sent a specimen of what he considers to be a new species of the genus. It is, however, very much worn and damaged, having been found in the bush dead. In my opinion it is certainly not this moth; and from the general form of head and thorax might at first sight be easily mistaken for a large cicada.

EUDOXYLA MACLEAYI, Scott.

This is the largest species of the genus, specimens in the collection measuring 9½ inches across the forewings.

The forewings are brown, clothed with fine grey down or scales, together with thicker patches of grey and black down, giving the whole of the centre of the wings a mottled appearance; the hind wings are dark brown. The head, legs and thorax thickly covered with long greyish-brown down; a large black patch rounded in front occupies the centre of the thorax, the central and hind part of it being variegated with grey, somewhat like the markings of a European Death's Head Moth; the base and apex of the abdominal segments are grey; the six inner segments covered with long thick down of a similar colour to the hind wings. The larva of this species has been watched for four years in the trunk of a "white mahogany" (*Eucalyptus tereticornis*), by Mr. Thornton, who says that its habits are identical with those of *E. liturata*. He has bred only one specimen out of the timber, as even in the chrysalis state they invariably die very soon after the log is cut; all his other specimens have been taken after their emergence.

CRYPTOPHASA IRRORATA, Lewin.

This is a rather common grey and brown moth, feeding and breeding in several species of she-oaks (*Casuarina*) both about Sydney and Newcastle.

Mr. Thornton has given me a long account of the habits of the larva of this moth, from his own original observations. But Lewin, in his work on "New South Wales Lepidoptera," published in 1805, has given such a complete description of their habits and food plants, that it is unnecessary to dwell further on the subject.

Charagia eximia, Scott.

Several specimens of both sexes of this moth are in the collection. The male has both the fore- and hindwings pale bluish-green, the former covered with indistinct wavy markings forming oval rings, and crossed with a line of fine yellow spots in the centre. The female has the head, legs, thorax and forewings bright vivid green, with two circular spots in the centre of each wing, and brown markings on the outer margins; the hindwings are bright reddish-pink with the tips yellowish-green; the first five segments of the abdomen of a similar red colour, the last three the same vivid green as the forewings; she is fully a third larger than the male.

These were watched feeding for three years. The young larva eats a hole in the bark, and forms a thin web over it like the "Bentwing;" then feeding down the centre of the stem, following any angle in the trunk, often makes a bore five feet deep.

Before passing into the chrysalid state it eats the web off, replacing it with a thin wad or button at the entrance of the hole, and though moving up and down the bore, it does not push the wad out of the hole until the moth is ready to emerge.

The larvæ feed upon the Lilly Pilly (*Eugenia smithi*), the water gum (*Phyllanthus ferdinandi*), and the Black Fig (*Ficus aspera*). They change into chrysalids in August, coming out in October in the Wallsend district.

Charagia splendens, Scott.

The male has the forewings of a delicate pale green, with the centre of the head, fore part of the thorax, a slender stripe along the outer edge of the forewings, and an irregular transverse band widest in the centre satiny-white; the outer edges are marbled with a broad band of the same colour enclosing a row of oval rings, with an angular patch containing a similar oval ring and another white patch near the shoulders, the hindwings and abdomen satiny-white.

The female has the forewings, head, thorax and legs pale brown, with a large irregular bright green patch running from the shoulders, and occupying the centre of the wing, a large irregular patch at the tip and two small spots on the hind margin of a similar colour; hindwings pinkish-red inclining to yellow at the tips and margined with brown behind; abdomen reddish-brown at tip.

This species breeds annually, forming a thick felty bag all round the branch, and boring a hole several inches down the stem or branch, the larva pupating about the middle of December and the moth coming forth three or four weeks later.

Mr. Thornton has found the larvæ in the following trees and plants—Lilly Pilly (*Eugenia smithi*), Grey Gum (*Eucalyptus tereticornis*), Stringybark (*E. leucoxylon*), Hollyhocks, Rock-lilies and other plants; while I have bred it from *Eucalyptus robusta* from Botany.

There is a small variety of this species which is never more than an inch across the wings, but is similar in its coloration and habits. The larvæ attack any kind of tree and bush, and though generally very scarce they appear in great numbers every three or four years at Wallsend. It is very likely that these are dwarfed specimens; and their coming out in such numbers may affect their food supplies, and have thus stunted them.

CHARAGIA sp.

This species is considered a rare one about Wallsend. Mr. Thornton says he has never bred it from any tree but the green wattle (*Acacia decurrens*). The female is a little smaller than *C. splendens*; the pattern of the forewing is exactly the same, but here the brown tints are much lighter and the bright greens are replaced with golden yellows, while the hindwings and body are identical, except in being somewhat lighter. The male has the hindwings pale green, the transverse white band very slender, the tips of the wings less marbled, and the white markings on the hind edge of the wings enclosing no circular ring, the hindwings pale whitish-green.

The larva does not form a felty bag round the stem, but after gnawing a furrow half round the branch, covers it with a thin web, and only makes a bore about three inches down the centre of the stem. When ready to pupate, it closes the entrance to the bore with a delicate semi-transparent membranous covering almost as thin as tissue-paper. This species also breeds annually, generally going into the chrysalid state in December, and emerging in January.

THE LAND MOLLUSCAN FAUNA OF BRITISH NEW GUINEA.

(Second Supplement, continued from Vol. vi., p. 695.)

By C. Hedley, F.L.S.

(Plates xxiv.-xxvi.)

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Since the publication of former parts of this paper, several small collections, made on various official tours, have been kindly sent to the Australian Museum by His Honour Sir William Macgregor, Administrator of British New Guinea. Instructed by the Trustees of that Institution, I have studied the new or little-known species therein contained.

Ground entirely new to science was broken by the exploration of the Purari Valley.* The mollusca found there embraced :— *Papuina canovarii*, Canefri ; *P. brazieræ*, Brazier var.; *hixoni* Brazier ; *P. tayloriana*, Adams and Reeve ; *Chloritis dinodeomorpha*, Canefri ; *Planispira macgregori*, Hedley ; *P. dominula*, Canefri ; *P. plagiocheila*, Canefri ; *P. rhodomphala*, Canefri ; *Nanina citrina*, Linné ; *N. cairni*, Smith ; *Sitala maino*, Brazier; *S. starkei*, Brazier ; *Helicarion musgravei*, Hedley ; H. sp. ; *Leptopoma gianelli*, Canefri ; *Cyclotus levis*, Pfeiffer ; *Helicina leucostoma*, Canefri ; *H. multicoronata*, Hedley ; H. sp.; *Realia isseliana*, Canefri ; *Melania singularis*, Canefri ; *Neritina porcata*, Gould ; besides the following two novelties :—

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* The Purari or Wickham, or Queen's Jubilee River enters the Papuan Gulf at 7° 50′ S. Lat., 145°10′ E. Long.

OTOPOMA MACGREGORIÆ, n.sp.

(Pls. xxiv. and xxv., figs. 5, 7, 20.)

Shell globosely conical, openly umbilicate, thin, translucent. Colour pale straw with a brown band which, peripheral on the last whorl, becomes sutural above; beneath this band are a few narrow indistinct brown lines, and the space above it is obscurely mottled with brown. This pattern is visibl e from within. Whorls 5, rounded and rapidly enlarging. Spire small, well exserted. Suture impressed. Epidermis thick, like felt to the touch, under the lens closely beset with tiny bristles, arranged quincunx. Umbilicus broad, deep and spiral. Aperture oblique, subcircular, angled posteriorly. Peristome sharp, straight, at the left anterior side broadly expanded into a sub-triangular lobe. Operculum (fig. 7) ovate, paucispiral, within flat and corneous, outside concave and calcareous, with a deep sulcus at the suture. Height of shell 13, maj. diam. 12, minor diam. 9 mm.

Type in the Australian Museum.

Judging from figures and description, this remarkable shell, of a genus not hitherto recorded from Papua, nearest approaches *O naticoides*, Recluz; it is dedicated to the writer's accomplished friend, Lady Macgregor. On pl. xxv. fig. 20, I have sketched the radula. But a solitary example of this species was obtained.

SITALA ANTHROPOPHAGORUM, n.sp.

(Pls. xxiv., xxv., and xxvi., figs, 1, 3, 21, 24.)

Shell conoid, rounded on the base and angled at the periphery, very thin, smooth, shining, translucent, subperforate. Coloured as if made of gelatine. Whorls 5½, moderately rounded. Sculpture: above and below faint, irregular, oblique, growth lines mark the surface; on the base in addition close, regular, waved, concentric striæ are visible with a microscope; a raised thread-like keel winds round the periphery and ascends the spire immediately above the suture. Aperture a little oblique, subrhomboidal, neither descending nor ascending, neither thickened nor reflected, except the columella, which is closely and shortly curled over a shallow, narrow, spiral, perforation. Height $5\frac{1}{2}$, major diam. $6\frac{1}{4}$, minor diam. $5\frac{1}{2}$ mm.

Type in the Australian Museum. Foot narrow, with pedal line and oblique grooves, tail with mucous pore. The absence or existence of a surmounting horn could not be ascertained from spirit specimens. Genitalia (Pl. xxvi., fig. 24) like that of *S. attegia*, Benson, in possessing a dart sac. The extreme smallness of the teeth of the radula (Pl. xxv., fig. 21) defied exact computation. I estimated their number at 160 rows of 140 : 6 : 1 : 6 : 140. The rachidian is long and slender, the median cusp overlapping the basal plate, two minute pairs of auxiliary cusps are located at one and two-thirds respectively of its length. The laterals are sinuate with a small proximal accessory cusp and two or three distal ones. The marginals are almost the shape of a reversed S, the distal blade beset with numerous small cusps.

This undescribed species has for many years been represented in the Museum by specimens obtained by Mr. W. W. Froggatt, of the Fly River Expedition of 1885.

My examination of this species induces me to suppose that the genus *Trochonanina* of Mousson should be reduced to a synonym of *Sitala*.

LAGOCHEILUS POIRIERII, Tapparone Canefri.

This species was described doubtfully as a *Cyclotus*, from a solitary example found by D'Albertis. A much larger and better preserved specimen has been sent from the Purari Valley by Sir William Macgregor. Its measurements are: height 11, maj. diam. 10, minor diam. 9 mm. The keel and elevated lines described by Tapparone Canefri are in this instance (Pl. xxiv, fig. 2) clad with short stiff epidermal bristles. The operculum (Pl. xxiv, fig. 4) is corneous, circular, multispiral, with subcentral nucleus. The species will therefore be more appropriately bestowed in *Lagocheilus*.

PARTULA MACLEAYI, Brazier.

A shell containing the animal, collected by Mr. English, was sent from Rigo I failed to make a satisfactory dissection of the genitalia. The jaw (Pl. xxvi, fig. 23) is thin, flexible and pale yellow, arched, crossed perpendicularly by very numerous and slender riblets which slightly denticulate the inferior margin. The slightly imperfect radula (Pl. xxvi., fig. 22) that I examined contained 160 rows of 40 : 6 : 1 : 6 : 40. The rachidian is advanced half a length before the immediate laterals; it is small, with a single ovate cusp whose tip projects over the basal plate, the latter being a little expanded posteriorly. The laterals are set aslant to the rachidian, and are armed with a large ovate proximal cusp and a small thorn-shaped distal one, the basal plate being bent posteriorly towards the rachidian. In the marginals the small cusp divides first into two then into three, receding they become larger and more sloped.

Seeing that a plaited jaw may be welded into a ribbed one, I am not disposed to consider the eccentric jaw of *macleayi* as outweighing in taxonomic value those characters of the shell and radula which point to *Partula.* Other figures of *Partula* dentition are: Malak. Blatt., 1867, xiv., Pl. i., fig. 1; Annals New York Acad., iii., Pl. xi., fig. L, Pl. xv., fig. O; Reis. Philip., iii., Pl. xvii., fig. 18.

PAPUINA ZENO, Brazier.

Specimens of this species accompanied the last. Its genital system (Pl. xxvi., fig. 27) was seen to be like that of *P. brumeriensis*, remarkable for its simplicity. The epiphallus, on which is the retractor muscle, passes insensibly into the wide vas deferens. My illustration shows the penis-papilla in section.

The jaw (Pl. xxv., fig. 15) is thin, wide, and crossed by weak ribs.

For formula the radula has 153 rows of 42 : 10 : 1 : 10 : 42. (Pl. xxv., fig. 14). The rachidian cusp is narrower than that of the laterals; both are square-headed and surpass the basal plates. On the laterals develop a minor proximal cusp, and the larger cusp becomes rounded.

On specimens from Rossel Island, Louisiades, were made the following notes.

PAPUINA CHAPMANI, Cox.

Genital system provided with a flagellum two-thirds the length of the epiphallus; penis sac stout; right tentacle retracted between male and female branches (Pl. xxvi., fig. 29).

The jaw (Pl. xxv., fig. 11) is arched, ends rounded, crossed by weak ribs.

Radula (Pl. xxv., fig. 12), formula 138 rows of 32 : 6 : 1 : 6 : 32, of the same pattern as the preceding.

PAPUINA GURGUSTI, Cox.

Genital system: epiphallus long with rudimentary flagellum; papilla long and tapering (Pl. xxvi., fig. 26).

Jaw (Pl. xxv., fig. 19) like the foregoing. Radula (Pl. xxv., fig. 18), formula 145 rows of 47 : 10 : 1 : 10 : 47, of similar character to the last.

TROCHOMORPHA NIGRANS, Smith.

Genital system: penis sac surmounted by a globose bilobed pouch, half its size, from the base of which arises the epiphallus. The boot-shaped spermatheca is seated upon a short duct. The above note was made before I saw the account of *T. planorbis* in Pilsbry's review of *Trochomorpha* [Man. Conch. (2) ix.], and I am not now able to say whether the external resemblance of *P. nigrans* to it is completed by the possession of internal vaginal glands.

Radula (Pl. xxvi., fig. 28) small, narrow, formula 118 rows of 26 : 23 : 1 : 23 : 26. Rachidian slender, with a single lanciform cusp which projects beyond the basal plate. Laterals slightly larger and inclined. Marginals sinuate, bicapitate.

An exploring expedition which ascended Mount Maneao (the Mount Dayman of earlier maps) brought back an interesting collection of mollusca, comprising *Neritina cornea, Nanina cairni, Rhysota flyensis, Chloritis rehsei, Papuina tayloriana*, var *strabo, P. t.* var *kataunensis*, and the following novelty :—

PAPUINA SECANS, n.sp.

(Pl. xxv., figs. 8, 9.)

Shell imperforate, trochiform, solid ; spire conic ; apex mamillar, obtuse. Whorls 5, separated by an impressed suture, inflated on their inner side, but on the outer compressed at the very sharp keel, which runs around the whorls and disappears just behind the aperture. Sculpture coarse, oblique growth lines decussated and somewhat microscopically beaded by minute, close, waved, spiral, impressed lines. Colour above pale purple, which fades into white on reaching the keel of the last whorl ; the latter is above the periphery painted by seven chestnut spiral bands, opaque when seen by transmitted light ; behind the aperture these bands broaden and merge together into a dark transverse stain ; thinning out they fade away after ascending the shell for about half a whorl. The base is encircled by five similar bands. Aperture diagonal, abruptly and deeply descending. Lip intense black, broadly reflected, beaked at the periphery, above the beak dinted without and tuberculate within. Columella very broad, adherent to the base, toothed on the inner edge. Margins united by a narrow brown ridge of callus Fragments of a coarse (?) yellowish, hydrophanous epidermis appear on the last whorl.

Maj. diam. 40, min. 33, alt. 22 mm.

One example containing the animal was found, March, 1894, at a height of from 1000 to 6000 ft. on Mount Maneao, B.N.G., by the collectors of Sir William Macgregor.

Type in the Australian Museum.

Larger than any related form this species resembles *tayloriana* in form and *zeno* in coloration ; other allies are *naso* and *diomedes*.

Mr. E. A. Smith has suggested ("Conchologist," March, 1893, iii. p. 108) that the shells I styled *Oxytes* would have been more suitably grouped under *Rhysota*. Specimens of *R. flyensis*, containing the animal, received from Mount Maneao prove that this opinion is perfectly correct. These spirit examples showed the foot to be provided with a large tail pore, pedal line and oblique grooves. Radula (Pl. xxv., fig. 17) narrowly ovate, 10 by 5 mm., formula 120 rows of 90 : 20 : 1 : 20 : 90; rows nearly straight, meeting at a low angle in the centre and sweeping gently backwards at the margin; rachidian cusp stout, an isosceles triangle, with rudimentary cusps at its base, basal plate rather hour-glass-shaped; immediate laterals rather larger than and inclined towards the rachidian, unicuspidate; the very numerous marginals with a long knife-like blade grow smaller as they retreat. Of the genitalia (Pl. xxiv., fig. 6) the penis sac is large and thick, epiphallus long and narrow, folded upon itself at half its length, where is attached the adductor muscle, which arises from the hind end of the floor of the pulmonary sac near the heart; a small caecum exists at the entrance of the vas deferens; the spermatheca is much enlarged at its base, then contracted, and again expanded. Jaw (Pl. xxv. fig. 16) smooth, arched, with a median keel projecting on the inferior margin.

Of CHLORITIS REHSEI, the only available animal parted in the middle while being withdrawn from the shell, and on unravelling the genitalia (Pl. xxvi., fig. 25) those parts lying beyond the first whorl were found wanting. The penis sac is long and tapers to the orifice above the attachment of the retractor muscle, the epiphallus gradually enlarges, and a finger-shaped flagellum arises at the termination of the vas deferens; on splitting the penis sac no papilla was found contained; the interior walls are obliquely wrinkled. Jaw (Pl. xxv., fig. 13) arched, crossed by numerous stout ribs. Radula (Pl. xxv., fig. 12) has for formula 224 rows of 46 : 20 : 1 : 20 : 46. It is constructed like others of its allies that I have previously described.

In several instances, chiefly from want of illustration, several Papuan species have received second names. The type of *P.*

sicula, Brazier, now in the Macleay Museum, but which I had, when writing the former article, been unable to study, I have since opposed to Tapparone Canefri's figure of *P. meditata*, with which it exactly corresponds. There can be no doubt that as *Nanina orbiculum*, Tapparone re-described Brazier's *Thalassia annula*, and I am sure that *Nanina bruijni* may similarly be referred to *Microcystina sappho*. From an inspection of authentic specimens (part of the original lot) kindly sent me by Mr. Pilsbry, I should consider that his species *Helicina dentoni* is equivalent to *H. solitaria*, Smith. When writing the preceding part, I examined the series collected by Mr. Bevan on the Douglas River, from which was selected the type of *P. agnocheilus*, Smith ; after contrasting this with a series of *P. tomasinelliana*, Tapparone Canefri, from its type locality, the Fly River, I referred it to that species.

An examination of the actual type of *Helix hixoni*, Brazier, preserved in the collection of Mr. Hobson, enables me to rectify mistakes which have arisen regarding it. I recognise in "*Helix hixoni*," the common or large form of *Papuina brazierae*, occurring abundantly throughout the St. Joseph River district, the veritable *brazierae* being a dwarf race confined to Yule Island. The classification of *Helix hixoni* as a *Hadra*, originated by Tapparone Canefri, was followed by Pilsbry and myself, who were unacquainted with the shell. A reference to the "Fauna Malacologica della Nuova Guinea" shows that Tapparone also never saw it. His figure, presumably from an unpublished sketch forwarded by Mr. Brazier, shows the shell so tilted as to hide the contour of the spire, and it is besides inaccurately drawn.

It may not be out of place to mention here that specimens in the Australian Museum, collected by Mr. Brazier at Wanga, San Christoval, Solomons, answer precisely to Papuan examples of *Helicina louisiadensis*, Forbes. This considerably extends the known range of that species.

EXPLANATION OF PLATES.

Plate xxiv.

Figs. 1 and 3.—Peripheral and basal aspects of the shell of *Sitala anthropophagorum*, Hedley; (type) much enlarged.
Fig. 2.—Sketch of sculpture of *Cyclotus poirierii*, Canefri.
Fig. 4.—Imperfect operculum of the same; much enlarged.
Fig. 6.—*Otopoma macgregoriæ*, Hedley; (type) much enlarged.
Fig. 7.—Exterior aspect of operculum of the same; much enlarged.
Fig. 6.—Genitalia of *Rhysota flyensis*, Hedley.
Figs. 8 and 9.—Basal and peripheral aspects of type shell of *Papuina secans*, Hedley; natural size.

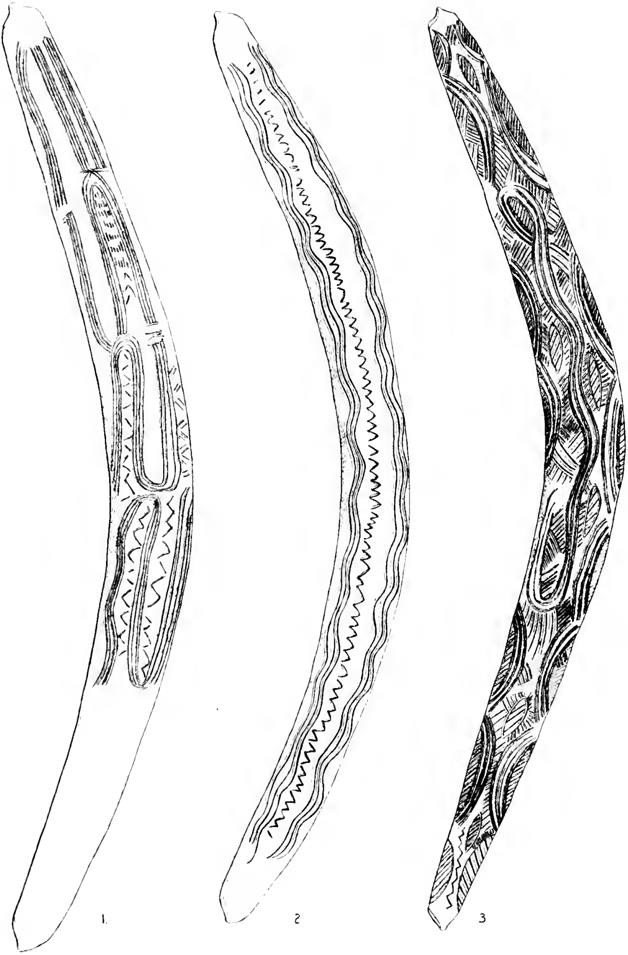
Plate xxv.

Fig. 10.—Central and marginal teeth from the radula of *P. chapmani*, Cox.
Fig. 11.—Jaw of the same.
Fig. 12.—Central and marginal teeth from the radula of *C. rehsei*, Martens.
Fig. 13.—Jaw of the same.
Fig. 14—Central and marginal teeth from the radula of *P. zeno*, Brazier.
Fig. 15.—Jaw of same.
Fig. 16.—Jaw of *R. flyensis*, Hedley.
Fig. 17—Central and marginal teeth from the radula of the same.
Fig. 18.—Central and marginal teeth from the radula of *P. gurgusti*, Cox.
Fig. 19.—Jaw of the same.
Fig. 20.—Teeth from the radula of *O. macgregoriæ*, Hedley.
Fig. 21.—Central and lateral teeth from the radula of *S. anthropophagorum*, Hedley.

Figs 10 to 21 variously magnified.

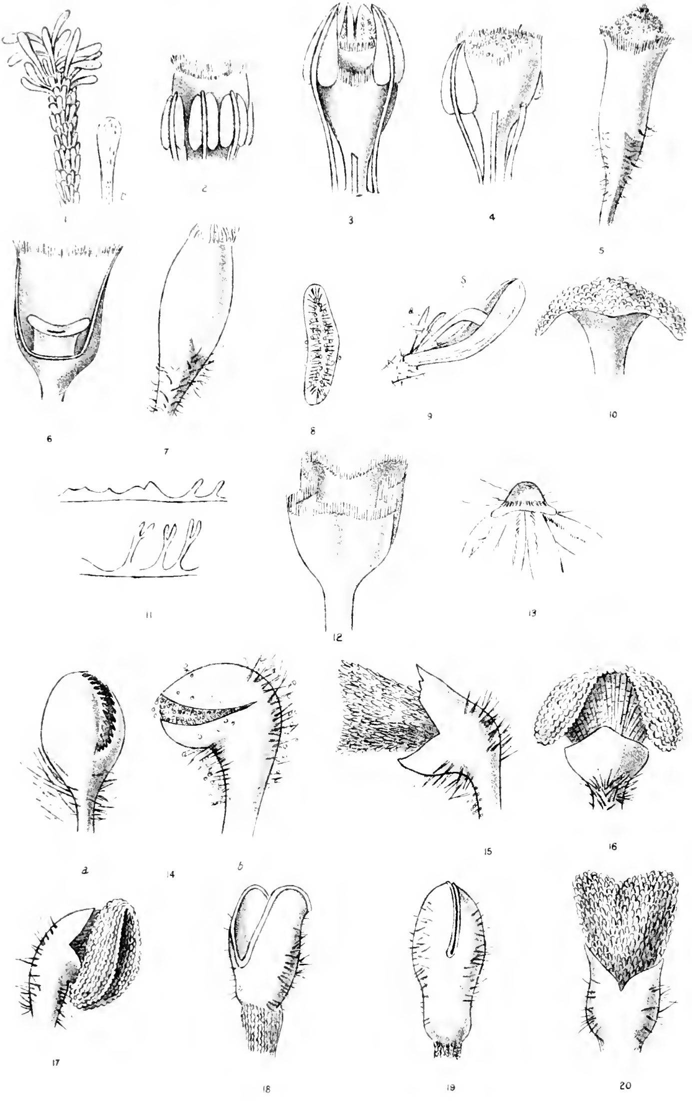
Plate xxvi.

Fig. 22.—Central and lateral teeth from the radula of *B. macleayi*, Brazier.
Fig. 23.—Jaw of the same.
Fig. 24.—Genitalia of *S. anthropophagorum*.
Fig. 25.—Genitalia of *C. rehsei*.
Fig. 26.—Genitalia of *P. gurgusti*.
Fig. 27.—Genitalia of *P. zeno*.
Fig. 28.—Central and marginal teeth from the radula of *T. nigrans*.
Fig. 29.—Genitalia of *P. chapmani*.

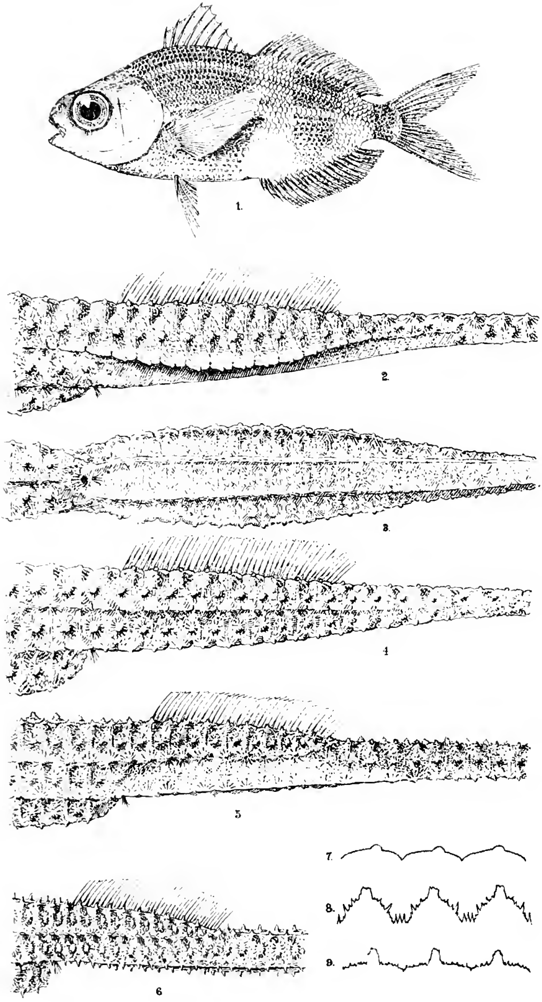


C. Hedley del.

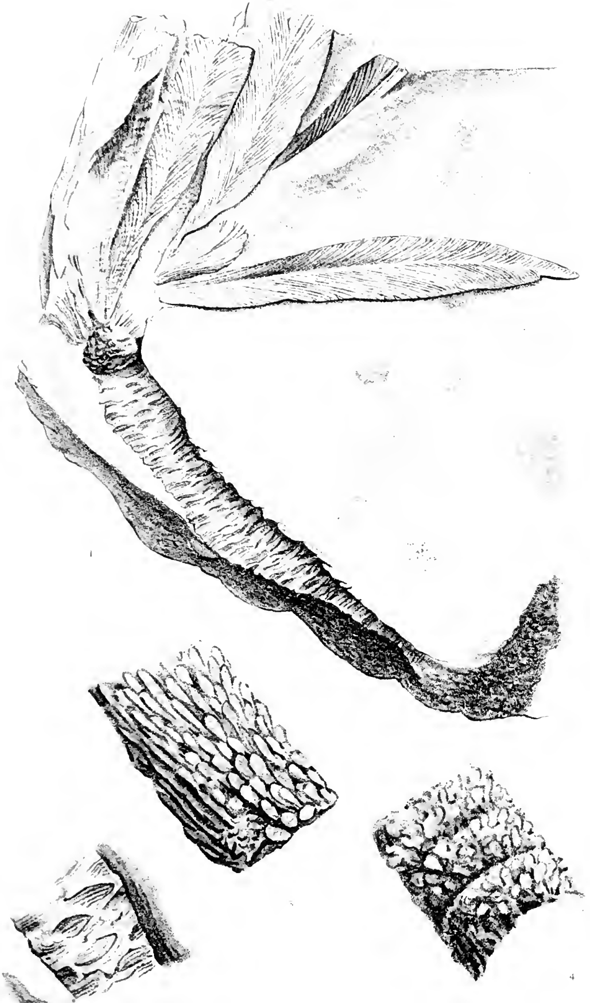
 Pl. XVI



A. G. H. del.



Edgar R. Waite del.



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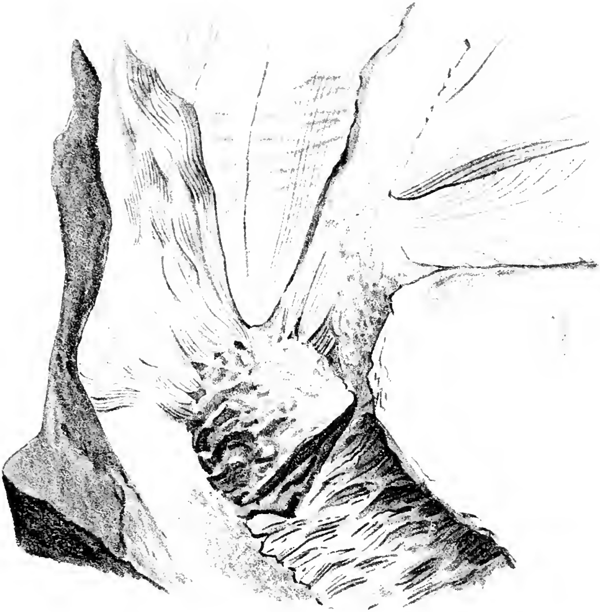

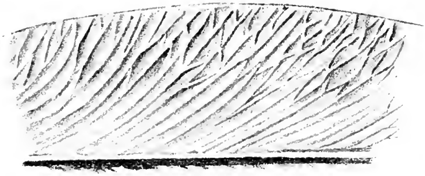

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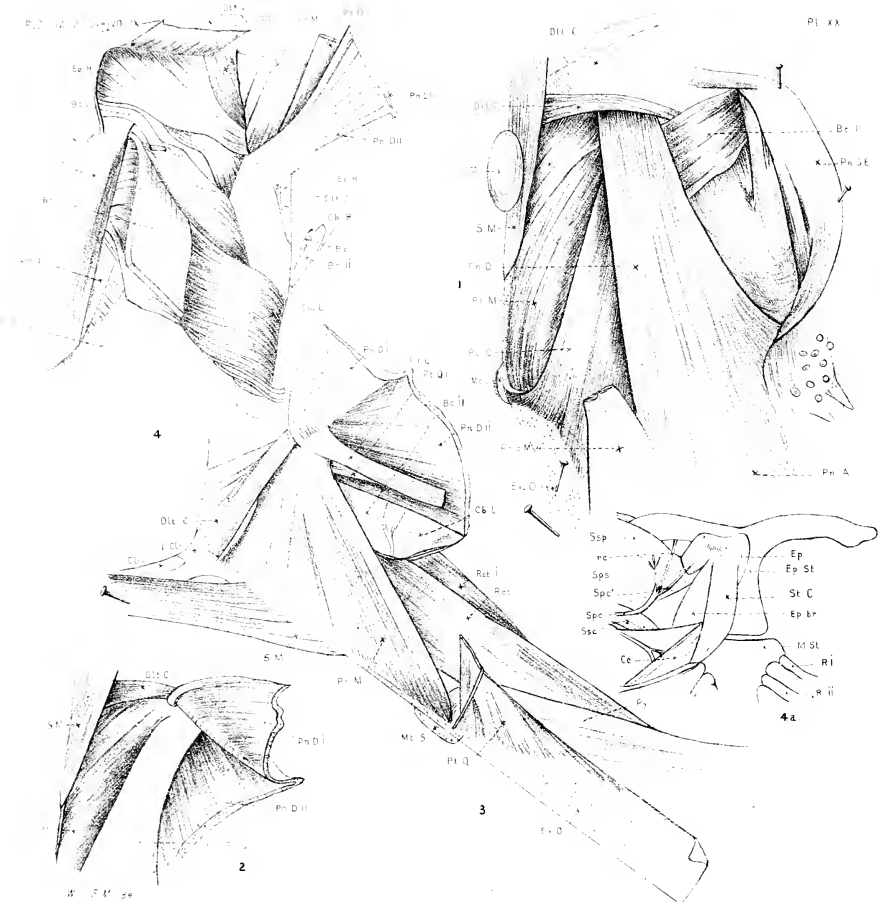
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Cb L
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Pt Q I
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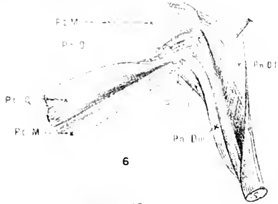

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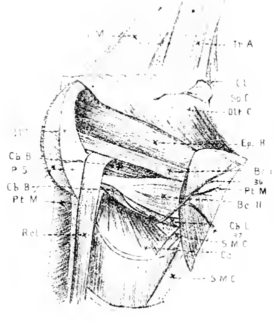

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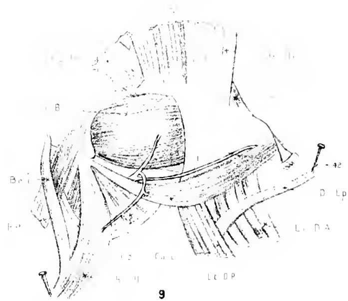

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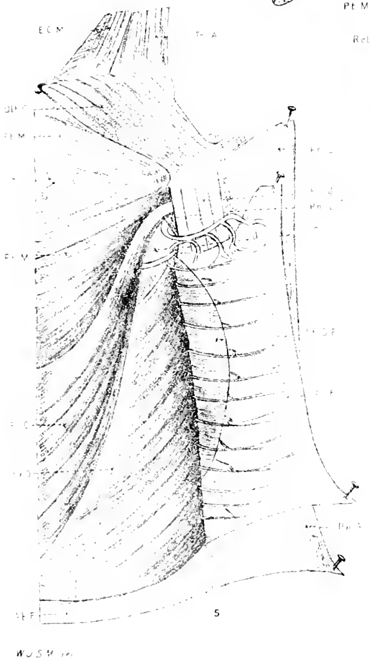

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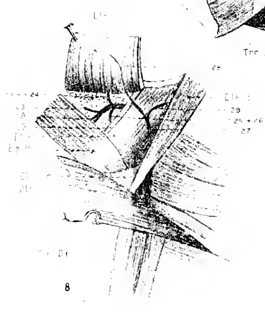

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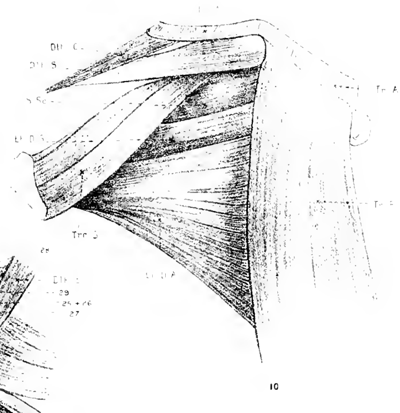

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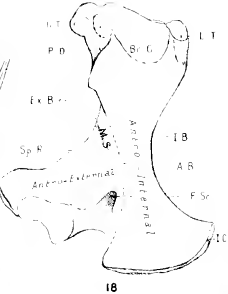
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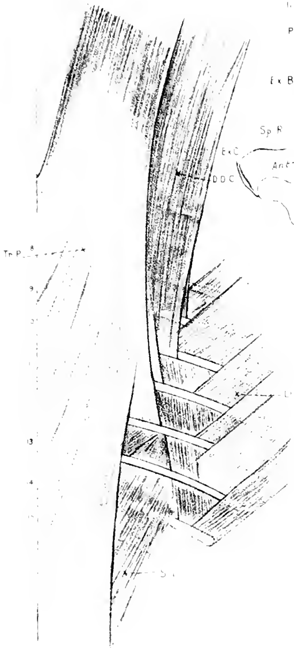
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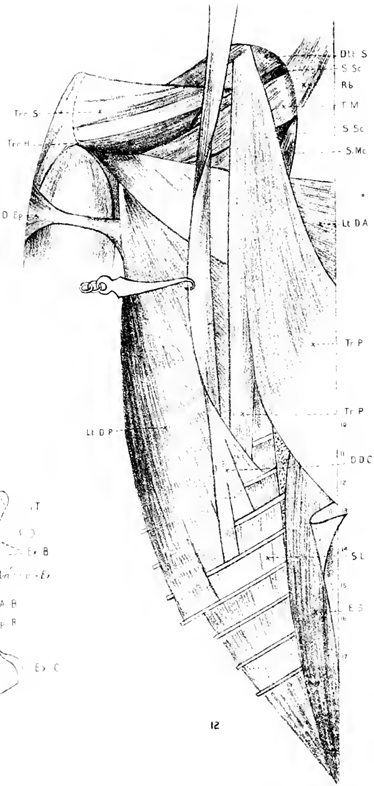
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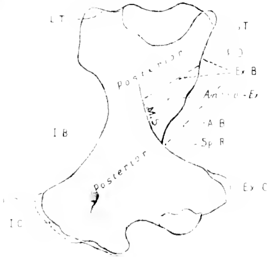
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Ex C
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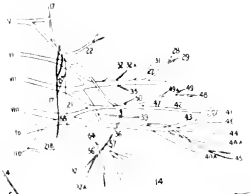

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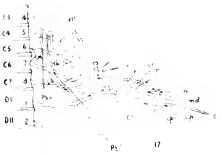

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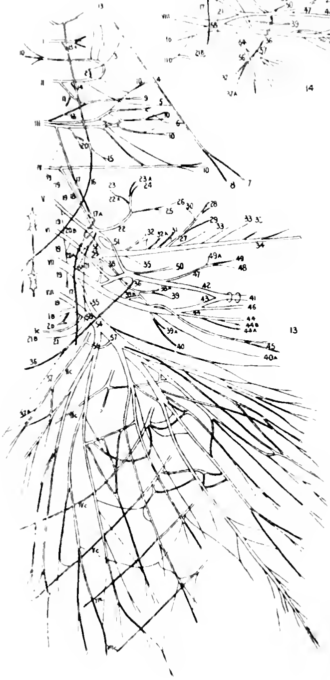

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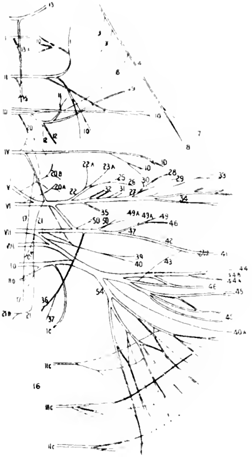

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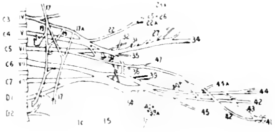

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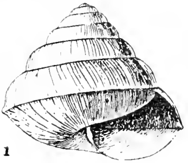

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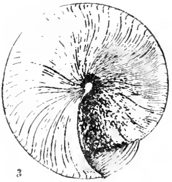

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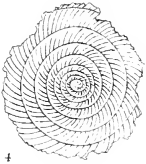

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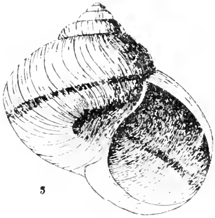

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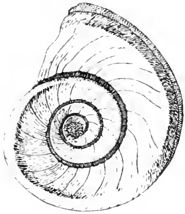

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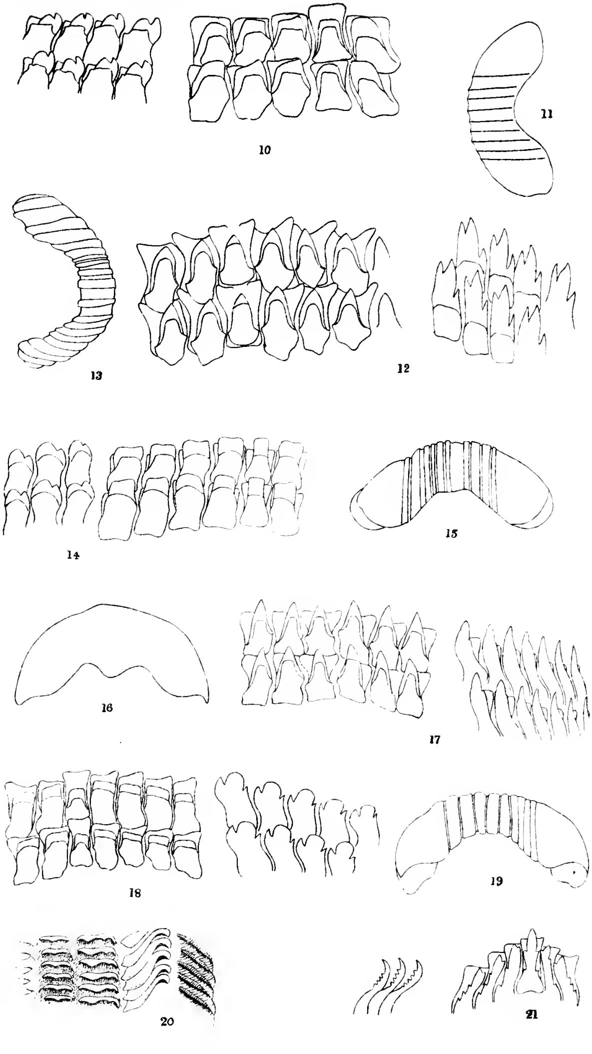
C. Hedley del.

NEW GUINEA LAND MOLLUSCA



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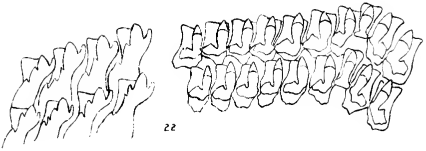

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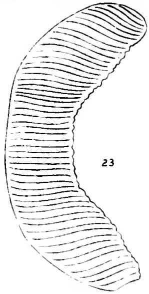

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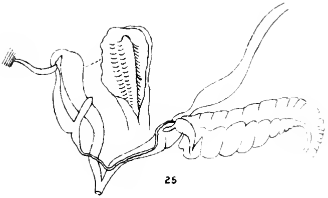

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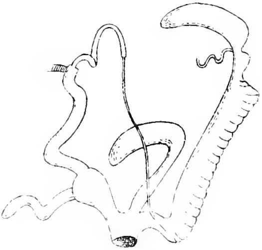

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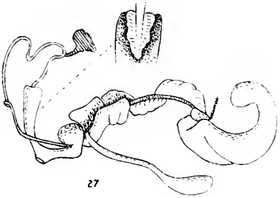

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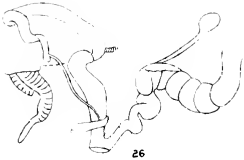

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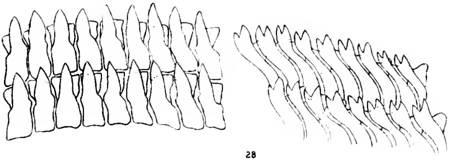

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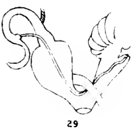

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C. Hedley del.

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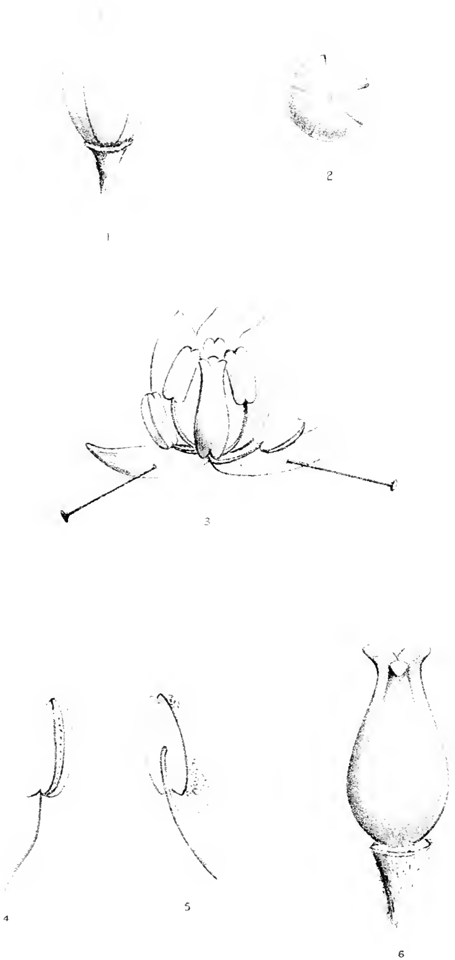

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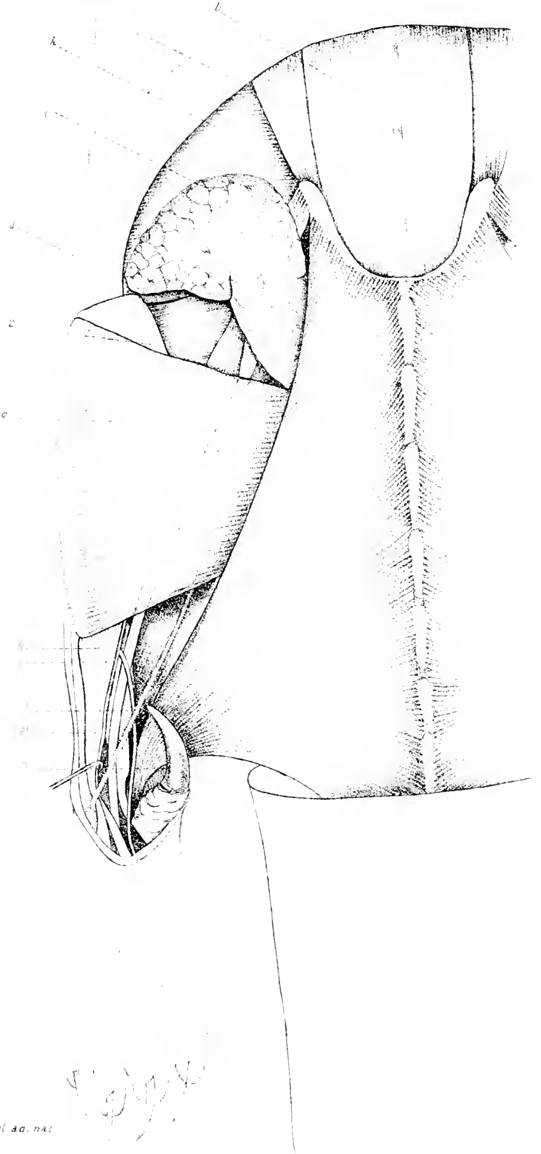
PENNANTIA CUNNINGHAMII, MIERS.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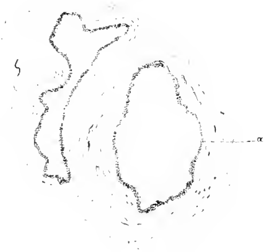

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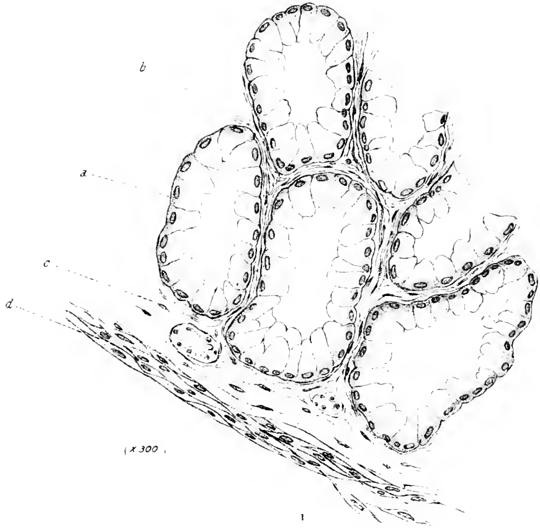
C J M del



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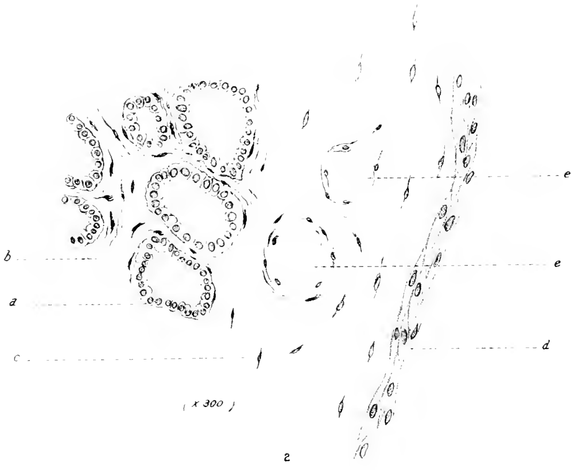

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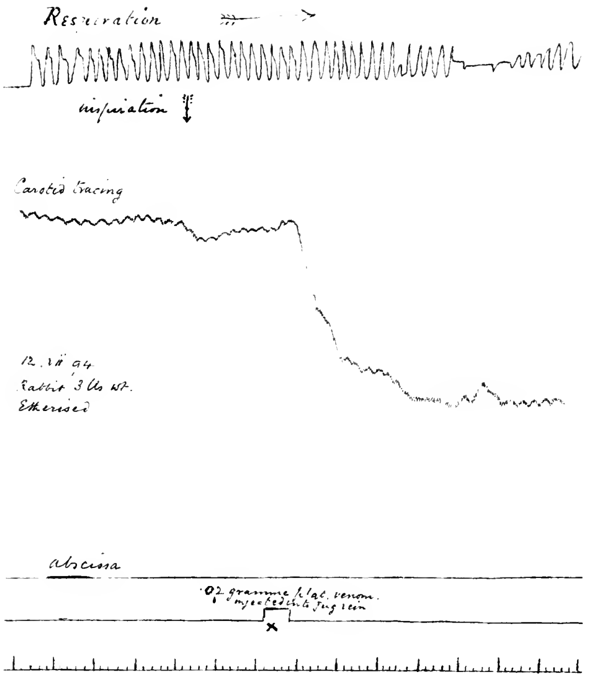
C.J.M. del.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Rabbit 3 lbs wt.
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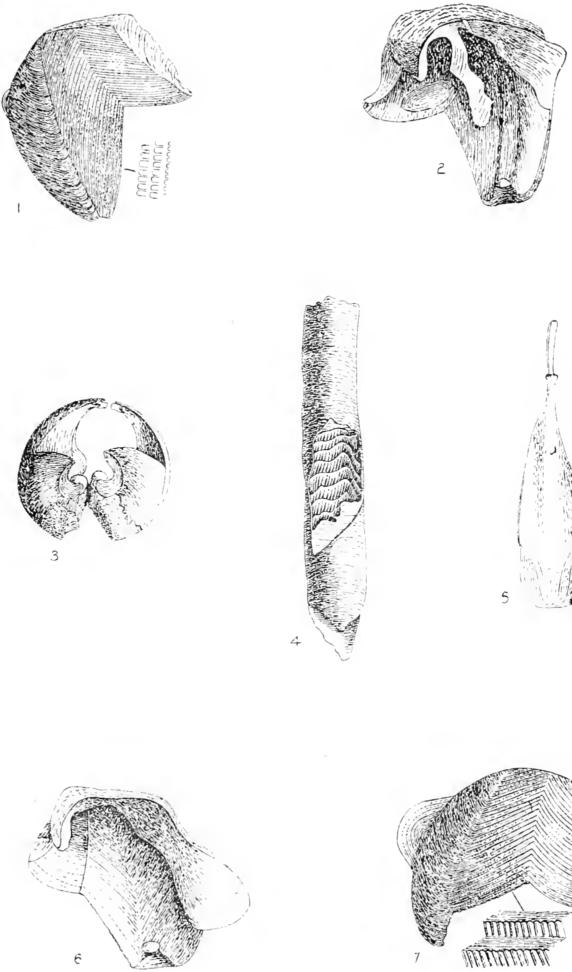

AUSTRALIAN SHIPWORMS

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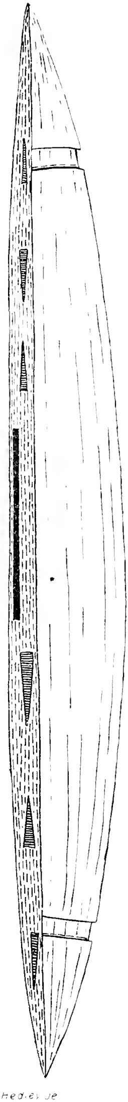

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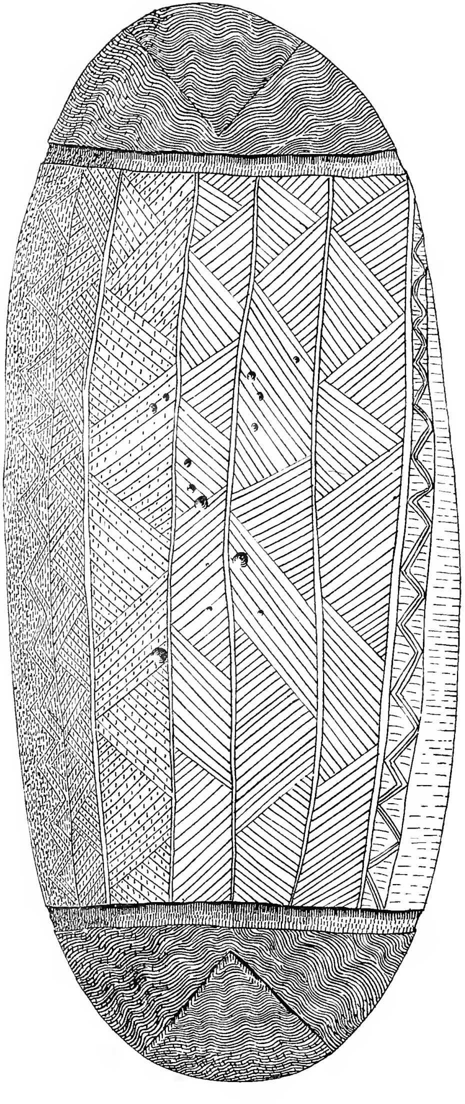

C. Hedley, del.

STUDIES IN AUSTRALIAN ENTOMOLOGY.

No. VII.—New Genera and Species of Carabidæ (Including Some Notes on Previously Described Species, and Synoptic Lists of Genera and Species).

By Thomas G. Sloane.

Scaritini.

Geoscaptus crassus, n.sp.

Robust, elongate, parallel, lævigate, lightly convex; prothorax transverse, obliquely narrowed on each side of base; anterior tibiæ tridentate.

Polished black. Head transverse (4·4 × 7 mm.), lightly convex; front depressed, strongly bi-impressed; the impressions distant from eyes, wide, shallow, converging slightly behind, curved outwards in front along course of clypeal suture, this impressed; clypeus longitudinally rugulose, anterior margin sloping lightly inwards on each side of labrum, emarginate behind labrum; eyes deeply set in orbits, not prominent; orbits tuberculiform behind eyes; the post-ocular processes two-thirds the size of eyes and nearly as prominent, abrupt behind. Upper surface of mandibles closely and finely rugulose. Prothorax transverse (5·5 × 8·3 mm.), widest near anterior angles, lightly convex; sides lightly rounded to anterior angles, straight and narrowing a little to posterior angles (these not marked), obliquely narrowed with a light sinuosity to base; basal angles not marked; base lightly sinuate in middle; anterior margin lightly sinuate on each side; anterior angles not marked or advanced; border narrow, reflexed, thicker on base; marginal channel wide and sinuate in middle on base; median line strongly impressed. Elytra hardly wider than prothorax (15 × 8·5 mm.), parallel on sides, truncate on base; shoulders rounded; apex widely rounded; a narrow space along base and sides very finely and closely granulate; border reflexed; two punctures on apical fourth of each elytron placed longitudinally and widely apart. Prosternal episterna covered with minute granules. Anterior tibiæ widely incrassate, 3-digitate externally, one or two fine projections above the larger ones; intermediate tibiæ incrassate, external edge serrate, a strong external spur near apex.

Length 30, breadth 8·5 mm.

Hab.—Cooktown District, Queensland. (Sent to me by Mr. N. H. Gibson, from King's Plains Station, 28 miles S.W. from Cooktown).

This is the largest species of the genus yet described; in shape it is mid-way between *G. levissimus*, Chaud., and *G. cacus*, Macl.; being far less convex and cylindrical than *G. cacus*, but much heavier and more convex than *G. levissimus*. Its general resemblance is to *G. levissimus*, from which its greater convexity (especially of the abdomen) and larger size at once distinguish it.

Euryscaphus terrenus, n.sp.

Oval, robust, convex, lævigate; elytra impunctate, the border reflexed and passing round the humeral angles.

Black, shining. Head smooth, subquadrate, transverse (6·3 × 9·8 mm.); frontal sulci deep, short, sub-parallel, turning outwards in front in a light sinuous course; pre-ocular sulcus lightly marked, short, not reaching eye; pre-ocular process small; eyes deeply set in orbits, edge of orbits thickened and obtuse below eye; one supra-orbital puncture on each side. Antennæ filiform, attenuate to apex. Prothorax short, widely transverse (6·5 × 12 mm.), convex; disc finely transversely rugulose; sides strongly and evenly rounded; anterior margin lightly bisinuate; base obsoletely and widely sinuate on each side, not lobate; anterior angles obtuse, very little advanced; posterior angles widely rounded, but a little marked; border reflexed, widely so at posterior angles, thick and strongly reflexed on base; median line strongly impressed; a short arcuate transverse impression at end of median line near base; two marginal setigerous punctures on each side as usual in the genus. Elytra widely rotundate (14·6 × 14 mm.), widely rounded at apex, very convex; the base truncate on each side, widely and very lightly emarginate in middle; humeral angles almost rectangular, their summits rounded; border reflexed, widely so at humeral angles, passing round these on to the base on each side; margin wide, declivous on apical curve, flat and widely explanate at shoulders; a row of fine punctures (6) on base of each elytron; a row of fine punctures along margins from shoulders to apex. Anterior tibiæ bidentate; external ridge with three small projections above the larger teeth.

Length 32, breadth 14 mm.

Hab.—Murchison District, W.A. (In the collection of Mr. C. French).

I have not ascertained the sex of the single specimen on which the description above is founded, but have no doubt, from the shape of the elytra, that it is a ♂. Among the species known to me its nearest ally is *E. politus*, Sl., from the MacDonnell Ranges. Only the ♀ of *E. politus* has been recorded, and *E. terrenus* shows the following non-sexual differences from it: the prothorax is more transverse, more equally rounded on the sides, the anterior angles less advanced and more obtuse; and the orbits are less sharply prominent below the eye. It is also almost certain, judging from other species, that the elytra of the ♂ of *E. politus* will prove far more strongly emarginate at the base than those of *E. terrenus.* It has also a general resemblance to *E. minor*, Macl., and *E. concolor*, Sl.; from the former the wider prothorax, not the least lobate in the middle of the base, at once distinguishes it: while from the latter the prothorax less rounded behind, with the anterior angles less advanced, and the border less prominently upturned at the posterior angles; and the elytra less emarginate on the base with more rectangular humeral angles, &c., easily separate it.

CARENUM FRENCHI, n.sp.

Robust, elliptic-oval, lævigate; prothorax transversely subquadrate, the posterior angles strongly marked; elytra oval, convex, impunctate, inflexed margins wide; abdomen convex; anterior tibiæ tridentate.

Black, shining, prothorax and elytra with a narrow metallic purple margin. Head smooth, subquadrate, transverse (5·3 × 8·1 mm.), convex across occiput; front depressed, vertical on each side above eyes; frontal sulci deep, lightly divergent backwards, turning outwards in front in a lightly marked linear course; clypeus truncate behind labrum with a short triangular projection on each side; pre-ocular sulcus short, deep, straight; pre-ocular process short, rounded externally; eyes not prominent; sub-orbital channel single, deeply impressed posteriorly; one supra-orbital puncture on each side. Mentum deeply emarginate; median tooth strong, prominent, triangular, strongly keeled in centre; a deep fovea on each side of keel at base. Second joint of antennæ shorter than third. Prothorax widely transverse (6·5 × 11 mm.), lightly convex, lightly declivous to base; sides subparallel, very lightly rounded; anterior margin lightly emarginate; anterior angles lightly and obtusely advanced; posterior angles rounded, but prominent and strongly marked; base short, bisinuate, roundly and widely produced backwards in the middle; the sinuosities on each side of the short basal lobe strong and wide; border widely reflexed on sides, very prominently so at posterior angles, narrower on base; marginal channel wide, narrowed at the posterior sinuosities, obsolete in middle of base; median line strongly impressed; basal declivity transversely striolate; two marginal punctures on each side as in *C. marginatum*. Elytra of same breadth as prothorax, oval (16 × 11 mm.), truncate on base between humeral angles, convex, strongly declivous to apex; sides subparallel (a little rounded in middle), rounded to shoulders; apex widely rounded; border reflexed, turned back at each humeral angle to form a short thick prominence; margin wide, most so (but not flat) on each side of apical curve; a row of four strong punctures on base of each elytron; a row of strong punctures along lateral margins, more closely placed in middle; suture forming a deeply impressed channel. Prosternum lightly rugulose on each side near anterior margin of coxæ, widely impressed between coxæ, truncate on base; two setigerous punctures on each side before base. Legs heavy: femora wide, compressed: anterior tibiæ tridentate externally, the upper tooth much smaller than the others; external ridge with three small projections above the larger teeth; inferior ridge strongly serrate, not extending to apex; apical plate narrow, projecting strongly in front below tarsus; intermediate tibiæ rough, strongly incrassate, a short light spiniform external spur at apex; posterior tibiæ light, incrassate.

Length 30, breadth 11 mm.

Hab.—Gnarlbine, W.A. (Yilgarn Goldfields District). (In the collection of Mr. C. French).

This splendid species is a very distinct one, differing decidedly in facies from all the other members of the genus I have seen. Its place will be with *C. transversicolle*, Chaud., which it resembles somewhat in the shape of the prothorax; the elytra are, however, proportionately longer and less rounded on the sides, which gives it a very different appearance.

CARENUM OPTIMUM, n.sp.

Elliptic-oval, robust, convex; head subquadrate, suborbital channel single; prothorax widely rounded at posterior angles, base lobate; elytra ovate, bipunctate, inflexed margin wide: anterior tibiæ tridentate, posterior tibiæ light.

Head, legs and underparts of body black, prosternum green on each side near anterior margin; prothorax black on disc (including middle of anterior margin) with wide brassy-green margins, inflexed margin of pronotum black with green reflections; elytra brilliant green, becoming of a coppery tinge towards margins, disc with purple reflections in some lights, inflexed margin green. Head not large, subquadrate, transverse (4·5 × 6·6 mm.), depressed, lævigate; frontal sulci deep, diverging strongly backwards, curving sharply out in front in a strongly marked course; pre-ocular sulcus short, lightly marked; pre-ocular process small; eyes not deeply set in orbits, convex, rather prominent; two supra-orbital punctures on each side. Antennæ setaceous. Prothorax transverse (5·3 × 9 mm.); sides hardly narrowed to anterior angles, sub-parallel on anterior third; posterior angles widely rounded, not marked; anterior angles wide, obtuse, hardly advanced; base decidedly lobate, the lobe rounded behind, a strong sinuosity on each side of the basal lobe; border strongly reflexed, a little wider at anterior and posterior angles, narrower on basal lobe; marginal channel wide; median line strongly impressed; a well marked transverse line defining basal part; four marginal punctures on each side, the anterior and posterior as usual in the genus, the two intermediate ones placed about midway between them a considerable distance apart.* Elytra oval (13·3 × 9·3 mm.), widest about middle, convex, rather depressed on disc, strongly declivous to apex and sides, abruptly declivous to peduncle; sides strongly rounded; base sub-emarginate between shoulders; humeral angles prominent; apex obtuse; border reflexed, more lightly so towards apex, thickened and upturned at each humeral angle to form a strong prominent obtuse projection; margin wide, most so and flattened on apical curve; a strong discoidal puncture on apical third of each elytron, placed a little nearer the suture than the margin just behind beginning of apical declivity; four or five fine punctures in a curved row, with a larger puncture below them, on base of each elytron; a row of punctures along margin; suture forming a strong depression. Prosternum strongly impressed between coxæ, truncate on base; one or two setigerous punctures on each side just before base. Legs light; anterior tibiæ tridentate externally, the upper tooth small; external ridge with two light projections above larger teeth; inferior ridge strongly serrate, not extending to apex; apical plate projecting strongly below tarsus at apex.

Length 26, breadth 9·3 mm.

* It is probable the normal number of marginal punctures may prove to be three placed as in *C. odewahnii*, Casteln., &c.

Hab.—Murchison District, W.A. (In the collection of Mr. C. French.)

It resembles *C. habitans*, Sl., but differs conspicuously from that species in having the posterior tibiæ light, instead of thick and incrassate; the frontal sulci, too, are more divergent behind; there are two setigerous punctures above each eye instead of one, four setigerous punctures in the marginal channel of the prothorax instead of two, and the elytra are more rounded on the sides. Its place is with *C. elegans*,* Macl., *C. odewahnii*, Casteln., and *C. speciosum*, Sl.; the slender posterior tibiæ and the anterior angles of the prothorax hardly advanced are sufficient to separate it from the two last of these; while the colour, and the more evenly oval elytra more obtuse at the apex are among the features distinguishing it from *C. elegans*. The specimen before me has the elytra covered with rows of very distinct punctures; but I have no doubt this is caused by long immersion in spirits of wine, and that the elytra are naturally smooth.

Carenum cognatum, n.sp.

Elliptic-oval, robust, convex, lævigate; prothorax transverse, anterior angles porrect, posterior widely rounded, base shortly lobate; elytra oval, bipunctate, inflexed margins wide; anterior tibiæ tridentate.

Head, legs and under-surface black; prothorax widely margined with green, disc black in middle (including anterior margin) with purple reflections towards sides; elytra deep purple margined with green. Head subquadrate, transverse (3·9 × 6 mm.), lightly transversely impressed behind frontal sulci; front depressed; sulci deep, diverging strongly backwards, turning sharply outwards in front in a short lightly marked course; pre-ocular sulcus light; pre-ocular process weakly developed; eyes convex, projecting but not prominent; two supra-orbital punctures on each side. Prothorax widely transverse (4·8 × 8 mm.), convex, declivous to

* I cannot separate *C. campestre*, Macl., from *C. elegans*, Macl., and now regard it as a synonym of *C. elegans*.

base; sides lightly rounded, the curvature to anterior and posterior angles equal; anterior angles obtuse, lightly advanced; posterior angles rounded, not marked; base short, lobate, lobe short, rounded, a strong sinuosity on each side of the basal lobe; border widely reflexed, hardly more prominent at basal angles; marginal channel wide, narrower along base; median line strongly impressed; three marginal punctures on each side as in *C. odewahnii.* Elytra cordate-oval, hardly wider than prothorax (11 × 8·2 mm.), widest at about half the length, convex, abruptly declivous to peduncle; sides lightly rounded; base truncate; shoulders rounded; border reflexed, lightly folded back (not prominently upturned) at humeral angles; margin widely explanate on apical curve; a strong discoidal puncture on apical third of each elytron, placed about midway between suture and margin just behind beginning of apical declivity; a few irregularly placed punctures on base of each elytron; a row of umbilicate punctures along margin. Prosternum widely impressed between coxæ, truncate at base; two setigerous punctures on each side before the base. Legs light; anterior tibiæ tridentate; inferior ridge not strong, not extending forward beyond second external tooth; apical plate wide, projecting lightly and obtusely at apex below tarsus.

Length 22·5, breadth 8·2 mm.

Hab.—Queensland. (Brought from Queensland by Mr. Lau, probably from the Darling Downs District).

This species resembles *C. splendens*, Casteln., so closely that it requires a careful examination to distinguish it. The head is similar; the prothorax is differently shaped, being wider in front; this is caused by the sides being more parallel, the widest part being about midway between the anterior and posterior angles, and the curvature to the anterior angles almost equal to that of the posterior; in *C. splendens* the widest part of the prothorax is towards the posterior angles, the sides narrowing roundly to the anterior angles; the curvature of the sides from the posterior angles to the short basal lobe is shorter and more decided in *C. cognatum* than in *C. splendens.* *C. interioris*, Sl., is another species that, from the description, might be mistaken for *C. cognatum*, but it has the prothorax shaped as in *C. transversicolle*, Chaud., with marked and prominent posterior angles.

Carenum gracile, n.sp.

Elliptic-oval, depressed, lævigate; head transversely impressed across vertex; suborbital channel to receive antennæ wide, short, the median ridge hardly indicated; gulæ defined from genæ; prothorax transverse, lightly narrowed behind posterior angles, base not lobate, widely sinuate in middle; elytra short, 4-punctate, inflexed margin wide; anterior tibiæ bidentate.

Head, prothorax and underparts shining black; prothorax with faint narrow violet margin; elytra of a splendid metallic violet colour, becoming steel blue towards sides and on inflexed margins. Head light (2·5 × 3·5 mm.), front smooth, declivously depressed; frontal sulci not deeply impressed, short, curved, their posterior part hardly stronger than their anterior part: a well-marked transverse impression crossing the vertex a little behind the posterior supra-orbital puncture; pre-ocular sulcus short, wide, lightly impressed; pre-ocular process small; eyes hemispherical, projecting; two supra-orbital punctures on each side. Prothorax transverse (3·2 × 4·6 mm.), lightly rounded on sides, narrowed rather obliquely behind posterior angles; base wide, lightly emarginate; anterior margin emarginate; anterior angles lightly advanced; border narrow, reflexed, thicker and more strongly reflexed on base, thus causing a light sinuosity on each side just before the base; median line strongly impressed; a strong curved transverse impression a little before the basal margin; three marginal punctures on each side as in *C. anthracinum*. Elytra short, ovate, wider than prothorax (7 × 5 mm.); sides strongly rounded; base truncate between the shoulders, these rather prominent; apex widely rounded; border reflexed, thickened and lightly turned back at humeral angles to form a short erect projection; margin wide on apical curve; two discoidal punctures on each elytron, the anterior a little distance (about 0·8 mm.) behind the humeral angle, the posterior on apical third just at beginning of apical declivity about midway between suture and margin; two punctures on base of each elytron near shoulder; a row of widely-placed punctures along margin. Prosternum strongly impressed between coxæ. Legs light; anterior tibiæ bidentate; apical plate shortly but decidedly produced at apex below tarsus.

Length 14·5, breadth 5 mm.

Hab.—Lower Murray. (Sent to me by Mr. C. French, as coming from the Lower Murray—Mildura or Wentworth District).

This beautiful little species is allied to *C. anthracinum*, Macl.; its affinity being to *C. cyanipenne*, Macl., from which its wider form, and the elytra entirely of a beautiful metallic purple, with bluish reflections, readily distinguish it.

EUTOMA VIRIDICOLOR, n.sp.

Robust, elongate, cylindrical; head large, the suborbital channel short, divided into two equal parts by a wide convex ridge; prothorax hardly broader than long, anterior angles projecting; elytra convex, emarginate between humeral angles, 4-punctate, border thick, inflexed margin narrow behind first ventral segment.

Head black in front, greenish behind for about as far forward as the eyes; prothorax green, a narrow space along anterior margin black; elytra green, shining, the thick border black, inflexed part blackish-green; under parts of prothorax black with the anterior part green towards the sides; underparts of body and legs black; third, fourth, and fifth ventral segments with green reflections. Head large (4·2 × 5·6 mm.), convex; frontal sulci deep, strongly divergent backwards, turning sharply out in front in a faintly-marked course not attaining anterior margin; a strong foveiform puncture on each side near their out-turned anterior course; clypeus very feebly trisinuate between lateral teeth; pre-ocular sulcus narrow, well-marked, continued backwards above eye; pre-ocular process large, rounded externally; eyes deeply sunk in orbits, not prominent. Mandibles short. Antennæ moniliform, short, thick, lightly incrassate, second joint not shorter than third, apical joint obtuse. Prothorax very little broader than head, a little broader than long (5·5 × 6 mm.), convex, sides parallel on anterior half, gently and roundly narrowed on each side behind posterior marginal puncture; base widely rounded; anterior margin truncate between anterior angles; these obtuse, projecting shortly but decidedly; posterior angles not marked; border narrow, wider towards anterior angles, more strongly reflexed behind posterior marginal puncture, lightly sinuate on each side of base, much thicker on base; marginal channel narrow; median line strongly impressed; basal part short, depressed below disc, defined anteriorly by a strong transverse linear impression; two marginal punctures on each side, the anterior a little behind anterior angles, the posterior at the place of the posterior angles. Elytra a little wider than prothorax (11·5 × 6·3 mm.), widest about middle, a little narrowed to shoulders, convex, strongly declivous on sides and apex, abruptly declivous to peduncle; base widely emarginate; shoulders prominent; apex obtuse; border very narrow on anterior half of sides, becoming thick and convex on apical third, thickened and upturned at humeral angles to form a short obtuse prominence; two discoidal punctures on each elytron, the anterior a little distance (hardly 2 mm.) behind humeral angles, the posterior at beginning of apical declivity; a row of five strong punctures on base of each elytron; a row of separate umbilical punctures along sides, these more closely placed towards shoulders; inflexed margins very narrow and parallel behind first ventral segment. Four anterior legs strong, posterior light: anterior tibiæ bidentate; intermediate incrassate, serrate, with an acute strongly projecting external spur at apex.

Length 22, breadth 6·3 mm.

Hab.—Northern Territory of South Australia. (In the collection of Mr. C. French).

This is one of those species that serve to break down the boundaries dividing *Eutoma* from *Carenum*. It is a very distinct species, the affinity of which is, on the whole, more towards *C. quadripunctatum*, Macl., than to any other Carenide known to me; but its head is larger than in that species, and its prothorax more elongate; while the emarginate base of the elytra gives that part of the body a very different appearance from what it has in *C. quadripunctatum*, which has the elytra almost quite oval, the base being shortly truncate behind the peduncle; the legs are as in *C. quadripunctatum*. It is probably also allied to *C. viridissimum*, Macl., but is a much heavier and more robust insect.

BEMBIDIINI.

BEMBIDIUM MASTERSI,* n.sp.

Narrow, elongate, lightly convex: mandibles long, acute, decussating; prothorax subcordate; elytra strongly and evenly striate, the striæ simple, third interstice bipunctate.

Head and prothorax blackish-green, shining; elytra testaceous, the basal half of the first interstice, and a spot of varying width and size on the disc of each elytron situated between the punctures of the third interstice, of a dark hue with greenish reflections; legs and antennæ testaceous. Head large, very finely shagreened; front depressed, somewhat rugulose, impressed on each side; the impressions extending forward to anterior margin of clypeus, their course sub-parallel, a little sinuous; clypeus transverse, anterior margin truncate. Penultimate joint of maxillary palpi elongate, incrassate. Antennæ long, rather slender, lightly incrassate. Prothorax very little wider than head with eyes (1·1 × 1·4 mm.), subcordate, convex, declivous posteriorly, evidently narrower across base than across apex, finely shagreened towards sides, smooth on disc; sides lightly rounded on anterior part, very little narrowed to anterior angles, strongly sinuate posteriorly and meeting the base at right angles; anterior margin very lightly emarginate; base rather roundly truncate; anterior angles prominent, rather advanced; basal angles sub-rectangular, not prominent or acute; lateral border narrow, reflexed; a short

* While this paper has been passing through the press I have noticed a reference in Trans. Ent. Soc. N.S.W., I., p. xvii, probably relating to this species, and if so, showing that as long ago as 1863 Sir William Macleay had collected it and intended to name it *B. flavescens*.

rather wide impression on each side of base; spaces between these impressions and basal angles gently acclivous, not elevated or carinulate; space across peduncle between the impressions depressed and defined by a distinct transverse line; median line distinctly marked. Elytra sub-oval (2·8 × 1·6 mm.), truncate at base, widely rounded at apex, lightly convex; sides sub-parallel, very lightly rounded; striæ simple, strongly impressed, fifth joining marginal channel at humeral angle; striole at base of first interstice strongly impressed; interstices convex; anterior puncture of third interstice a little before the middle, posterior just before the apical declivity; marginal channel wide, with four punctures on anterior third; lateral border strongly reflexed.

Length 4·5-5, breadth 1·4-1·6 mm.

Hab.—Port Jackson.

This seems a thoroughly isolated species among the Australian Bembiides; I know of none resembling it. The decussating mandibles, the head flattened and wide across the clypeus and between the eyes, and the prothorax with prominent advanced anterior angles are quite different from any other Australian Bembiide I have seen; and my want of knowledge of foreign species prevents me from suggesting any extra-Australian affinities.

I dedicate it to the veteran Australian naturalist,—Mr. George Masters, Curator of the Macleay Museum, from whom I have received specimens; and who informs me it is found near the water's edge in the bays and inlets of Port Jackson, but that he has never taken it on any beach exposed to the ocean.

BEMBIDIUM RIVERINÆ, n. sp.

Robust, elongate-oval; prothorax cordate, sides sinuate behind; elytra convex, strongly punctate-striate; upper surface of head and prothorax and the interstices of the elytra shagreened.

♂. Bronzy or brassy green, shining; apex of elytra and legs pallid, apex of femora, base and apex of tibiæ, and tarsi fuscous; antennæ fuscous, basal joint pallid; under-surface black or piceous. Head with frontal impressions diverging strongly backwards as far as back of eyes; the eyes hemispherical, very prominent. Prothorax very little wider than head with eyes, transverse (1 × 1·3 mm.), cordate, convex, widest before the middle (at anterior marginal puncture), evidently narrower across base than in front, truncate in front and behind; sides a little obliquely (hardly roundly) narrowed in front to anterior angles; roundly narrowed behind anterior marginal puncture, strongly sinuate posteriorly and meeting the base at right angles; basal angles acute, prominent; lateral border narrow, sharply reflexed; a deep fovea on each side near the basal angle, this fovea margined externally by a short lightly raised carina joining the border at the basal angle; median line linear, distinctly marked. Elytra ovate (2·75 × 1·8 mm.); sides lightly rounded, a little widened behind the shoulders; apex evenly and widely rounded; shoulders rounded, not marked; seven strongly punctate but lightly impressed striæ on each elytron, exclusive of the marginal stria and the scutellar striole; interstices flat, third lightly bipunctate on disc; scutellar striole long, punctate; marginal channel lightly punctate behind shoulders; border finely reflexed, a little thickened and turned back to form a slight prominence at base of fifth stria.

Length 4-4·75, breadth 1·8-2 mm.

Hab.—Urana District, N.S.W.

The female is rather darker coloured than the male, both in the green, and the pale apical marking of the elytra. The pale part of the elytra extends round the apex a little way along the sides and is about the width of the lateral declivity. This seems a very distinct species among the described species of Australian Bembidiides; comparing it with *B. jacksoniense*, Guér.,* which it resembles in the colour of the elytra, and in company with which I have taken it; its greater size and very differently shaped prothorax are apparent and conspicuous differences. I found it

* *Bembidium jacksoniense*, Guér., (Voy. Coquille, 1830, p. 61) undoubtedly = *subviride*, Macl., and *B. ocellatum*, Blkb.

in great numbers along the edge of permanent fresh water in the Urana District in April, 1892.

TACHYS MURRUMBIDGENSIS, n.sp.

Elongate; prothorax subcordate; elytra depressed, finely punctate-striate; head, prothorax and interstices of elytra sparsely and very minutely punctulate.

Piceous black. Head smooth; front strongly bi-impressed; the impressions parallel, extending to anterior margin of clypeus; the clypeus truncate, anterior part hollowed out between frontal impressions; eyes convex, not very prominent. Antennæ moniliform, strongly incrassate. Prothorax subcordate, lightly transverse, widest before the middle, evidently narrower across base than in front; base very widely sub-lobate; sides rounded, shortly sinuate before the base; basal angles acute and very prominent; lateral border narrow; a transverse impression on each side near basal angle defining basal part of prothorax; lateral foveæ of base obsolete; median line very lightly impressed. Elytra a little wider than prothorax (1·2 × 0·75 mm.); sides subparallel; base emarginate; shoulders prominent, round; apex evenly and widely rounded; five finely punctulate lightly impressed striæ (exclusive of marginal stria) on each elytron, first, second, and fifth reaching base, third and fourth finer than others not extending to base, first flexuous and approaching very near suture towards base, fifth strongly impressed near base; interstices flat, fourth with two setigerous punctures uniting the third and fourth striæ (the anterior puncture placed at the beginning of the striæ, the other about half way between it and the apex), third with a lightly impressed puncture on posterior declivity; scutellar striole wanting; marginal channel strongly impressed with a few punctures behind shoulders.

Length 1·75, breadth 0·75 mm.

Hab.—Narrandera, N.S.W. (I took two specimens running near the edge of the water on a sand-bank in the Murrumbidgee at Narrandera, 16th March, 1893.)

I am in some doubt as to the position of this species, but owing to the oblique termination of the anterior tibiæ and the well marked striolæ of the apical declivity of the elytra have placed it in *Tachys*. It seems a thoroughly isolated species; the high-shouldered, parallel elytra are among its most conspicuous features. The inner portion of the usual apical striole is very distinctly marked, though it does not join the sutural stria; between this short stria and the marginal channel is another short deep stria, on the apical declivity, which extends round the apex and joins the sutural stria. The penultimate joints of the maxillary palpi are greatly swollen; the last joint is very small, being a mere projecting spike.

Tachys mitchelli, n.sp.

Oval, robust, convex; prothorax short, sides not sinuate before base, posterior angles not prominent; elytra widely oval, striate-punctate, posterior declivity smooth.

Testaceous (disc of elytra sometimes more or less infuscate), legs pallid. Head convex, smooth; front with two strong elongate narrow impressions converging in front, eyes convex, prominent; penultimate joint of maxillary palpi very thick and inflated. Antennæ moniliform, lightly incrassate. Prothorax short, transverse, convex, smooth, about as wide (not narrower) across base as across apex; sides rounded in front, narrowed behind, not sinuate before basal angles; anterior angles widely rounded, not marked; posterior angles not prominent, acute at summit; base cut obliquely to peduncle on each side behind posterior angles, truncate across peduncle; lateral border wide in front, narrower towards posterior angles; median line obsolete; a lightly marked transverse line across base near margin; the lateral foveæ of the base wide and weakly marked. Elytra greatly wider than prothorax, convex, oval, truncate on base; shoulders rounded, not marked; six rows of punctures on each elytron (exclusive of marginal stria), sutural stria entire, simple on posterior declivity, others successively shorter towards sides, seventh wanting, eighth (marginal) punctate, the punctures interrupted a little behind shoulders; lateral border wide, reflexed, with a well marked sinuosity on each side towards apex; recurved part of sutural stria shortly but strongly marked near apical sinuosity of border.

Length 1·9, breadth 0·9 mm.

Hab.—Urana District, N.S.W.

This little species much resembles *T. flindersi*, Blkb., at a casual glance; but it differs in the shape of the prothorax, which in *T. flindersi* is very strongly transversely impressed behind, and has the sides decidedly sinuate before the base, the basal angles being prominent; the elytra, too, in *T. flindersi* are narrower, with the humeral angles more prominent, and the puncturation finer.

FERONINI.

In his Essay on the Classification of the Carabidæ, published in the Trans. Am. Ent. Soc., ix, 1881, which I believe is the latest comprehensive work on the subject, Dr. G. H. Horn has discarded Lacordaire's tribal name *Feronides* in favour of *Pterostichini*, though without giving his reasons for so doing. I prefer to retain the name adopted by Lacordaire for the tribe, because it is more familiar, because I do not know Dr. Horn's reasons for changing it, and because I would associate under it a far more extensive group of genera than Dr. Horn places in his *Pterostichini*.

In addition to the genera tabulated and mentioned below as allied to *Pterostichus*, I would include in the *Feronini*, *Leirodira*, *Cyrtoderus*, *Delinius*, *Lesticus*, *Mecynognathus*, *Morphnos*, *Nuridius* and *Catadromus*; and I believe the limits of the tribe should be further extended to take in the *Morionini*, which seem to me to be separated from the *Feronini* on very artificial grounds, *Catadromus* may be considered a genus connecting the two tribes, it having the weak basal border of the elytra, and four glabrous joints of the antennæ which characterise the *Morionini*.

After the death of Baron de Chaudoir, the elucidation of the Australian *Feronini* remained in Australian hands till 1891, when M. Tschitschérine entered the lists with a short but comprehensive essay on the Feronides of Australia and New Zealand.* It is to be regretted that M. Tschitschérine overlooked, or at least ignored, all the work done by de Chaudoir and Macleay among the Australian Feronides subsequently to de Chaudoir's original Essay on the subject in 1865, and thereby rendered his paper of almost no practical value. His classification of the genera, or more properly the sub-genera, is very crude, and his want of knowledge of de Chaudoir's later work makes it worthless. As the paper is published in a foreign periodical, hardly to be met with in Australia, I take the present opportunity of noting all that is of interest in it.

(1). Four species are described as new, viz :—

Holcapsis convexidorsis, from New Zealand (unknown to me) ; *Rhabdotus chaudoiri*, from Tasmania (= *R. floridus*, Bates) ; *Rhytisternus lævidorsis*, from Brisbane (?) (= *Pœcilus lævis*, Macl.) ; *Chlænioidius irideomicans*, from Moreton Bay (which from comparison of descriptions, seems to me *Ch. pœciloides*, Chaud.)

(2). Three new subgenera are proposed, viz :—*Castelnaudia*, *Pseudoceneus*, and *Pœciloidia* : the first is proposed for *Homalosoma nitidicolle*, Casteln., and seems an entirely needless division ; *Pseudoceneus* is founded on *Pterostichus holomelanus*, Germ., a species that I place in *Simodontus ; Pœciloidia* is intended to receive *Pœcilus iridescens*, Casteln., which Chaudoir has placed in the American genus *Loxandrus ;* should it ultimately prove that the Australian species thus referred to the latter do not actually belong to that genus, then *Pœciloidia* may come in.

(3). Our knowledge of the synonymy of the described Australian fauna is further increased by *Catadromus cordicollis*, Motsch., being placed as a synoym of *C. lacordairii*, Boisd.; and *Orthomus antipodus*, Motsch., as a synonym of *Simodontus australis*, Dej. In these conclusions M. Tschitschérine may be followed with confidence, as he is situated so as to be able to speak with more certainty than would be possible for any Australian worker.

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*Hor. Soc. Ent. Ross. 1891, T. xxv.

(4). He points out that Gemminger and Harold's Catalogue contains an error in saying the genus *Parhypates*, Motschulsky, is Australian; this error has also been adopted by Mr. Masters in his Catalogue of the Coleoptera of Australia.*

MECYNOGNATHUS MACLEAYI, n.sp.

Black, shining: elytra opaque with a shining margin. Robust, body pedunculate; prothorax short, narrowed behind; elytra ovate, widest near base, gradually narrowed backwards; convex transversely and longitudinally, not bordered on base; shoulders rounded. Male without squamulose tissue beneath anterior tarsi.†

♂ Head very large (7 × 7·5 mm.), convex, smooth; front with a strongly marked uneven wide impression on each side extending on to the clypeus; clypeal suture distinct between the frontal impressions; clypeus longitudinally impressed in middle, lightly emarginate behind labrum; eyes convex, not prominent; post-ocular prominences large, almost equalling the eyes, not abruptly declivous behind; a prominent ridge extending forward from eyes above base of antennæ; genæ greatly inflated below antennæ. Mandibles long (about 6 mm.), decussating. Labrum subquadrate, strongly emarginate, 6-setose in front; anterior angles rounded. Mentum with short broadly obtuse lobes; median tooth short, bifid. Palpi slender, truncate at apex: labial with penultimate joint long, narrow, 2-setose in front; apical joint subsecuriform. Antennæ filiform, compressed; three basal joints glabrous, first thick, longest (not as long as second and third together), with an irregular longitudinal impression and a setigerous puncture on upper side. Prothorax heavy, a little wider than head (6 × 9 mm.),‡

*I would also note that *Homalosoma laevicolle*, Brullé, and *H. striaticolle*, Brullé, though placed by Mr. Masters in his Australian list, are said by Brullé (Hist. Nat. Ins. iv. 364) to be from Madagascar.

† At the time of writing this description my single male specimen has lost the anterior tarsi, but I had formerly observed and noted that they were without squamulose tissue beneath—but without noting their shape.

‡ The length of the prothorax in the middle is 6 mm.; the length from anterior to basal angle is 7 mm.

widest towards the front (at anterior marginal puncture), rounded on anterior half, narrowed behind, strongly declivous between lateral basal impressions; a narrow flattened space near base across peduncle; anterior margin lightly emarginate; base almost truncate on each side, strongly emarginate across the peduncle; anterior angles rounded, hardly advanced; basal angles subrectangular, rounded at their summit; border thick, reflexed (more widely so near base), extending along base on each side to peduncle; marginal channel wide, shallow; median line lightly impressed; a strong short deep impression on each side of the base extending obliquely outward in front; a broad flattened space between these impressions and the basal angles; anterior marginal puncture placed in marginal channel, posterior on edge of lateral border a little before the basal angle. Elytra ovate, not wider than prothorax (13·5 × 9 mm.), convex, lightly declivous to peduncle and apex; base rounded on each side between humeral angle and peduncle; apex evenly rounded; striæ lightly impressed, eighth obsolete, a row of fine punctures along its course; interstices raised, third and seventh more prominent, third and fifth subcarinate, seventh carinate; space between eighth and margin shining; border extending from peduncle to apex, widely reflexed behind shoulders, more narrowly so posteriorly, its course not interrupted posteriorly by edge of inflexed part of elytra. First ventral segment attaining metasternum in a sharp point, three last smooth, a puncture on each side of anus. Legs light: posterior trochanters unipunctate, elliptic, obtuse at apex.

Length 29, breadth 9 mm.

♀. Resembling the ♂, but with the head larger (7 × 8.5 mm.); prothorax wider (6·25 × 9.75 mm.); elytra (15·5 × 10 mm.), a little less convex (both transversely and longitudinally), less narrowed behind, more widely rounded at apex. First joint of anterior tarsi about as long as two succeeding ones together.

Length 30, breadth 10 mm.

Hab.—North Queensland (Cape York ?); ♂ and ♀ in my collection.

Comparing the ♀ of this species with that of a North Queensland species which I take to be ***M. dilaticeps***, Chaud., the following differences may be noted: In *M. macleayi* the head is broader; the eyes and the post-ocular prominences are much less prominent, the latter being much less abruptly terminated behind; the prothorax is narrower towards the base and sinuate before the basal angles; the elytra are much narrower and less widely rounded at apex (those of *M. dilaticeps* measure 16 × 11·4 mm.), the interstices are more raised—especially the seventh—(in *M. dilaticeps* the third and fifth are more prominent than the seventh, but none is as sharply defined as in *M. macleayi*). The four posterior tibiæ are more spinose in *M. dilaticeps*, and the posterior trochanters are more bluntly rounded at the apex. Both species have the abdomen setigero-punctate behind the posterior coxæ—(this feature is also present in the ♂ of *M. macleayi*, but to a much less marked degree). *M. dilaticeps* and *M. macleayi* are very distinct from one another, and both are very different from that remarkable insect, *Mecynognathus dameli*, Macl., which is the type of the genus.

The Pterostichus Group.

The Feronides which I now propose to treat of, under the name of "The *Pterostichus* Group," may be defined briefly, as including all those presenting a combination of the following characters:—

Mandibles without a setigerous puncture in the groove (scrobe) on outer side. Elytra bordered on base; a strong plica on inner surface near edge, the lateral margin usually interrupted on each side of apical curve where the plica joins it.* Mentum with a distinct median tooth or projection.

According to Dr. Horn another feature of great classificatory importance characterises the group, viz., the contiguity of the posterior coxæ; but the genus *Homalosoma* is aberrant in this

* Dr. Horn's words are (*l.c.* p. 137) "margin strongly interrupted posteriorly and with a well marked internal plica," but I think a slight modification is necessary; for, in the genus *Homalosoma* the margin is not interrupted posteriorly," though the plica is as strong as usual

respect, for, though in most of the species the posterior coxæ are in close proximity, or even contiguous, *H. cyaneum* and some others have them distinctly separated.

Table of the principal Genera of Australia allied to Pterostichus.

I. Abbreviated stria of elytra on base of first interstice (ventral segments never transversely sulcate).

A. Elytra with interstices costate or carinate .....*Homalosoma.*

AA. Elytra with interstices neither costate nor carinate.

a. Legs short; posterior femora broadly dilatate towards apex and strongly channelled below......*Prionophorus.*

aa. Posterior femora not dilatate towards apex, or channelled below.

b. Third interstice of elytra punctate.

c. Apterous, punctures of third interstice of elytra not (or very rarely) near second stria... ....*Pterostichus.*

cc. Winged; third interstice of elytra 3-punctate, the basal puncture on the course of the third stria, the two hinder ones on the course of the second stria.....*Leptopodus.**

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* The genus *Leptopodus* appears never to have been diagnosed by its author; it was proposed by de Chaudoir (Ann. Mus. Civ. Genov. 1874, vi., p. 600) to receive three species, viz., *Pterostichus sollicitus*, Erich., *P. holomelanus*, Germ., and *Feronia (Pœcilus) iridipennis*, Casteln., which he placed under it without comment. The Rev. T. Blackburn (P.L.S.N.S.W., 1889 (2), iv., p. 730), says, *Leptopodus* was "proposed by the Baron de Chaudoir for *Pterostichus holomelanus*, Germ." and he then proceeds to give the characters distinguishing that species as diagnostic of the genus; adding the following note:—"I am unable to find any structural characters to distinguish this genus from *Simodontus* except the strong declivity of the median tooth of the mentum and the strongly sulcate tarsi." I do not know why Mr. Blackburn says *Leptopodus* was founded for *P. holomelanus*, but if this be the case, it should merge with *Simodontus*: the form of the median tooth of the mentum and the sulcus of the external side of the joints of the tarsi being characters on which little reliance can be placed in the *Feronini*. Only two of the species mentioned by de Chaudoir as belonging to *Leptopodus*, viz , *Pterostichus holomelanus*, and *Fer.* (*Pœcilus*) *iridipennis*, are known to me; I think the latter should be considered the type of the genus, in which case it will be very distinct from *Simodontus*, and as well characterised as any Australian genus of the *Feronini*. It can be distinguished readily by the characters given in the present table.

bb. Third interstice of elytra impunctate......... *Chlæniodius.*

II. Abbreviated stria of elytra wanting, or on base of second interstice.

B. Third interstice of elytra punctate.

d. Elytra with second and third interstices very narrow and placed in a deep furrow between first and third, and third and fifth, interstices respectively........ *Notolestus.*

dd. None of the elytral interstices abnormally narrow, or placed in a furrow between larger interstices.

e. Ventral segments not transversely sulcate.

f. Apterous, elytra with humeral angles dentate.... *Zoedera.*

ff. Winged, elytra with humeral angles rounded *Loxandrus.*

ee. Ventral segments transversely sulcate.

g. Punctures of third interstice of elytra all situated along course of third stria.................... ....*Simodontus.*

gg. Punctures of third interstice of elytra (excepting one on basal third, if present, near third stria) situated near course of second stria.

h. Third interstice of elytra 3-punctate (the puncture on basal third situated near third stria)..............*Prosopogmus.*

hh. Third interstice of elytra 2-punctate (without a puncture on basal third); mesosternal episterna elongate......... ....*Hormochilus.*

hhh. Third interstice of elytra unipunctate on posterior third; mesosternal episterna short........... ......*Setalimorphus.*

BB. Third interstice of elytra impunctate.

i. Ventral segments not transversely sulcate (labrum truncate).

j. Prosternal episterna longitudinally striolate, striæ of elytra simple...................................*Rhytisternus.*

jj. Prosternal episterna smooth; striæ of elytra punctate (size small)........... ....*Pediomorphus.*

ii. Ventral segments transversely sulcate.

k. Elytra striate on disc, smooth towards sides, rounded at humeral angles.............................. *Darodilia.*

kk. Elytra striate on sides, as well as on disc, dentate at humeral angles.

l. Head large, not transversely impressed across vertex...... .... *Cyphosoma.*

ll. Head small, transversely impressed across vertex (penultimate joint of maxillary palpi much shorter than last)......*Setalis.**

In addition to the genera noted above, the following, belonging to the *Pterostichus* group of genera, have been omitted, viz., *Abacetus, Eurystomis* and *Nelidus*: *Abacetus*, because, having only a specimen of one species, I feel unable to deal with it; *Eurystomis* and *Nelidus* because they are unknown to me in nature.

The table above merely indicates what appear to me the most obvious points of distinction between the genera mentioned. Baron de Chaudoir, the author of nearly all these genera, though he bestowed names upon them, regarded them merely as sub-genera (or sub-divisions) of the central genus *Feronia*, and apparently for that reason multiplied them in what seems a very random way; unfortunately he never tabulated his genera and sub-genera, and has thus thrown upon those who have followed him the task of determining the relative value of his divisions. In the present classification I have merged in *Pterostichus* the sub-genera *Notonomus, Sarticus, Rhabdotus* and *Coronocanthus*, because it has seemed impossible to maintain them satisfactorily

* *Setalis niger*, Casteln. = *Loxogmus obscurus*, Sl. The species Sir William Macleay calls *S. niger*, Cast., in his paper on "The insects of Gayndah" (Trans. Ent. Soc. N.S.W. 1873, Vol. II.), is a species of *Hormochilus*, as I have recently found by seeing the specimens in the Australian Museum, from Gayndah, so named by him. I have seen a number of specimens in the Howitt Collection at the Melbourne University, labelled "*Setalis niger*, Casteln.," and they are identical with the species on which I founded the genus *Loxogmus*. It may be noted that I have said there is but one lateral basal impression on each side of the prothorax, while de Castelnau has said there are two; however, the external one is feebly developed, and was obsolete in my unique specimen.

when the characters on which they are founded are submitted to careful and critical investigation; for the same reasons I have been compelled to merge *Nurus*, *Trichosternus* and *Loxodactylus* in *Homalosoma*, and *Ceneus* and *Ophryosternus* in *Prosopogmus*. Furthur, I may be permitted to add that, to my mind the following seem entitled to take full rank as genera, viz., *Homalosoma*, *Prionophorus*, *Notolestus*, *Zoedera*, *Loxandrus*, *Phytisternus*, *Pediomorphus*, *Darodilia*, *Cyphosoma* and *Setalis*; if this course be adopted some alterations in nomenclature made by de Chaudoir will have to be rescinded and the original names reverted to.

Genus Homalosoma.

In the present state of my views on the classification of the *Carabidæ*, I feel compelled to unite in the genus *Homalosoma* all the Feronides of the Australian Continent which are characterised by having the elytra with a basal border and with the interstices between the striæ costate. In *Homalosoma* the median tooth of the mentum may have the apex either rounded or excised, but this is a character that seems of little, if any, value. *Homalosoma* as here constituted, agrees with de Castelnau's ideas of its limits, and includes Motschulsky's genus *Nurus*, de Chaudoir's genus *Loxodactylus*, and part of the latter author's genus *Trichosternus*. *Nurus* seems only to be separated from *Homalosoma* by the ♂ having the anterior tarsi with two basal joints, instead of three, dilatate and squamulose below, a character that I cannot recognise as of more than specific importance. *Trichosternus* seems a genus of doubtful value; de Chaudoir appears to have regarded the presence of setæ on the base of the prosternum as a sufficient reason for placing any Feronide in *Trichosternus*, though latterly, as he admitted the validity of the genus *Nurus*, he must have thought the character of less weight; as far as I can judge it is a feature of merely specific value, and I would remove from *Trichosternus* all the species with costate elytral interstices, placing them in *Homalosoma*; this would exclude *Trichosternus* from the Australian fauna; unless *Feronia regalis*, Casteln., which has the base of the prosternum with a few setæ, be regarded as a species of *Trichosternus*. *Loxodactylus* is a more distinctive group than the other two, but I cannot find sufficient grounds for constituting it a genus separate from *Homalosoma*.

Synoptic Table of the Species of Homalosoma known to me.

I. Basal border of elytra forming a dentiform projection at humeral angles.

A. Prosternum with base setigero-punctate; mesosternum glabrous.

Head and prothorax of a splendid brassy green colour. *H. imperiale*, Sl.

Head black, prothorax only metallic towards margin....... .... *H. breve*, Motsch.

B. Prosternum (at base) and mesosternum setigero-punctate: colour black.............................. . . ..*H. renardi*, Chaud.: *H. vigorsi*, Gory; *H. alternans*, Sl.*

Black, prothorax and elytra margined with green............ .... *H. angulosum*,† Chaud.

C. Prosternum and mesosternum glabrous.

d. Elytra with 3rd, 5th and 7th interstices strongly carinate, others weakly developed.

e. Ninth interstice of elytra obsolete, merged with margin.

Elytra obovate, widely rounded at apex; a wide light sinuosity at each side of apical curve................... .... *H. viridescens*, Casteln.

Elytra oval, narrow at apex, apical curve without any sinuosity............................ *H. wilsoni*, Castln.

ee. Ninth interstice of elytra narrow, plainly indicated on posterior third (elytra strongly declivous behind, apex widely rounded without any sinuosity; prothorax of a brassy colour).........................*H. nitidicolle*, Casteln.

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*For differences between these three species see description of *H. alternans*, p. 423.

† *Hab.*—Richmond River, N.S.W.; its exact habitat has not before been recorded.

dd. Elytra with the interstices equal, or sub-equal.

f. Ninth interstice of elytra merged with margin, colour of upper surface purple... ....*H. cyaneum*, Casteln.

ff. Ninth interstice of elytra distinct, narrow, general colour of upper surface black (sinus of mentum divergent on sides, posterior tarsi sulcate externally).

Prosternum bordered at base *H. carinatulum*, Chaud.

Prosternum not bordered at base.......................... ....*H. amaeropterum*, Chaud.

II. Basal border of elytra joining lateral border without any dentiform projection.

g. Prothorax with the sides sinuate before the base; the basal angles marked.

Colour entirely black..............*H. cordatum*, Chaud.

Colour purple......................*H. superbum*, Casteln.

gg. Prothorax without any sinuosity on the sides near the base; the basal angles rounded.

h. Elytra with interstices equal, 3rd impunctate; colour black..................................*H. obscuripenne*,* Macl.

hh. Elytra with 3rd, 5th and 7th interstices stronger than others.

Elytra with 3rd, 5th and 7th interstices carinate; colour black; prothorax and elytra margined with green ....*H. cyaneocinctum*, Boisd.

Elytra with 3rd, 5th and 7th interstices costate, and little stronger than others; elytra of a blackish but green colour....................*H. atro-viride*, Sl.

The species of *Homalosoma* not tabulated above are:—*carbonicolor*, *curtum*, *nigrum*, *opacipenne*, *subvirens*, *violaceum*.

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* *Homalosoma obscuripenne*, Macl., P.L.S.N.S.W., 1887 (2), II., p. 220. Specimens of this species are in my collection, which have been identified by comparison with the type; it is, however, impossible to recognise it from Sir William Macleay's description in which he described the prothorax as "longer than broad," whereas in reality it is broader than long, the actual measurement (from one of my specimens) being 5 × 7 mm.

H. curtum and *H. nigrum*, Chaud., are said by de Chaudoir* to be allied to *H. breve*, Motsch., being placed in the genus *Nurus*. Both are black species.

H. subvirens, Chaud. Unknown to me in nature. From the description it resembles *H. alternans*, Sl., but has the prothorax and elytra margined with green. The elytra are described as in *vigorsi*, all the interstices nearly equal; no mention is made of the humeral angle.

H. violaceum, Casteln. I have never seen the description of this species, and know nothing about it.

H. opacipenne, Macl. This species seems, from the description, to be allied to *H. nitidicolle* and *H. wilsoni*. Its black opaque colour would in itself distinguish it from these species.

H. carbonicolor, Motsch. The description of the prothorax as with rectangular basal angles, and the elytra with flat impunctate interstices (the 8th being carinate) seems to approximate this species to *Trichosternus planiusculus*, White, from New Zealand. These features do not occur in any Australian species known to me, therefore I think *H. carbonicolor* will prove to be an extra-Australian species.

Homalosoma imperiale, n.sp.

♀. Broad, robust; head large; prothorax short, transverse, a little narrowed behind; elytra broadly ovate, finely punctate-striate, interstices lightly costate, shoulders dentate.

Upper surface of head and prothorax of a gilt brassy colour with purple reflections; elytra subsericeous, finely shagreened, purple black with a narrow shining brassy green margin; under-surface and legs piceous-black. Head large (7·5 × 7·75 mm.), smooth, depressed between eyes; vertex convex; front bi-impressed, the impressions wide, foveiform behind the clypeus; clypeal suture well marked; clypeus longitudinally strigose; eyes convex, prominent; orbit widely and lightly inflated below and behind eyes. Prothorax short, transverse (6·5 × 10 mm.), widest a little behind anterior angles, depressed, lightly declivous towards

* Bull. Mosc. 1878, LVIII., No. 3, pp. 37, 38.

base; sides lightly rounded on anterior half, gently and continuously narrowed on posterior half; anterior margin emarginate; base emarginate in middle, lightly rounded on each side of peduncle; anterior angles roundly obtuse, a little advanced; basal angles marked, obtuse; border reflexed, wide in front, becoming narrower backwards; median line linear, extending from anterior to basal margin, placed in a wide channel in middle of length; lateral basal impressions wide, shallow, irregularly shaped, distant from lateral margin, attaining the base; the space between the basal impressions depressed, striolate; posterior marginal puncture placed very near the edge a little before the basal angle. Elytra wider than prothorax (17 × 12·75 mm.), widest behind the middle, truncate on base, widely rounded behind, depressed on disc towards base, very gently declivous to apex, decidedly declivous on sides from seventh interstice; sides rather strongly rounded, narrowed to base; apical curve short, obtuse, obsoletely sinuate on each side, a light emargination at suture; striæ wide, shallow, finely punctate; striole at base of first interstice short, distinct; interstices raised, lightly costate, their summits not shining, fifth and seventh stronger than others, seventh strongest, eighth convex, ninth not defined from margin, a row of strong punctures along its inner margin and a row of very small irregularly placed punctures indicating the place of the ninth stria; lateral border strongly reflexed in middle of length, much less so on apical curve and behind the shoulders, forming a short upturned projection at the humeral angles; marginal channel wide, narrower towards base; basal border arcuate on posterior margin; third interstice with three or four punctures along its course, the anterior placed on basal fourth near third stria, the others on apical two-thirds, the posterior distant from apex. Prosternum longitudinally impressed between coxæ, setigero-punctate; mesosternum and metasternum lævigate. Ventral segments smooth, third, fourth, and fifth setigero-punctate on middle of posterior margin. Legs long, light; posterior coxæ contiguous.

Length 33, breadth 12·75 mm.

Hab.—North Queensland (Du Boulay). In the collection of Mr. C. French.

This splendid species would have been considered by Baron de Chaudoir as belonging to the sub-genus *Nurus.* I can only compare it with *H. breve*, Motsch., which is a much smaller and differently coloured insect, with the prothorax strongly sinuate behind and the elytra much more deeply striate, the interstices being stronger and more costate. *H. breve* has a puncture on the outer side of the third interstice of the elytra near the base (about 1·75 mm. behind the basal border) as in *H. imperiale*; this is probably a distinctive feature of this group of *Homalosoma* as I have not found it in other species known to me. In *H. breve* the anterior marginal puncture of the prothorax is present, but it is wanting in the type specimen of *H. imperiale.*

HOMALOSOMA ALTERNANS, n.sp.

Robust, elongate-oval, depressed; prothorax subquadrate, the sides sinuate towards base; elytra ovate, punctate-striate, third, fifth and seventh interstices subcarinate, shoulders dentate.

♂. Black; head and prothorax shining; elytra opaque, excepting the margin and summits of the stronger interstices; undersurface and legs black, shining. Head large (5·75 × 6 mm.), smooth, depressed between the eyes; vertex convex; front with two widely placed shallow impressions; clypeal suture lightly impressed; eyes convex, not prominent; orbits swollen below eyes, shortly but not abruptly declivous behind. Prothorax depressed, broader than long (6·3 × 7·6 mm.), broadest a little before the middle; sides lightly rounded on anterior part, a little narrowed to anterior angles, lightly narrowed behind the middle, lightly sinuate posteriorly and meeting the base at right angles; anterior margin emarginate; base sinuate, emarginate in middle, gently rounded on each side; anterior angles widely obtuse, a little advanced; posterior angles marked, obtuse at summit; lateral border reflexed, a little wider towards the basal angles, narrowly and weakly marked along base on each side; median line well marked, linear, reaching the base; lateral basal impressions broad, shallow ; posterior marginal puncture in the marginal channel at the basal angle. Elytra depressed, ovate, broader than prothorax (15·5 × 9·8 mm.), widest a little behind middle, widely rounded at apex ; sides lightly rounded, a little narrowed to base ; apical curve short, obtuse, oblique (not sinuate) on each side ; striæ finely punctate ; striole at base of first interstice short, distinct ; interstices costate, first, third, fifth and seventh strongly costate and much more elevated than second, fourth and sixth, eighth flat, ninth obsolete anteriorly, narrow posteriorly, punctate along the course of the deeply impressed eighth stria, the punctures more closely placed posteriorly ; lateral border lightly upturned ; marginal channel wide ; third interstice with three widely placed punctures on apical half. Prosternum longitudinally impressed between coxæ, setigero-punctate on base. Metasternum with a few strong setigerous punctures on each side near posterior margin. Ventral segments lightly impressed on each side, second with a few fine setigerous punctures behind posterior coxæ, third with a few inconspicuous punctures on each side of middle, fourth and fifth with a single setigerous puncture on each side of middle. Posterior coxæ contiguous ; anterior tarsi with three basal joints broadly dilatate and squamulose beneath.

♀. Not differing from ♂, except in sexual characters, and in having the sides of the prothorax apparently less sinuate towards the base.

Length 29, breadth 9·8 mm.

Hab.—Port Macquarie, N.S.W. (I took a single specimen (♀) at Port Macquarie in February, 1886 ; other specimens are in my collection without exact locality).

The affinity of this species is to *H. renardi*, Chaud., and *H. rigorsi*, Gory, with both of which it agrees in all important structural characters. Its smaller size prevents it from being confused with *H. renardi*, while from *H. rigorsi*, which is about the same size, it may easily be distinguished by its broader and more depressed form ; the prothorax sinuate on each side towards the base, with the basal angles more decidedly marked ; and the elytra with the third, fifth and seventh interstices much more raised than the alternate ones.

Homalosoma atro-viride, n.sp.

♂. Robust, elongate-oval, convex ; prothorax transverse, subcordate, posterior angles rounded ; elytra oval, punctate-striate, interstices lightly costate, shoulders rounded.

Head black, with greenish reflections ; prothorax black, becoming green towards the sides and in the lateral basal impressions ; elytra blackish-green (summits of the interstices black, the rest of the elytra of a green hue) ; undersurface, legs, antennæ and palpi piceous (a faint green tinge on the prosternal episterna). Head large (5·6 × 6·4 mm.), smooth, lightly convex ; front with two widely placed shallow irregular impressions ; clypeal suture distinctly impressed ; eyes convex, not prominent ; three supra-orbital setigerous punctures on each side.* Prothorax subcordate, short, transverse (5·6 × 8·2 mm.), broadest before the middle, evenly and roundly narrowed to base, convex, declivous towards base ; anterior margin emarginate ; base widely and very lightly emarginate ; anterior angles narrow, obtuse, projecting slightly ; basal angles not marked, rounded ; border reflexed, widely so and forming the margin of the basal foveæ at the basal angles, narrowly marked along each side of the base almost to the middle ; median line strongly impressed, reaching the base, placed in a well marked channel ; a deep wide depression near each basal angle ; the space between these depressions flattened and defined anteriorly by an arcuate transverse line ; two marginal setigerous punctures on each side, the anterior a little before the middle, the posterior near the edge considerably

* My single specimens of *H. cyaneocinctum*, Boisd., and *H. superbum* Cast., also have three setigerous supra-orbital punctures on each side ; all the other species of *Homalosoma* known to me have only two supra-orbital punctures, the normal number among the *Feronides*. Considering how constant the presence of two supra-orbital punctures is among the *Feronides* and allied tribes, and the high classificatory value attributed to their presence among this division of the *Carabidæ* by Dr. G. H. Horn, this variation from the ordinary number is worthy of note.

before the basal angle. Elytra oval, a little wider than prothorax (15·5 × 9·7 mm.), lightly convex, gently declivous to apex; apical curve obtuse, evenly rounded; striæ shallow, finely punctate; striole at base of first interstice obsolete; interstices lightly costate, third, fifth and seventh stronger than second, fourth and sixth, seventh strongest (decidedly costate), eighth convex, ninth merged with margin, a row of lightly impressed rather distantly placed punctures along its inner margin; lateral border reflexed, hardly so on apical curve; marginal channel narrow, equal; basal border hardly arcuate on each side; third interstice with two or three widely placed punctures on apical half. Prosternum lightly longitudinally impressed between coxæ; a single setigerous puncture on each side of base. Mesosternum and metasternum lævigate. Ventral segments smooth, third, fourth and fifth with a setigerous puncture on each side of middle. Posterior coxæ narrowly divided, metasternum and first ventral segment meeting between them; anterior tarsi with three basal joints broadly dilatate and squamulose beneath.

♀. Not differing from ♂, except in sexual characters.

Length 28, breadth 9·7 mm.

Hab.—Inverell, N.S.W.; (sent by Mr. W. S. Duncan).

A thoroughly distinct species. The colour alone would serve to separate it from *H. cyaneocinctum*, Boisd., *H. superbum*, Casteln., and *H. obscuripenne*, Macl., the three most nearly allied species known to me. The interstices of the elytra are very different in *H. cyaneocinctum*, which has the third, fifth and seventh strongly carinate, the fourth and sixth being obsolete. *H. superbum* differs in the shape of the prothorax and elytra; the sides of the prothorax being sinuate behind, the elytra obovate, &c. *H. obscuripenne* has the elytra similarly shaped, but with all the costæ equal; and has the prothorax more cordate, with the posterior angles more marked though obtuse; its colour is entirely black. *H. subvirens*, Chaud., (only known to me by description) is a smaller species, and seems to differ decidedly in colour, shape of prothorax, and the interstices of the elytra.

Genus PTEROSTICHUS.

Though in the table given above I have felt compelled to include the genera *Notonomus*, *Sarticus*, *Coronocanthus*, and *Rhabdotus* in the central genus *Pterostichus*, yet, for Australian workers the genera *Notonomus* and *Sarticus* are so convenient that in all practical work they should be maintained ; their use greatly simplifies the recognition of species, and except in very rare cases no difficulty is experienced in referring species to the right one of these genera.*

Coronocanthus sulcatus, Macl., = *Sarticus quadrisulcatus*, Chaud. A comparison of a specimen of *Coronocanthus sulcatus*, Macl., with the description of *Sarticus quadrisulcatus*, Chaud., leaves no doubt in my mind of their identity. Macleay's description was published in the year 1877 ; Chaudoir's in 1878. It seems probable the genus *Coronocanthus* should be recognised as distinct from *Sarticus*, though, at present, I am not prepared to separate it.

Rhabdotus is founded for a Tasmanian group of species having the labrum with a light linear longitudinal impression in the middle ; I cannot satisfactorily differentiate it from *Pterostichus*. The facies of the species of this group readily separate them from *Notonomus* and *Sarticus*.

PTEROSTICHUS BLACKBURNI, n.sp.

♂. Robust, elytra rather depressed on disc ; prothorax transverse, widely margined ; elytra oval, strongly crenulate-striate, the interstices depressed.

Black. Head not large, smooth, convex ; frontal impressions quite obsolete ; clypeal suture hardly impressed ; eyes prominent,

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* *Notonomus* and *Sarticus* may be separated as follows :—

Prothorax with a narrow basal impression on each side, the lateral border narrow, not forming a wide border to the basal impressions ... ... *Notonomus*.

Prothorax with a broad foveiform basal impression on each side widely margined by the lateral border ... ... *Sarticus*.

Perhaps, the more accurate course would be to regard the species now attributed to *Notonomus*, which vary among themselves a good deal, as belonging to *Pterostichus*, and to maintain the genus *Sarticus* which comprises a clearly defined group of species.

projecting beyond posterior part of orbit, this about two-thirds the size of eyes. Prothorax subquadrate (3·5 × 4·6 mm.); sides evenly rounded; anterior margin very lightly emarginate: base truncate, very lightly emarginate across peduncle; anterior angles rounded; basal angles rounded, but marked; lateral border widely and strongly reflexed; marginal channel wide; lateral basal impressions wide, foveiform; median line linear, well marked, not ending behind in a punctiform impression; posterior marginal puncture at basal angles. Elytra oval (10 × 5·8 mm.), lightly convex, depressed on disc, widest a little behind middle; shoulders rounded; basal border nearly straight on each side from scutellar striole to shoulders, not raised above lateral border or projecting the least at shoulders; apex widely rounded, lightly subsinuate on each side: striæ strongly impressed, crenulate; scutellar striole very short, on first interstice; interstices rather depressed, hardly convex, hardly more prominent towards apex, third unipunctate (the puncture placed on the posterior declivity about 1·5 mm. from apex), ninth punctate (the punctures separate, widely placed in middle). Ventral segments smooth, first not punctate near coxæ, apical with two setigerous punctures on each side of anus. In all other respects similar to *Notonomus.*

Length 16, breadth 5·8 mm.

Hab.—Mountains at source of Ovens River, Victoria. (A single specimen sent to me by the Rev. Thos. Blackburn.)

This is an isolated species showing no very close affinity, or even resemblance, to any other Australian Feronide that I know; its position seems to be between the sub-genera *Notonomus* and *Sarticus,* and it makes a link between them that points to the necessity of merging both with the genus *Pterostichus.* The form of the prothorax separates it from any species hitherto attributed either to *Notonomus* or *Sarticus*; the lateral border does not extend past the basal angles to form a reflexed margin behind the lateral basal impressions, as it does in all the species of *Sarticus,* but it is far more widely reflexed than in any species of *Notonomus;* the basal angles, too, are marked, though rounded at their summit; in *Sarticus* they are never marked. The unipunctate third elytral interstice is a remarkable feature in an Australian Feronide with the scutellar striole at the base of the first interstice.

NOTOLESTUS, n.gen.

This is a new genus proposed for the reception of *Abax sulcipennis*, Macl. The single specimen in my possession was brought by Mr. J. H. Maiden from the Don Dorrigo scrub, near the Bellinger River, N.S.W., and is in an imperfect condition, so that I can only indicate some of its most striking features in the following brief diagnosis. It appears a completely isolated form.

Colour of upper surface entirely cupreous. Head transversely impressed across vertex; front strongly bi-impressed, the impressions divergent backwards. Mandibles short, stout. Labrum transverse, lightly and widely emarginate. Prothorax depressed, transverse, with wide lateral margins: lateral border thick; two basal impressions on each side. Elytra lightly convex; dorsal surface of each elytron with two wide channels, a narrow ridge at bottom of each of these channels (being the second and fourth interstices): abbreviated scutellar striole wanting; third interstice with two widely separated punctures on posterior half, fifth interstice very wide, extending to the marginal stria; shoulders rounded: basal border wide, forming a strong short prominence at each humeral angle; margin very strongly sinuate on each side of apex; a strong internal plica joining the margin on each side behind the sinuosity of the apical curve. Ventral segments not transversely sulcate (apical segment wanting in my specimen). Male with three basal joints of anterior tarsi dilatate and squamulose beneath.

GENUS PROSOPOGMUS.

I have found it impossible to maintain de Chaudoir's genera *Ceneus* and *Ophryosternus* distinct from *Prosopogmus*. It seems necessary to accept *Prosopogmus* as the name of the genus, it having been characterised before the other two;* but it is with reluctance I adopt it, seeing that it was originally formed for a species (*P. impressifrons*, Chaud.) † said to be from New Zealand, which may differ considerably from Australian species. The genus, as constituted in this paper, may be broken up into groups thus:—

A. Metasternal episterna short ... (*Prosopogmus* of Chaudoir.)

B. Metasternal episterna elongate.

a. Elytra with fifth and seventh interstices enclosing sixth at apex ... ... (*Ophryosternus* of Chaudoir.)

b. Elytra with sixth and eighth interstices enclosing seventh at apex ... ... (*Cenens* of Chaudoir.)

The form of the metasternal episterna has no weight in *Simodontus*, therefore I think it should not be given undue prominence here; the interstitial character also appears to me of subordinate importance. It may be noted here that the genera *Simodontus*, *Hormochilus*, and *Setalimorpha* are differentiated from one another, and from *Prosopogmus* on very doubtful grounds.

PROSOPOGMUS AUSTRINUS, n.sp.

Oval, depressed; prothorax subquadrate, posterior angles sharply rectangular; elytra striate, shoulders feebly dentate; metasternal episterna short.

Piceous black; legs, antennæ, mouth-parts and sides of elytra towards apex piceous red.

Head moderate; front strongly impressed; the impressions short, very divergent behind, curved inwards at posterior extremity, eyes convex, not deeply set in orbits. Labrum lightly emarginate. Prothorax subquadrate (2·2 × 2·6 mm.), depressed on disc and towards base, lightly declivous on anterior three-

* Bull. Mosc. 1865, III. p. 93.

† It seems as well to point out here that Captain Broun is in error (Man. N.Z. Col., 1880, p. 30.) in making the comparison of *P. impressifrons* in de Chaudoir's original description as being with *Trichosternus guerini*, Chaud., (=*Platysma australasiæ*, Guér.) instead of with *Feronia (Notonomus) australasiæ*, Dej.; the latter being the species de Chaudoir referred to.

fourths of sides, widest a little behind anterior marginal puncture, wider across base than across apex; sides lightly rounded on anterior three-fourths, subsinuate posteriorly and meeting the base at right angles; anterior margin emarginate; base emarginate across peduncle; anterior angle obtuse; basal angles rectangular; border narrow, reflexed on sides, extending along anterior margin on each side, ending at basal angles; median line lightly impressed; a short straight linear impression extending forward from base on each side, rather nearer median line than margin; space between these impressions and margin flat, obsoletely and widely impressed; posterior setigerous marginal puncture beside the border at each basal angle. Elytra ovate, short, a little wider than prothorax (4·6 × 3 mm.), lightly rounded on sides, depressed on disc, strongly declivous to apex, abruptly declivous on sides from sixth stria; apical curve obtuse, widely sinuate on each side; striæ well marked; interstices flat on disc, seventh and eighth convex, fifth and seventh enclosing sixth at apex; third lightly 3-punctate, anterior puncture near third stria, two posterior ones along course of second stria; ninth interstice wider towards apex, strongly punctate; basal border ending in a short dentiform projection at humeral angles; lateral border strongly reflexed. Prosternum bordered on base. Posterior femora dilatate behind trochanters.

Length 7·5, breadth 3 mm.

Hab.—Burrawang, N.S.W. (Taken by me 10th November, 1890.)

This species is readily distinguished from *P. boisduvallii*, Casteln., by its much smaller size; it differs too in having the eighth interstice of the elytra narrow and convex; and not wide and flat, as in *P. boisduvallii*. From *P. rubricornis*, Sl., its larger size, more depressed form, and the finer punctures of the third interstice of the elytra help to differentiate it.

PROSOPOGMUS RUBRICORNIS, n.sp.

Elliptic-oval; prothorax subquadrate; elytra short, striate, shoulders dentate; prosternum bordered; metasternal episterna short.

Piceous black ; legs, antennæ and mouth-parts reddish. Head of moderate size ; front strongly impressed on each side ; impressions short, strongly divergent behind ; orbit weakly developed behind eyes, abruptly constricted posteriorly; eyes small. Labrum truncate. Prothorax subquadrate (1·75 × 2·1 mm.), widest just behind anterior marginal puncture, wider across base than apex ; sides rounded, more shortly and decidedly narrowed anteriorly than posteriorly, lightly subsinuate before the base ; anterior margin emarginate ; base truncate (lightly emarginate across peduncle); anterior angles widely obtuse ; basal angles rectangular ; border narrow, reflexed on sides, extending along lateral third of anterior margin on each side, ending abruptly at basal angle ; median line lightly impressed, not reaching either margin ; a well marked straight impression extending forward from base about one-third the length of prothorax on each side, rather nearer median line than margin ; space between this impression and margin not convex and with a short obsolete impression in middle ; posterior setigerous marginal puncture beside the margin near each basal angle. Elytra ovate, short, a little wider than prothorax (3·5 × 2·5 mm.), convex, strongly declivous to apex, sinuate on each side of apical curve ; striæ strongly impressed ; striole at base of second interstice short, linear ; interstices not convex on disc, seventh convex for whole length, fifth and sixth convex towards posterior extremity, fifth and seventh enclosing sixth at apex ; third 3-punctate, the punctures strongly impressed, anterior on basal third in course of third stria, two posterior ones along course of second stria ; ninth interstice wider at apex, strongly punctate along course of eighth stria, the punctures interrupted in middle ; basal border ending in a short dentiform projection at humeral angles ; lateral border strongly reflexed. Prosternum bordered on base. Metasternal episterna short. Posterior femora dilatate behind trochanters.

Length 6·5, breadth 2·5 mm.

Hab.—Bulli, N.S.W. (A single specimen occurred to me 7th November, 1889.)

Its small size, and the deep foveiform impressions of the third interstice of the elytra distinguish the species; it is rather a member of the central group of the genus than of *Ceneus*, or *Ophryosternus*.

PROSOPOGMUS NAMOYENSIS, n.sp.

Apterous; elongate-oval, lightly convex, prothorax subquadrate; elytra striate, interstices convex, shoulders dentate; metasternal episterna elongate.

Black, shining (elytra slightly opaque in ♀); tarsi and antennæ reddish. Head not large, smooth; front strongly bi-impressed; eyes convex, prominent, not set deeply in orbits behind. Labrum hardly emarginate. Prothorax subquadrate (2·2 x 2·5 mm.), widest a little behind anterior marginal puncture, hardly narrowed to base, wider across base than across anterior margin; sides lightly rounded, strongly and roundly narrowed to anterior angles, not sinuate before the base; anterior margin emarginate; base lightly emarginate in middle, a little oblique at each side; anterior angles obtuse; basal angles well marked, sub-rectangular; lateral border narrow, reflexed; median line lightly impressed; a deep straight impression extending forward from base on each side, rather nearer median line than margin; space between these impressions and margin depressed and impressed with a wide foveate impression; the lateral basal impressions minutely punctulate; posterior setigerous marginal puncture beside border at each basal angle. Elytra ovate, considerably wider than prothorax (5 x 3·3 mm.); sides subparallel, shortly and lightly narrowed to shoulders; base truncate; apical curve lightly sinuate on each side; striæ deeply impressed; striole at base of second interstice short, linear; interstices convex, eighth and sixth enclosing seventh at apex; third 3-punctate, anterior puncture on basal third near third stria, two posterior ones on course of second stria; ninth interstice punctate, the punctures interrupted in middle; basal border ending in a short dentiform projection at humeral angles; lateral border reflexed. Prosternum bordered on base. Metasternal episterna elongate.

Length 9, breadth 3·3 mm.

Hab.—Namoi River, N.S.W. (I found this species plentiful at Carrol on the Namoi, 12 miles above Gunnedah.)

The ♀ has the interstices of the elytra less convex than the ♂, and slightly subsericeous or opaque. The colour of the elytra in both sexes seems rather a deep blue-black than a true black.

It belongs to the *Ceneus* group of the genus. It may be distinguished from *P.* (*Ceneus*) *chalybeipennis*, Chaud., by its smaller size, narrower form, the less convex interstices of the elytra, and by the shape of the prothorax, which is less transverse, being less dilatate at the anterior marginal punctures and less narrowed posteriorly.

Note.—I had formerly thought this species might be the one described by de Castelnau as *Harpalus quadraticollis*, which is said by de Chaudoir* to be a *Hormochilus*; but besides its not agreeing with the description of *H. quadraticollis*, I have a specimen of a *Hormochilus* from Southern Queensland, which I believe to be de Castelnau's species. My Southern Queensland species is identical (from comparison with type) with the species that Sir William Macleay took to be *Setalis niger*,† Casteln; it is a winged insect, as is also *Hormochilus monochrous*, Erich., from examination of a specimen from Melbourne in my collection.

SETALIMORPHUS, n.gen.

Labrum lightly emarginate.

Mentum not deeply emarginate; lobes short, very oblique on inner side; median projection short, wide.

Labial palpi with last joint thick, truncate.

Prothorax subquadrate; two basal impressions on each side.

Elytra deeply striate; 3rd interstice unipunctate on apical third; shoulders dentate.

Prosternum margined at base.

Metasternal episterna (with epimera) about as long as wide, hardly narrowed posteriorly.

* Ann. Mus. Civ. Genov. 1878, xii. p. 475.

† See note on *Setalis*, *ante* p. 416.

Ventral segments transversely sulcate; ♂ with apical segment deeply bifoveolate towards middle.

It seems impossible to associate the species on which this genus is founded *(S. punctiventris)* with any previously described Australian Feronide. Having only one specimen, and that with the maxillary palps and the apical portion of the antennæ wanting, I am unable to diagnose the genus fully; but the characters given above distinctly separate it from the many divisions that have been formed among the Feronides of Australia. As far as I know, *Setalis niger*, Casteln., is the only other Australian Feronide with the last ventral segment deeply bifoveolate; this character I believe to be a sexual one, but never having seen the female of either of these species, only judge by analogy from the Chlæniide genus *Coptocarpus*, in which it also occurs, but only in the male.

SETALIMORPHUS PUNCTIVENTRIS, n.sp.

Elongate-oval; head smooth; prothorax subquadrate; elytra striate, the interstices convex, third unipunctate.

♂. Black; undersurface, legs, antennæ and mouth-parts reddish-piceous. Head small, suddenly constricted to a wide neck behind eyes; front strongly impressed on each side; the impressions wide apart, diverging backwards; eyes globose, very prominent, enclosed behind; an obsolete transverse impression across vertex level with posterior margin of eyes. Prothorax subquadrate (2·2 × 2·4 mm.), widest a little before middle, rather depressed, declivous on each side to anterior angles; sides lightly rounded on anterior half, a little narrowed to base; anterior angles wide, lightly marked, not advanced; base subtruncate, widely and lightly emarginate across peduncle; basal angles rectangular; lateral border narrow, reflexed, ending behind at basal angles; median line distinctly impressed; two basal impressions on each side, the interior strongly impressed, narrow, placed about half-way between median line and margin, the other lightly marked, wide, short, near basal angle. Elytra a little wider than prothorax (4·75 × 2·8 mm.), lightly convex, lightly declivous to base on each side of suture, roundly and abruptly declivous to apex, truncate at base, rounded at apex; apical curve with a light sinuosity on each side; sides almost parallel; striæ deep, simple, extending to base and apex, 2nd rising in a punctiform impression at base; scutellar striole wanting; interstices strongly convex, the single puncture of 3rd placed a little behind half the length, near second stria; ninth interstice punctate, the punctures wide apart in middle; basal border with a strong short tooth at each shoulder; lateral border narrow, reflexed. Prosternum truncate and margined at base; episterna lightly and finely punctulate; mesosternal and metasternal episterna punctate, the latter short. Ventral segments sulcate, punctate laterally; anterior margin of three last segments foveate-impressed; apical segment deeply bifoveolate; punctures of ambulatorial setæ strongly marked.

Length 8, breadth 2·8 mm.

Hab.—Springwood, N.S.W. (A single specimen in my collection taken in March.)

SETALIMORPHUS NANUS, n.sp.

♀. Elongate-oval; prothorax subquadrate; elytra striate, interstices flat, third unipunctate; metasternal episterna very short.

Black, shining; legs, antennæ and mouth-parts reddish-piceous. Head convex, not constricted into a neck behind eyes; front strongly bi-impressed; the impressions wide apart, diverging backwards; vertex not transversely impressed; eyes hemispherical, prominent, hardly enclosed behind by orbit. Prothorax subquadrate (1·8 × 2 mm.), widest before middle, depressed, gently declivous on each side to anterior angles; sides hardly rounded, a little narrowed to anterior angles, very little narrowed to base; anterior angles wide, marked, not advanced; base subtruncate, hardly emarginate across peduncle; basal angles rectangular; lateral border fine, ending behind at basal angles; median line linear, lightly marked, extending to base; two light basal impressions on each side; the interior about half-way between median line and margin, narrow, deep; the other lightly marked, wide, short, near basal angle; a few punctures in the basal impressions. Elytra a little wider than prothorax (3·7 × 2·3 mm.), depressed (very lightly convex), very gently declivous to base on each side of suture, roundly but not abruptly declivous to apex, truncate at base, widely rounded at apex; sides subparallel, hardly narrowed to base; striæ shallow, simple, extending to base and apex, second rising in a punctiform impression at base; a short oblique striole on second interstice at base; interstices flat, lightly convex on lateral and posterior declivities; the single puncture of third placed about posterior third near second stria; ninth interstice punctate, the punctures more widely placed in middle of length; basal border with a strong short tooth at shoulders: lateral border narrow, reflexed. Prosternum not impressed between coxæ, truncate and margined at base; the episterna impunctate; mesosternal and metasternal episterna and sides of metasternum punctate. Ventral segments finely transversely sulcate, obsoletely rugose laterally, fourth, fifth and sixth bipunctate towards middle, apical quadripunctate along posterior margin.

Length 6·5, breadth 2·3 mm.

Hab.—Ferntree Gully near Melbourne. (A single specimen taken in the ranges between Ferntree Gully and the Village Settlement, 19th Nov., 1893.)

In general appearance this species resembles the smaller species of *Simodontus*, but differs decidedly from them in the rectangular basal angles of the prothorax, and the unipunctate third interstice of the elytra. I do not feel certain that it should be considered congeneric with *S. punctiventris* (the type of the genus). My single example is a female, and probably for that reason has not the labial palps with a thick terminal joint, or the apical segment of the abdomen deeply bifoveolate as in *S. punctiventris*; but, as it is more closely allied to that species than to any other Australian Feronide, and as the classification of our Feronides is certainly far from perfect yet, it seems better to err on the side of having too few genera rather than to make them to try and maintain an artificial and probably hopelessly confused system of classification.

Genus Rhytisternus.

Table of Species of Rhytisternus known to me.

I. Unicolorous species (black or piceous-black).

A. Elytra with strongly impressed striæ.

a. Sides of prothorax roundly narrowed behind without any trace of sinuosity before base, basal angles not marked.

b. Form narrow, convex............................*R. solidus*, Sl.

bb. Form depressed. ....
.........*R. cyathoderus*, Chaud., & *R. splendidus*, Blkb.*

aa. Sides of prothorax lightly but not roundly narrowed to base, basal angles obtuse.

c. Form stout, convex............................*R. bovilli*, Blkb.

cc. Form depressed.........................*R. lævilaterus*, Chaud.†

aaa. Sides of prothorax sinuate or subsinuate before base, basal angles marked.

d. Interstices of elytra not convex posteriorly ....
....*R. nigellus*, Sl.

dd. Interstices of elytra convex.

e. Prosternal episterna not perceptibly strigose, humeral angles shortly but distinctly dentate.........*R. gigas*, Sl.

ee. Prosternal episterna longitudinally strigose, humeral angles without any dentiform projection.

f. Prothorax but little broader than long, size small...........
....*R. miser*, Chaud.

ff. Prothorax transverse, size large.

g. Five decidedly convex interstices on each elytron...........
....*R. carpentarius*, Sl.

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* The differences between *R. cyathoderus*, Chaud., and *R. splendidus*, Blkb., are more of a general than a particular character, and are not easily tabulated. The smaller size and the longer prothorax more narrowed to the base of *R. splendidus* are perhaps the most easily noted characters distinguishing it from *R. cyathoderus*.

† = *R. sulcatipes*, Blkb.

gg. Four rather convex interstices on each elytron.. *R. liopleurus*, Chaud.

AA. Elytra smooth with faint linear striæ .... *R. (Pœcilus) lævis*, Macl.

II. Upper surface black, elytra widely margined with yellowish red.. *R. limbatus*, Macl.

The remaining species of the genus are *R. puella* and *R. plebius* of Chaudoir; *R. (Omaseus) arnheimensis*, Casteln.; *R. angustulus*, *R. (Omaseus) froggatti* and *R. mastersi* of Macleay; and *R. cardwellensis*, Blkb.

R. puella and *R. plebius* go with *R. miser*, of which, it being a species subject to variation in size, they are likely to prove synonyms.

R. arnheimensis I have seen in the Howitt Collection, at the Melbourne University. It is a narrow species with the prothorax cordiform, the sides being sinuate before the base; I cannot indicate its position in the genus.

R. angustulus is allied to *R. solidus*.

R. froggatti:—I have ascertained, by inspection of the type, that *Omaseus froggatti*, Macl., is a *Rhytisternus*, but I cannot now tabulate it.

R. mastersi:—I have a specimen from the Gayndah district in Queensland, but apart from the prothorax being slightly less sinuate behind than is usual in *R. liopleurus*, Chaud., can find no differences between them. I think it synonymous with *R. liopleurus*.

R. cardwellensis I have seen in the collection of Mr. C. French, but I cannot now place it with any confidence.

Rhytisternus solidus, n.sp.

Elongate, robust, convex; prothorax transverse, narrowed behind, sides rounded, not sinuate before base; elytra with four inner striæ strongly impressed.

Black, shining; labrum, antennæ, palpi and tarsi reddish-piceous. Head large, smooth; front strongly impressed; the impressions diverging backwards; clypeal suture strongly impressed and connecting frontal impressions in front; clypeus declivous to labrum; eyes convex, set lightly in orbit at base. Prothorax shortly subcordate (2·8 × 3·5 mm.), convex, very lightly declivous posteriorly, not wider across base than apex; disc transversely striolate; sides rounded, more shortly and decidedly so to anterior angles, lightly and evenly so to base; anterior margin hardly emarginate; base lightly rounded; anterior angles rounded, hardly advanced; basal angles rounded, not marked; lateral border thick, ending at basal angle; median line well marked, linear; two lateral basal impressions on each side; the interior short, narrow, linear at bottom, attaining base; the external foveiform, placed near the basal angle; space between inner basal impressions depressed below disc, convex; posterior marginal puncture at basal angle. Elytra a little wider than prothorax, oval (7 × 4 mm.), truncate on base with shoulders rounded, convex; sides lightly rounded; apical curve widely but decidedly sinuate; striæ subcrenulate; four inner striæ entire, strongly impressed, fifth entire, very lightly impressed, sixth and seventh obsolete, except towards the apical extremity, eighth strongly impressed; four inner and ninth interstices strongly convex, ninth punctate as usual in genus; lateral border finely reflexed, marginal channel narrow. Prosternum bordered on base. Ventral segments finely and closely rugulose-punctulate.

Length 12, breadth 4 mm.

Hab.—Coomooboolaro, Duaringa, Queensland. (Sent to me by Mr. Geo. Barnard.)

This species can only be compared with *R. angustulus*, Macl., but I have been able to ascertain by comparison with the type of *R. angustulus* that it is distinct. Beyond the larger and heavier form of the present species I cannot now suggest the actual differences between them. The narrow convex facies of these two species separate them decidedly from all the others of the genus I have seen.

RHYTISTERNUS NIGELLUS, n.sp.

♀. Oblong, depressed; prothorax subcordate, as wide across apex as across base, sides lightly sinuate towards base; elytra with four inner striæ strongly impressed, entire, fifth weaker, interstices depressed.

Black; legs, labrum, palpi and antennæ piceous-red. Head small, smooth; front bi-impressed; the impressions short, linear, arcuate, divergent behind, their apices connected by the strongly impressed clypeal suture; clypeus strongly declivous to labrum; eyes convex, set lightly in orbits at base. Prothorax transversely cordate (2·4 × 3·2 mm.), depressed on disc, roundly declivous on anterior part of sides; disc transversely striolate; sides almost evenly rounded on anterior three-fourths, obliquely straightened (not out-turned) before base; anterior margin almost truncate, hardly emarginate; base subtruncate, very lightly sinuate; anterior angles truncate, not perceptibly advanced; basal angles sharply marked, rectangular; lateral border thick; median line lightly impressed, linear; two separate lateral basal impressions on each side, neither attaining base, the internal having a narrow elongate well-defined course, the external forming a foveiform puncture; the space between the internal basal impressions depressed, that between external and lateral margin very narrow; posterior marginal puncture small, placed at extremity of marginal channel. Elytra wider than prothorax (6·8 × 4 mm.), lightly rounded on sides, truncate on base with the shoulders rounded; apical curve lightly but decidedly sinuate on each side; striæ lightly crenulate, four inner ones entire, strongly impressed, more lightly so towards apex, fifth entire, lightly impressed, sixth very faintly impressed, seventh obsolete; interstices depressed, ninth punctate, the punctures widely interrupted in middle; lateral border fine, reflexed; basal border curved behind on each side; marginal channel widened a little before the apical sinuosity. Prosternum truncate and bordered on base; episterna finely rugulose. Ventral segments obsoletely and very finely punctulate.

Length 11·5, breadth 4 mm.

Hab.—Gascoigne River District, W.A. (Given to me by Mr. C. French.)

A more sombre-coloured species than usual in the genus, the black having a piceous tinge; in this resembling *R. bovilli*, Blkb., but differing decidedly from that species in its smaller size, more depressed form, differently shaped prothorax with rectangular basal angles, and less strongly striate elytra, &c. From *R. miser*, Chaud., which is about the same size, it may be distinguished by its colour, shorter and more depressed prothorax, more depressed and less strongly striate elytra, &c. I cannot indicate the differences between *R. nigellus* and *Feronia arnheimensis*, Casteln., but consider there is no possibility of their being identical.

RHYTISTERNUS GIGAS, n.sp.

♂. Oblong, robust; prothorax transverse, a little narrowed and sinuate on each side towards base, wider across base than apex; elytra convex, strongly striate (seventh stria only, obsolete towards base), interstices strongly convex; prosternal episterna smooth (obsoletely subrugulose under a lens).

Black, shining; palpi reddish, tarsi piceous. Head large, smooth; front with two short lightly divergent impressions, and behind each of these another light foveiform impression; front convex between impressions; clypeal suture lightly marked; clypeus strongly declivous to labrum; eyes convex, lightly set in orbits at base. Prothorax subquadrate, transverse (4·4 × 6 mm.), depressed on disc, roundly declivous to sides anteriorly; disc faintly transversely striolate; sides rounded on anterior three-fourths, narrowed to anterior angles, lightly narrowed posteriorly, almost straight, but not the least out-turned before base; anterior margin widely and lightly emarginate; base sinuate, truncate (hardly oblique) on each side of peduncle, lightly emarginate across peduncle (this median emargination nearly truncate); anterior angles rounded, very lightly advanced; basal angles rectangular, obtuse at summit; lateral border thick, reflexed; median line lightly impressed; two separate lateral basal impressions on each side, both attaining base; the interior rather wide, elongate, linear at bottom; the external shorter, wide, straight, well defined; space between internal basal impressions depressed, slightly convex, defined anteriorly by a light arcuate transverse impression; space between external impression and lateral border convex and bearing at its base the posterior marginal puncture. Elytra oblong, wider than prothorax (12·5 × 7·3 mm.), sub-parallel on sides, truncate on base, convex; sides shortly and decidedly narrowed to base; apical curve lightly and widely sinuate on each side; striæ simple, deeply impressed, sixth not attaining basal border, seventh strongly impressed on apical third, becoming obsolete towards base; six inner interstices strongly convex for their whole length; seventh and eighth separately convex on apical third, becoming united towards base; ninth narrow, convex, ocellate-punctate along course of eighth stria, the punctures closely placed near shoulder, a single widely separated one at about anterior third, eight irregularly separated ones on apical half; lateral border strongly reflexed; basal border with posterior margin almost straight (hardly curved) on each side, a short lightly upturned projection at humeral angle; marginal channel narrow behind shoulder, becoming wider to apical sinuosity. Prosternum rounded on base, not margined; episterna almost lævigate, obsoletely rugulose. Ventral segments smooth; second and third obsoletely punctulate laterally near the posterior trochanters; a narrow convex raised space along anterior margin of three last, giving them a widely transversely impressed appearance.

Length 20, breadth 7·3 mm.

Hab.—North Queensland, Gulf of Carpentaria. (A single specimen given to me by Mr. C. French.)

A very distinct species and the largest of the genus. It is thoroughly differentiated from all the described species of the genus by the strong convexity of the six inner elytral interstices, and the almost absolutely smooth prosternal episterna, on which, however, a slight wavy rugulosity is discernible with a lens. It is the only *Rhytisternus* known to me with dentate humeral angles.

RHYTISTERNUS CARPENTARIUS, n.sp.

Elongate-oval, sub-depressed; prothorax transverse, quadrate-cordate, sinuate on each side towards base, wider across base than apex; elytra with five inner striæ strongly impressed, the interstices convex.

Black, shining; tarsi, palpi and two basal joints of antennæ reddish-piceous. Head moderate, smooth; frontal impressions short, deep, clearly defined, arcuate, strongly divergent backwards; clypeal suture strongly marked, clypeus strongly and evenly declivous to labrum; eyes convex. Prothorax short, transverse (3·3 × 4·8 mm.), widest a little before middle, lightly convex anteriorly, depressed posteriorly; disc faintly transversely striolate; sides rounded on anterior two-thirds, shortly narrowed to anterior angles, lightly narrowed behind, straightened to meet the base almost at right angles; anterior margin widely emarginate; base lightly sinuate, hardly emarginate across peduncle, sloping lightly forward on each side; anterior angles wide, very lightly advanced; basal angles subrectangular, obtuse at summit, lateral border thick, lightly reflexed; median line lightly impressed; two lateral basal impressions placed in a wide depression on each side; the internal short, strongly marked; the external much shorter, equally impressed; space between internal basal impressions depressed but convex, that between external impression and lateral margin convex and bearing at its base the posterior marginal puncture. Elytra oblong, wider than prothorax (10 × 6 mm.), subparallel on sides, lightly convex, a little depressed on disc, strongly declivous to sides; apical curve widely but decidedly sinuate on each side; striæ simple, five inner ones strongly impressed, entire; fifth lightly flexuous towards base; sixth strongly impressed near apex, its course plainly discernible and crenulate on basal two-thirds; seventh strongly impressed near apex, its course faintly discernible and crenulate on basal two-thirds; eighth strongly impressed; five inner interstices lightly convex (fifth less so than others), more decidedly so and narrower on apical declivity, sixth, seventh and eighth decidedly separated at apex, ninth punctate as usual in genus; lateral border narrow, reflexed, basal border lightly curved on posterior margin, not dentate at shoulders; marginal channel becoming wider towards apical sinuosity. Prosternum not margined at base; episterna strongly rugulose. Ventral segments smooth (hardly obsoletely rugulose); first with a few punctures along anterior margin.

Length 16-18, breadth 6-6·75 mm.

Hab.—North Queensland. (Several specimens sent by Mr. C. French as coming from the Gulf of Carpentaria.)

This species is allied to *R. liopleurus*, Chaud., but is easily distinguished by its wider and more depressed form, the prothorax proportionately wider and much more strongly rounded on the anterior part of the sides, the elytra more strongly striate with the interstice more convex—the fifth stria and interstice are hardly less developed than those nearer the suture, while in *R. liopleurus* the fifth stria and interstice are both very feeble.

Genus Darodilia.

Darodilia macilenta, n.sp.

Elongate narrow, depressed; body shortly pedunculate; prothorax cordate; elytra oblong, 4-striate on disc, smooth towards sides; prosternal episterna feebly longitudinally rugulose; labrum deeply emarginate; mandibles long, hooked, decussating.

Black, shining; undersurface, legs and antennæ piceous; tarsi and palpi reddish. Head long, smooth, convex; clypeal suture distinctly impressed, a fine puncture towards each extremity; clypeus smooth; eyes convex, deeply set in orbits at base; orbits not protuberant behind eyes. Antennæ filiform, long, lightly compressed, a little thicker to apex. Prothorax as long as broad (2·3 × 2·3 mm.), narrowed to base, evidently narrower across base than apex, truncate in front and on base above peduncle, subdepressed, evenly and very lightly convex; sides lightly and continuously rounded from apex to base; basal angles rounded, not marked; lateral border narrow, equal; median line obsoletely impressed; two clearly marked linear impressions on each side of base near basal angles, the external very short, the inner a little longer; posterior marginal seta placed a little before the base at extremity of marginal channel. Elytra oblong, a little wider than prothorax (4·5 × 2·6 mm.), depressed, abruptly roundly declivous to sides, strongly declivous to apex; sides subparallel (very lightly rounded); base subtruncate, very lightly emarginate; shoulders rounded, hardly advanced; apex strongly sinuate on each side; four inner striæ strong, entire, simple, fifth, sixth and seventh wanting (seventh indicated on apical declivity), eighth strongly impressed: four inner interstices convex; lateral interstice punctate on basal and apical third; lateral border narrow; basal border weak, curved on posterior margin; marginal channel narrow. Prosternum truncate and margined at base; episterna with a few feeble longitudinal rugæ towards inner margin. Metasternal episterna narrowly elongate. Ventral segments smooth in middle, transversely sulcate. Legs light; posterior tarsi sulcate externally; posterior trochanters impunctate; ♂ with three basal joints of anterior tarsi lightly dilatate and squamulose below.

Length 8, breadth 2·6 mm.

Hab.—Darling River, N.S.W. (Brought from the Darling River by Mr. R. Helms, probably from the neighbourhood of Bourke.)

This species is closely allied to *D. castelnaui*, Macl., but having compared it with Sir William Macleay's type, I am able to state with certainty they are distinct. From *D. rugisternus*, Sl., it may be distinguished easily by its narrower and more depressed form, proportionately longer prothorax, and the feeble rugosity of the prosternal episterna.

DARODILIA RUGISTERNUS, n.sp.

Elongate-oval, robust; body shortly pedunculate, elytra ovate, convex, strongly 4-striate on disc, smooth towards sides;

prosternal episterna strongly longitudinally striolate: labrum deeply emarginate; mandibles long, hooked, decussating.

Black, shining; undersurface piceous, legs reddish-piceous, antennæ and palpi ferruginous. Head large, smooth, convex; clypeal suture impressed, a fovea towards each extremity: clypeus slightly rugulose: eyes convex, prominent, deeply set in orbits at base; orbits not protuberant behind eyes. Antennæ filiform, long, compressed, thicker towards apex. Prothorax transverse (1·8 × 2·1 mm.), narrowed to base, evidently narrower across base than apex, lightly emarginate in front, truncate on base above peduncle; lightly and evenly convex; sides strongly and continuously rounded from apex to base; anterior angles obtuse, hardly advanced; basal angle rounded, not marked; lateral border narrow, even; median line very lightly impressed; two short, narrow oblong foveæ on each side of base near basal angles; posterior marginal setigerous puncture placed a little before the base at extremity of marginal channel. Elytra oblong, truncate on base, very little wider than prothorax (3·8 × 2·3 mm.), convex, strongly declivous to apex; sides subparallel in middle, rounded to base; shoulders widely rounded; apical curve short, hardly sinuate on each side; four inner striæ strong, entire, simple, fifth very lightly impressed throughout its whole length, sixth and seventh wanting (seventh indicated on apical extremity), eighth strongly impressed; four inner interstices convex, fifth flat; lateral interstice punctate on basal and apical third: lateral border narrow; basal border narrow, curved on posterior margin; marginal channel narrow. Prosternum narrowed on each side of base, basal border obsolete; episterna strongly longitudinally striolate on inner half. Metasternal episterna narrow, elongate. Ventral segments smooth in middle, transversely sulcate. Posterior trochanters impunctate.

Length 6·25, breadth 2·3 mm.

Hab.—Queensland. (Given to me by Mr. D. Best of Melbourne, as coming from Queensland, most probably from the Rockhampton District.

Speaking from memory, I should say this species has a great resemblance to, and is perhaps congeneric with *Meonis ovicollis*, Macl.; but I have not been able to compare it with the type of that species which unfortunately is not described, Sir William Macleay's notice of it being merely an indication of some differences between it and Castelnau's species *Meonis ater* and *niger*.

Genus CYCLOTHORAX.

I believe Dr. Sharp has placed *Cyclothorax* in the tribe *Feronini*, but it is evident this is not its true position, which cannot be far from *Amblyteius* or from the Australian *Carabidæ* which Count de Castelnau has referred to the genus *Drimostoma*. In the present system of arranging the *Carabidæ* the mandibles with a seta in the anterior part of the scrobe will exclude it from the *Feronini*, while the margin of the elytra interrupted posteriorly and with an internal plica will prevent its coming into the tribe *Pogonini*, to which it has an affinity. I am not sure that it can be admitted into any of the recognised tribes of the *Carabidæ*.

Table of the Species of Cyclothorax known to me.

I. Disc of prothorax smooth, without punctures except near basal margin.

A. Prothorax short, strongly rounded on sides, with a wide lateral border.

Elytra black........................... *C. ambiguus*, Erichs.*

* A species of *Cyclothorax* is found everywhere in south-eastern Australia (N.S.W. and Victoria) where I have collected, and is also reported by the Rev. Thos. Blackburn to occur generally in South Australia (*vide* P.L.S.N.S.W. 1891 (2), vi. p. 481). It is subject to considerable variety in size, in the character of the puncturation of the elytral striæ, and in the depth of the black colour of the upper surface; I believe it to be identical with *C. ambiguus*, Erichs., and that *C. lophoides*, Chaud., is also founded on it. I do not feel confident that *C. punctipennis*, Macl., is a distinct species from *C. ambiguus*, though it is quite likely that it is.

Elytra black on disc, with wide testaceous margin ....*C. lateralis*, Casteln.†

B. Prothorax cordate, border narrow, basal angles not prominent .... *C. peryphoides*, Blkb.‡

C. Prothorax short, border not wide, basal angles rectangular.

Elytra with the striæ formed of rows of punctures becoming obsolete on apical declivity; median line of prothorax lightly impressed............................. *C. fortis*, Blkb.

Elytra with strong punctate striæ extending to apex; median line of prothorax deeply impressed.......... *C. curtus*, Sl.

II. Disc of prothorax entirely covered with a strong punctuation, size very small .... *C. punctatus*, Sl.

CYCLOTHORAX CURTUS, n.sp.

Oval, robust, convex; elytra strongly punctate-striate.

Black; legs and antennæ reddish. Head short, convex, impressed on each side between eyes; impressions divergent behind. Prothorax transverse (1 × 1·4 mm.); base and apex equal in width; sides evenly rounded; base wide, lightly oblique on each side to basal angles, these strongly marked, rectangular; lateral border narrow, reflexed, very shortly sinuate just before the base, meeting the base at right angles; median line strongly impressed; a broad deep punctate fovea on each side of base; the space between these foveæ convex, impunctate. Elytra wide (2·2 × 1·75 mm.), convex, 9-striate; striæ deeply impressed on disc, extending to apex, not reaching base (seventh lightly impressed), strongly

† A species of *Cyclothorax* which I have taken in New South Wales at Mulwala, on the Murray, and near Urana, agrees so well with the description of *Phorticosomus lateralis*, Casteln., that I have no hesitation in regarding it as that species. *C. cinctipennis*, Blkb., seems to me certainly the same species.

‡ Specimens of a *Cyclothorax* are in my collection which apparently cannot be differentiated from *C. peryphoides*, Blkb., unless by the testaceous colour of the legs, a character that is not likely of specific value; a variety with the apex of the elytra testaceous also occurs It is a widely distributed species; I have specimens from the following localities:—Victoria: Ferntree Gully, Lillydale. N.S.W.: Mulwala, Urana District, Windsor (Lea), Clarence River (Lea).

punctate, the puncturation lighter posteriorly; the scutellar striole very short; eighth interstice subcostate behind.

Length 4, breadth 1·75 mm.

Hab. Bendigo, Victoria. (A single specimen in my collection received from Mr. W. W. Froggatt, who took it at Bendigo.)

This seems a very distinct species; the absence of puncturation across the middle of the prothorax near the base seems in itself to separate it from all other described species; it is probably more allied to *C. eyrensis*, Blkb., than to any other known species.

CYCLOTHORAX PUNCTATUS, n.sp.

Oval, robust, convex; prothorax strongly punctate; elytra punctate-striate.

Reddish-brown, femora yellowish. Head strongly impressed on each side between eyes; three strongly impressed punctures on each side a little behind frontal impressions; eyes prominent, globose. Prothorax transverse (0·75 × 1·15 mm.), widest and dilatate a little before middle, shortly and decidedly narrowed in front, more gently narrowed behind; base evidently wider than apex, oblique on each side near angles; anterior angles not marked; basal angles prominent; lateral margin narrow, hardly reflexed, median line wanting, whole upper surface covered with strong punctures; fovea near each basal angle lightly marked, wide. Elytra broad (1·75 × 1·4 mm.), convex; five punctate striæ on disc of each elytron; sutural stria entire, others obsolete on posterior declivity; lateral declivity smooth; margin as usual in genus. Prosternum with episterna thickly and strongly punctate; mesosternal episterna punctate, short, wide; metasternum (with episterna) punctate.

Length 2·9, breadth 1·4 mm.

Hab.—Urana District, N.S.W.

A thoroughly distinct species, nothing resembling which has hitherto been described; its small size and the strong puncturation of the whole of the pronotum and nearly all the under thoracic parts show it to be thoroughly *sui generis*. I have found it in considerable numbers under logs and the leaves of fallen saplings at a place about twenty-five miles north-west from the town of Urana. It is sluggish in its movements.

PLATYNINI.

PLATYNUS COOKI, n.sp.

Elliptic-oval, depressed; prothorax lightly transverse, widely margined; elytra much broader than prothorax, lightly striate, three foveiform punctures on each elytron, the anterior on course of third interstice, the two hinder ones on course of second stria.

Olive-black; undersurface piceous, legs light brown. Head smooth; front longitudinally and widely impressed on each side, the impressions extending to the clypeus: clypeal suture lightly marked; eyes very convex and prominent. Prothorax transverse (1·2 × 1·6 mm.), widest a little before the middle, evidently wider across base than apex; basal part a little depressed; sides rounded; anterior margin truncate; base truncate above peduncle, cut obliquely forward to angles on each side; basal angles marked, but obtuse; border wide, reflexed, widest and prominent at basal angles; a wide fovea on each side of base; median line strongly impressed, reaching base; marginal punctures as in *P. marginicollis*, Macl. Elytra ovate (4 × 2·7 mm.), base emarginate in middle with shoulders roundly and widely advanced; apical curve strongly sinuate on each side; striæ simple, entire, fifth more strongly impressed near apex, sixth more strongly impressed near base; striole at base of first interstice long; interstices flat, first narrow; three strong foveiform punctures on each elytron, anterior on basal third on course of third stria, intermediate about middle on course of second stria, posterior about half way between the intermediate one and apex on course of second stria; ninth interstice strongly punctate along course of eighth stria; border reflexed. Ventral segments smooth.

Length 6·5, breadth 2·7 mm.

Hab.—Queensland; King's Plains Station, 28 miles south-west from Cooktown. (Sent to me by Mr. N. H. Gibson.)

A distinct species; its small size and the large foveæ of the third interstice of the elytra are among its most marked characters.

Helluonini.

Lestianthus, n.gen.

Head constricted posteriorly to a short wide neck; vertex and front strongly punctate; some long hairs behind each eye.

Mandibles stout, short, pointed but hardly hooked at apex.

Maxillæ with inner lobe falcate, strongly bent inwards towards apex and acutely pointed: inner margin fringed (not thickly) with strong bristles; outer lobe biarticulate.

Labrum truncate, sexsetose.

Labium small, triangular, coriaceous; ligula bisetose, the setæ strong, short, placed near each anterior angle; paraglossæ large, connected behind, truncate in front, hardly advanced before ligula, each equalling ligula in width on anterior margin.

Mentum deeply emarginate, without a median tooth.

Palpi: maxillary with penultimate joint short, conical; the apical joint long, elliptical, thick, obtuse, rather more than a half longer than penultimate: labial with penultimate joint bisetose; apical joint large, very widely securiform.

Antennæ short, thick, subfiliform, lightly incrassate; all the joints setose; the three basal ones more sparsely so; four basal joints cylindrical; seven succeeding ones a little compressed, subequal; first joint hardly as long as two succeeding ones together, having a puncture in front on apical third bearing a long strong seta; second joint a little shorter than third, thickened at apex; apical joint a little longer than penultimate.

Prothorax not much broader than long, convex, punctate; a very prominent, acute angular projection on each side a little before the base.

Elytra connate, abbreviated at apex, striate; the interstices depressed, punctulate; a few scattered setæ towards sides and base.

Prosternum punctate, narrow, not impressed between coxæ.

Legs (♂) stout ; femora having scattered hairs over their surface ; anterior thick, not channelled below ; anterior tibiæ strongly notched on inner side , tarsi short ; a few hairs on upper surface ; anterior lightly dilatate, not squamulose below, fourth joint small, transverse, hardly emarginate ; ungues finely serrate ; posterior coxæ divided.

The species on which this genus is founded might perhaps be more correctly placed among the *Lebiini ;* but it has altogether the appearance of a Helluonide and seems to me, although the labium is coriaceous, to be more in its natural position as placed above. It is such a distinct species in many ways that it can hardly be confused with any of the previously described Australian *Truncatipennes.*

LESTIANTHUS SCULPTURATUS, n.sp.

Small, robust ; elytra depressed ; head, prothorax and elytra punctate and bearing numerous scattered long hairs ; head constricted posteriorly to a short neck ; prothorax with a strong acute projection on each side a little before the base ; elytra striate.

Uppersurface of a very dark blue colour, hardly metallic (elytra dark violet) ; undersurface black, shining ; mesosternum, metasternum and coxæ piceous ; femora, tarsi and antennæ darker than coxæ ; tibiæ testaceous, with base and apex piceous. Head large, punctate ; occiput smooth ; front obsoletely bi-impressed ; eyes deeply set in orbits, not prominent ; orbits swollen behind eyes ; the post-ocular processes as large as the eyes but less prominent, covered with long hairs. Mandibles short, projecting but little beyond labrum. Prothorax convex, punctate, a little broader than long (1 × 1·3 mm.), widest before the middle ; sides lightly rounded anteriorly, strongly sinuate posteriorly to form the strong angular projection on each side in front of the base, not oblique behind these projections and meeting the base at right angles ; anterior margin lightly and widely emarginate ; anterior angles obtusely advanced ; base truncate ; lateral margin wide ; lateral border reflexed, not reaching base, forming at its posterior extremity the strong acute dentiform ante-basal projection; these projections truncate behind; median channel deeply impressed. Elytra broad, short (2·75 × 2 mm.), roundly emarginate behind peduncle, abbreviated (very lightly rounded) at apex; sides lightly rounded; shoulders rounded; striæ strongly impressed, striole at base of first interstice short, oblique; interstices depressed, closely punctulate, the puncturation shallow, deeper and closer on the lateral interstices; border extending from near scutellum to apex, reflexed from humeral angle to apical curve.

Length 4·75, breadth 2 mm.

Hab.—Lillydale, Victoria. (Two specimens occurred to me in a dry situation, on the ground, under bark and débris near the foot of a large tree on 20th Nov., 1892.)*

BRACHININI

PHEROPSOPHUS MACLEAYI, n.sp.

Robust; prothorax a little broader than long; elytra much wider than prothorax, truncate at apex, costate, the spaces between the costæ flat.

Head yellow with a triangular black spot on vertex, mandibles brown; prothorax yellow, anterior margin, posterior margin and a connecting median vitta black, underparts black along posterior margin, the black extending forward on each side along inner sutures of episterna to anterior margin; elytra black, lateral margin (including inflexed part), apical margin, a spot near each humeral angle and a broad fascia at about middle of length extending from each margin almost to the suture yellow; under parts of body piceous inclining to yellow in middle; legs and antennæ testaceous. Head large, convex, lightly bi-impressed between the antennæ; occiput finely rugulose. Prothorax a little broader than long (2·7 × 3

* Mr. G. Masters has, while this was passing through the press, sent me a specimen labelled "Ropes Creek, N.S.W."; it is of a greener colour than my type.

mm.), lightly convex; a few punctures and setæ on disc; sides lightly rounded on anterior three-fourths, straight posteriorly and meeting the base at right angles; anterior margin truncate; base subtruncate, the middle a little produced backwards; basal angles rectangular, obtuse; lateral border reflexed; median line strongly impressed. Elytra greatly wider than prothorax (8 × 5·3 mm.), lightly convex, a little narrowed to base; shoulders rounded, apex truncate; eight narrow costæ on each elytron; space between eighth costæ and lateral border wide; lateral border reflexed. Underparts of prothorax and body setose.

Length 11·5-13, breadth 4·7-5·3 mm.

Hab.- Northern parts of Australia. (King's Sound, W. W. Froggatt; Gulf of Carpentaria, on the authority of Mr. French).

This species was originally brought from Derby by Mr. W. W. Froggatt, but the late Sir William Macleay in going through the *Carabidæ* from King's Sound did not consider it presented sufficient differences from *Ph. verticalis*,* Dej., to justify its being recognised as a distinct species; it may also be the variety of *Ph. verticalis*, from Cooper's Creek, mentioned by Count de Castelnau with "a yellow humeral spot"; † to me it seems a thoroughly distinct species. Apart from its colour and smaller size, the narrower prothorax, less strongly rounded on the anterior half of the sides, is the decidedly different character that I notice between the two species; a comparison of all the specimens of both species in my possession seems to indicate this as a constant difference, and one that is readily seen when the two species are compared. The amount of black on the prothorax varies in different specimens, and the yellow spots on the elytra at each shoulder also vary a little in size; the shape of the fascia across the middle of the elytra is constant in the three specimens before me; it is produced both forwards and backwards at the fifth costa.

* See P.L.S.N.S.W., 1888 (2) III. p. 451.
† Trans. Roy. Soc. Victoria, 1868, VIII., p. 109.

Harpalini.

Gnathaphanus riverinæ, n.sp.

Robust, parallel; prothorax subquadrate; elytra striate, the interstices lightly convex, third with six or seven punctures; mentum with median tooth feebly developed.

Elytra blackish-green (often with a brassy tinge); head, prothorax, undersurface and legs black. Head smooth, convex; front with a light punctiform impression on each side; clypeal suture lightly marked between the frontal impressions, eyes convex. ♂. Prothorax subquadrate (3·25 × 4 mm.), widest about middle, hardly at all narrowed behind, wider across base than apex, smooth, lightly convex; sides lightly rounded, more decidedly and roundly narrowed to anterior than to basal angles; anterior margin emarginate; base subtruncate; anterior angles prominent, very obtuse; basal angles broad, not marked; border narrow, wanting only on middle of anterior margin, reflexed on sides; posterior foveæ well marked, about half way between median line and margin; median line very lightly impressed. Elytra very little wider than prothorax (7·75 × 4·5 mm.), subparallel on sides, lightly convex; base truncate; apical curve obsoletely sinuate on each side; striæ deep, simple; striole at base of second interstice strongly impressed, elongate; interstices convex, third with six or seven widely placed punctures along its course from just behind striole of second interstice to near apex, these punctures more closely placed on posterior half; ninth interstice punctate as usual in genus.

♀. With interstices of elytra hardly as convex as in ♂, but not differing otherwise except sexually.

Length 13, breadth 4·5 mm.

Hab.—N.S.W., Urana District, (Sloane); Tamworth (Lea); (I find it in considerable numbers, 20 miles N.E. from Urana during the autumn and winter.)

A distinct species.

BOTANICAL NOTES FROM THE TECHNOLOGICAL MUSEUM, SYDNEY.

No. II.

(Plate xxvii.)

By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S.

Ranunculaceæ.

Clematis aristata, R.Br.

This species has now been collected as far north as the Goulburn River, N.S.W. Previously recorded from the Illawarra and the neighbourhood of Port Jackson.

Menispermaceæ.

Carronia multisepala, F.v.M.

This species is to be recorded as far north now as the Richmond River, having been collected by Mr. W. Bäuerlen at Tintenbar, near Lismore. Previously recorded only from the Bellinger and Clarence.

Malvaceæ.

Hibiscus Sturtii, Hook.

This species occurs mostly in rivers of the interior and north-east of this colony, but it is found well up the Mountains, or even on the summit of the Mountain Ranges at Camboon and Bylong near Rylstone.

Rutaceæ.

Phebalium glandulosum, Hook.

Foot of the Ranges at Murrumbo, Goulburn River, N.S.W. A. Cunningham gives Eurylean Scrub as the New South Wales locality.

Evodia xanthoxyloides, F.v.M.

This species previously recorded from Rockingham Bay, Queensland (*Fragm.* iv. 155), has been collected at Tintenbar, N.S.W., by Mr. W. Bäuerlen.

Geijera parviflora, Lindl.

This *interior* species has been collected as far east as Murrumbo, on the Goulburn River, by R. T. Baker.

Acronychia imperforata, F.v.M.

This plant, previously only found in Queensland, has now been collected at Lismore by Mr. W. Bäuerlen.

Olacineæ.

Pennantia Cunninghamii, Miers.

This species has been collected in the Glenfernie Forest Reserve by one of us. The flowers of *Pennantia* are diœcious or polygamous. In Forster's *Characteres Generum Plantarum* (London, 1776), at Plate 134 is a figure of a male and of an hermaphrodite flower of a New Zealand species. The flowers of the same species, *P. corymbosa*, are similarly figured in Kirk's *Forest Flora of New Zealand.*

Flowers of the New South Wales species (*P. Cunninghamii*) do not appear to have been recorded. Our specimens show hermaphrodite flowers (Plate xxvii).

If we follow the nomenclature of Bentham (B. Fl. i. 395) and Kirk, we should designate these so-called hermaphrodite flowers "female flowers" on the ground that the stamens are infertile, but in our flowers of *P. Cunninghamii* the stamens are pollen-bearing, and it would appear to be more correct to retain the term hermaphrodite for them. The flower depicted in the drawing shows a perfect pistil, and had Bentham such material he would have been able to give a description of the female organs of this plant, to the absence of which in the specimens sent in by collectors he draws attention. In all the specimens seen the petals are closed; in the drawing they are shown opened back.

CELASTRINEÆ.

CELASTRUS DISPERMUS, F.v.M.

The specimens of this species, collected by W. Bäuerlen at Lismore, agree with Baron Mueller's description (Trans. Phil. Inst. Vict. iii. 31) in regard to the presence of an aril at the base of the fruits, but not seen by Bentham in the specimen examined by him (B.Fl. i. 399).

SAPINDACEÆ.

RATONIA ANODONTA, Benth.

Syn.—*Cupania anodonta*, F.v.M.

This species is now recorded for this colony for the first time. It has been found at Lismore by Mr. W. Bäuerlen.

NEPHELIUM FOVEOLATUM, F.v.M.

Previously recorded from Moreton Bay (W. Hill and F.v.M.), has now been collected by W. Bäuerlen at Lismore.

LEGUMINOSÆ.

PULTENÆA STYPHELIOIDES, A. Cunn.

Previous localities recorded for this species have all been in the western slope of the Dividing Range, but now it has been found on the Goulburn River, near Widdin.

ACACIA ARMATA, R.Br.

Has been collected on the right bank of the Goulburn River at Murrumbo.

ACACIA UNDULIFOLIA, Fras.

Has been collected as far south as Yass by Mr. W. W. Froggatt; the Blue Mountains being previously recorded as its southern limit in this colony.

Acacia undulifolia, Fras., var. pubescens.

A softly pubescent variety with typical phyllodes,—those on the young shoots at the base of the peduncles mostly deciduous in drying, giving the appearance of a raceme in inflorescence very much resembling *A. vestita.* The flower heads are smaller than those of the typical species. This variety is all the more interesting as it brings this species within the County of Cumberland, the type being previously recorded from the Blue Mountains.

It was sent to us by the Rev. T. V. Alkin, M.A., of Campbelltown, who collected it at George's River. We propose the name *pubescens* for this variety. It differs from the variety *dysophylla* in having smaller phyllodes.

Acacia neriifolia, A. Cunn.

Should be recorded in the Mudgee Flora, having been collected at Camboon by R. T. Baker.

Acacia amblygona, A. Cunn.

Generally regarded and recorded (A. Fraser and A. Cunningham) as an inland species, has been found at Murrumbo, on the Goulburn River.

Acacia harpophylla, F.v.M.

New South Wales Brigalow timber has been sold in the Sydney market for a number of years, but it has only come down in quantity since the opening of the line to Narrabri. As it was suspected to be the product of *Acacia harpophylla,* Mr. Henry Deane, M.A., was written to on the subject, who says:—"It grows in the Counties of Pottinger and White to my knowledge. The nearest place that I know is about six miles beyond Boggabri on the North-Western Railway. You can see it from the railway carriage. There used to be a thick clump of it also about four miles this side of Narrabri Station. I am not sure of the other spots, but there is a creek running into the Namoi from it south, a few miles beyond Narrabri, called the Bohena or Brigalow Creek, on which it is abundant I believe."

The species has hitherto been unrecorded for New South Wales.

MYRTACEÆ.

MYRTUS BIDWILLII, Benth.

This species previously recorded from Queensland has now been collected at Lismore by Mr. W. Bäuerlen. The leaves can scarcely be said to be "very shining."

CUCURBITACEÆ.

BYRONIA (BRYONOPSIS) LACINIOSA, Linn. (B.Fl. iii. 319).

Mr. W. A. B. Greaves, attracted by the ornamental character of this climber, particularly when in fruit, has raised some plants from seed gathered by him a year or two ago on the Upper Clarence River, from truly indigenous plants. We are able, from examination of the ripe fruit, to add a note in regard to it. The berry is ellipsoid not globular, of length $\frac{3}{4}$ inch, width $\frac{1}{2}$ inch, in average specimens. Colour terra-cotta, with about eight longitudinal white stripes; each contains about ten or twelve seeds, enclosed in a fluorescent bluish-green pulp.

ARALIACEÆ.

ASTROTRICHA FLOCCOSA, DC., var. SUBPELTATA.

This variety which has only been collected previously on the coast, has now been found to occur at Portland, near Mudgee (J. Geddes).

RUBIACEÆ.

CANTHIUM OLEIFOLIUM, Hook., var. PEDUNCULATUM.

This variety differs from the normal species in having peduncles sometimes over an inch long, instead of "flowers in short *almost sessile* axillary cymes." This variety is from Condobolin, which brings the range of this species from the Castlereagh River as far south now as the Lachlan.

Coprosma hirtella, Labill.

This species has been collected as far west as Mount Vincent, Ilford (R.T.B.).

Compositæ.

Aster argophyllus, Labill.

This species extends as far north as the top of the Bulli Pass.

Olearia (Aster) Nernstii, F.v.M.

This species is now recorded from Gosford and Paterson River, so evidently is to be found right along the coast from Brisbane Water to Queensland.

Calotis microcephala, Benth.

This plant, usually recorded from the Western plains, has been collected at Quiedong, near Bombala, by W. Bäuerlen.

Leptorrhynchos panaetioides, Benth.

Mr. W. J. Cahill has collected this species at Wee Waa, on the Namoi River, so far the most northerly locality recorded.

Goodeniaceæ.

Dampiera adpressa, A. Cunn.

Collected at Murrumbo by R. T. Baker; previous range, Croker's Range to Queensland.

Epacrideæ.

Styphelia laeta, R.Br., var. angustifolia.

This is now to be recorded as far north as Camboon, near Rylstone, where it attains a height from 10 to 12 feet.

Leucopogon muticus, R.Br.

This species has been collected at Camboon by R. T. Baker, so should be included in the Mudgee Flora.

BORAGINEÆ.

CYNOGLOSSUM AUSTRALE, R.Br.

This species is now to be recorded as far east as the Goulburn River, having been collected at Murrumbo.

LENTIBULARINEÆ.

UTRICULARIA DICHOTOMA, Labill.

Has now to be recorded as far west as Mudgee (Miss C. Bahlsen).

VERBENACEÆ.

SPARTOTHAMNUS JUNCEUS, A. Cunn.

This species previously recorded by Dr. Woolls from the Castlereagh has been collected as far south now as Condobolin on the Lachlan.

LABIATÆ.

PROSTANTHERA PRUNELLOIDES, R.Br.

This species extends as far north as Murrumbo, on the Goulburn River, N.S.W.

PROTEACEÆ.

GREVILLEA SPHACELATA, R.Br.

Fruits of this *Grevillea*, previously unrecorded, have been obtained at Carlton by Mr. Clark. They measure nearly 12 lines in length and 3-4 in width, are compressed, slightly villous. Seeds flat, winged all round.

EUPHORBIACEÆ.

ACTEPHILA MOOREANA, Baill.

This species has been collected at Ballina by W. Bäuerlen, thus extending further south from the only previous recorded locality of Mount Lindsay.

Croton acronychioides, F.v.M.

This species has been collected at Tintenbar by W. Bäuerlen.

Mallotus discolor, F.v.M.

The fruits of this species, which have managed to escape previous collectors, have been found by W. Bäuerlen at Lismore. The capsule may be described as tridymous, mostly 3 lines in diameter, covered with yellow glands without any processes, in contradistinction to the red coloured glands of *M. philippinensis*. Seeds quite globular. It may not be out of place to mention that a chemical investigation of these glands gives identical results with the "Kamala" of commerce; the substance is a little lighter in colour, but otherwise conforms to the tests given for the resin of *M. philippinensis*.

Urticeæ.

Ficus Bellingeri, C. Moore.

This species, previously only recorded from the locality from which it received its specific name, is found now to have much farther northern range, having been collected near Lismore on the Richmond by W. Bäuerlen.

Ficus rubiginosa, Desf.

This coast-loving species has been discovered as far west now as Carroll, near Gunnedah, and as far south as Currawang via Nelligen (J.H.M.).

NOTES ON PLANTS COLLECTED ON A TRIP TO THE DON DORRIGO FOREST RESERVE.

By J. H. Maiden, F.L.S.

NOTES AND EXHIBITS.

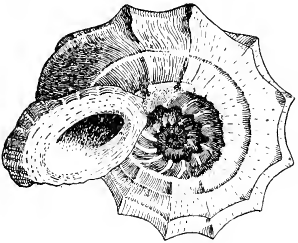
Messrs. Maiden and Baker exhibited interesting collections of plants in illustration of their papers.

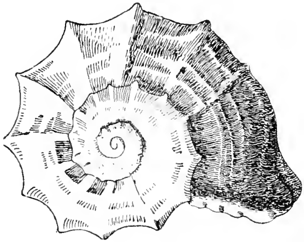
Mr. Hedley read the following Conchological Notes:—

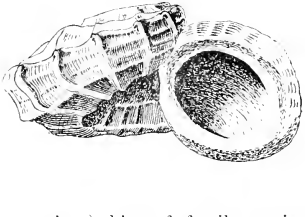
"In discussing *Gundlachia beddomei*, in the last Volume of these Proceedings I treated it as an undescribed species. Miss Lodder, the well-known Tasmanian conchologist, kindly reminds me that it was both figured and described by Petterd, Proc. Roy. Soc. Tasmania, 1887 (1888), p. 41, Pl. XLIV. Dr. Dall writes to me that he doubts whether *Gundlachia* be a genus at all, suspecting it to be a form assumed by winter survived *Ancylus*; no other hypothesis explaining to him its sporadic occurrence. Against this I would balance the objection that in Europe, the best searched division of the globe, *Ancylus* has not yet been observed to sport *Gundlachia*. My statement on p. 513 that *Gundlachia* differed anatomically from *Ancylus* by a distinct pattern of radula, was based on figs. 231, 249, and 253 of the Smithsonian Miscellaneous Collection, No. 143. An additional illustration of *Gundlachia* dentition from Mr. Suter's pencil appears on Pl. XIV. Vol. XXVI., Trans. N.Z. Institute. In support of the affinity of American fluviatile mollusca to Australasian, I have collected the following additional evidence. White has recorded *Melanopsis* (Proc. U.S. Nat. Museum, 1882, v. p. 96 Pl. IV. ff. 9, 10) as fossil from the Laramie of Colorado, and *Latia* (*op. cit.* p. 100, Pl. v. ff. 17, 20) from the Miocene of Nevada. In America *Lyogyrus* contains three species, *L. pupoides*, Gould; *L. brownii*, Carpenter; and *L. dalli*, Pilsbry and Beecher; to this genus I have referred (*ante*, Vol. VII. p. 373) the Queensland *anodonta*, the only other known member being *L. perroquini*, Crosse, from New Caledonia. For a comparison of Unio embryos from New Zealand and S. America see "The New Zealand Journal of Science," Nov. 1891, pp. 250, 254.

"Mr. C. E. Beddome recently lent to me for study authentic examples of *Liotia tasmanica*, T. Woods, described in Proc. Roy.

Soc. Tasmania, 1875 (1876), p. 153. The opportunity was seized to sketch of this hitherto unfigured species the drawings now presented. This species has been discovered in Victoria by Mr. J. H. Gatliff, who collected it at Flinders, Western Port."







"At a late meeting of this Society, it was announced by Mr. Brazier, apparently on negative evidence, that *Patella kermadecensis* did not inhabit the Kermadec group as stated by Pilsbry. Mr. C. Spencer, a conchologist resident in Auckland, New Zealand, has since communicated to me a complete and contrary account of the discovery of the species. It was collected at Raoul or Sunday Island, by the crew and at the orders of Captain Fairchild of the Government steamer "Hinemoa." Brought by him from the Kermadecs to Auckland, specimens were thence distributed to the United States and elsewhere."

"The shelly tubes that I now exhibit, like (if I may be excused so frivolous a comparison) bits of fossil gaspipe, are built by the mollusk *Kuphus arenarius*, Linn. This rare animal is one of the few of which, so far as I can learn, science has in the past half century taught us nothing new. An excellent account, but quite neglected by later writers, of the shell and its habitat by J. Griffiths may be seen in the Phil. Trans. 1806, pp. 269-273, Pls. x. and xi. The specimens he procured from Sumatra were examined by Sir Everard Home, who compared them to *Teredo*, figured the palettes (op. cit. Pl. xii. ff. 4, 5), and what he supposed to be a valve (f. 6) This latter Gray holds (P.Z.S. 1857, p. 245) to have been "evidently a fragment of the plates which close the end of the tube." No naturalist has seen the animal of *Kuphus;* it is presumed to be a Pelecypod, but it is a matter of dispute whether it possesses valves or not. In Tryon's Catalogue of the *Pholadacea* (Am. Journ. Conch. III. 1867, Suppl. p. 21), the species is quoted from "Philippines, Van Dieman's Land," the latter an evident blunder. The examples before you were collected by our fellow member, Mr. Brazier, who found them fairly abundant sticking out of a coral reef off Mboli on the coast of Florida Island, Solomons, during the cruise of H.M.S. Curaçoa. This record extends the known range of *Kuphus* by several thousand miles. But from my personal experience I am able to furnish an intermediate habitat. In 1890 I extracted from a raised coral reef of recent formation, at Redscar Head, British New Guinea, several fragments of *Kuphus* pipes which now lie in the Museum of the Geological Survey of Queensland. Mr. Louis Becke, the well known author of "By Reef and Palm," tells me that he remembers using in the eastern archipelagoes fragments of *Kuphus* tube, broken into shelly rings, as convenient sinkers for fishing lines. He thinks it to be a deep water species. It is greatly to be hoped that scientific visitors to the Pacific will endeavour to procure whole specimens containing the animal for investigation. Future search of the Great Barrier Reef will probably result in adding this genus to the catalogue of the Australian mollusca."

Mr. Pedley showed an interesting collection of ornately carved Aboriginal weapons comprising boomerangs, nullah nullahs and a hielaman, from the neighbourhood of Angledool and Collarendabri in the north-western part of the colony.

Rev. J. M. Curran exhibited a specimen of a typical trachyte from Coonabarabran, with a photograph of the locality; also a specimen of blue sapphire in a matrix of basalt from New England, the first record of the matrix for sapphire in Australia. A section of the matrix was shown under the microscope.

Mr. Froggatt exhibited specimens of the moths mentioned in his paper; a section of the stem of an Acacia attacked by *Eudoxyla eucalypti;* the felted bags formed by the larger variety of this species, and the wads formed by *Leto Stacyi.*

Dr. Cox showed a beautiful specimen of a lamellibranch (*Mactra*), obtained by Mr. Massie at the White Cliffs, near Wilcannia, the calcareous matter of the valves of which had been partly replaced by precious opal. He also exhibited an elaborately ornamented specimen of a form of boomerang club, one of several he had recently seen, procured from the Pitchery country, to the north or north-east of Bourke, in Queensland. Associated with this weapon, received by Mr. Rankin from a squatter, were some dozen or more fine boomerangs, all of them elaborately ornamented with carvings, and three wooden spears, about 18 feet or more long, each made from a single piece of wood, evidently for use without a womerah; these likewise are ornamented from end to end with longitudinal carving as if in imitation of a climbing plant. There were also three fine shields.

Professor David exhibited some specimens of the Silurian coral *Mucophyllum* from the Yass District, with numerous small siliceous fossils, probably siliceous sponges, attached chiefly to the undersurface of the coral. The siliceous skeleton as seen under the microscope is minutely spicular. In most of the specimens the original organic structure of the silica has been obliterated through the alteration of the silica into the chalcedonic variety of quartz, beekite.

WEDNESDAY, JULY 25TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

Dr. R. Gunson Thorpe, H.M.S. 'Penguin,' Dr. F. Tidswell, and Dr. J. A. Dick were present as visitors.

The President announced that Mr. A. H. S. Lucas, M.A., B.Sc., had been elected to a seat on the Council, *vice* Mr. E. G. W. Palmer, who in consequence of official engagements had found it necessary to retire.

DONATIONS.

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), Nos. 4 and 6. *From the Editor.*

"Société d'Horticulture du Doubs, Besançon—Bulletin." n.s. No. 41. *From the Society.*

"University of Melbourne Examination Papers: Matriculation, May, 1894." *From the University.*

"Zoologischer Anzeiger." xvii. Jahrg. Nos. 447-449 (May-June, 1894). *From the Editor.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 11-12. *From the Government Secretary.*

"Entomological Society of London—Transactions, 1894," Parts 1-2. *From the Society.*

"Royal Society of Tasmania—Papers and Proceedings, 1893." *From the Society.*

"Hooker's Icones Plantarum." Fourth Series. Vol. iv. Part 1. (1894). *From the Director, Kew Gardens.*

"Verein für Erdkunde zu Leipzig—Mitteilungen, 1893." *From the Society.*

"Bombay Natural History Society—Journal." Vol. viii. No. 4 (1894). *From the Society.*

"Sciencias Naturaes e Sociaes—Revista." Vol. ii. No. 5; Vol. iii. No. 10 (1891-94). *From the Editor.*

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Bd. xxi. (1894), No. 5. *From the Society.*

"Société Hollandaise des Sciences à Harlem—Archives Néerlandaises." Tome xxvii. 4me et 5me Livs. (1894); Tome xxviii. 1re Liv. (1894). *From the Society.*

"Zoological and Acclimatisation Society of Victoria—Thirtieth Annual Report, for the year 1893." *From the Society.*

"Department of Mines and Agriculture, Sydney—Records of the Geological Survey of N.S.W." Vol. iv. Part 1 (1894). *From the Hon. the Minister for Mines and Agriculture.*

"American Naturalist." Vol. xxviii. No. 330 (June, 1894). *From the Editor.*

"American Museum of Natural History—Bulletin." Vol. vi. (1894), Sheets 11-12. *From the Museum.*

"Société Royale Linnéenne de Bruxelles—Bulletin." xixme Année. No. 8 (May, 1894). *From the Society.*

"Société Impériale des Naturalistes de Moscou—Bulletin." Année 1893. No. 4; Année 1894. No. 1. *From the Society.*

"Zoological Society of London—Proceedings, 1894." Part 1: "Abstract" June 5th, 1894. *From the Society.*

"Johns Hopkins University Circulars." Vol. xiii. No. 112 (May, 1894). *From the University.*

"New Zealand Institute—Transactions and Proceedings, 1893." Vol. xxvi. *From the Institute.*

"Naturforschende Gesellschaft in Bern—Mittheilungen." (1893). *From the Society.*

"Société Helvétique des Sciences Naturelles—76me Session réunie à Lausanne." (September, 1892): Actes et Compte Rendu. *From the Society.*

"Société Belge de Microscopie—Bulletin." Tome xx. Nos. 7-8 (1894). *From the Society.*

"Australasian Journal of Pharmacy." Vol. ix. No. 103 (July, 1894). *From the Editor.*

"Agricultural Gazette of N.S.W." Vol. v. (1894), Part 6. *From the Hon. the Minister for Mines and Agriculture.*

"United States National Museum—Bulletin." No. 43. *From the Museum.*

"Michigan Fish Commission—Bulletin." Nos. 2-3. *From the Commission.*

"Archiv für Naturgeschichte." lvi. Jahrg., ii Band, 2 Heft; lix. Jahrg., ii Band, 2 Heft; lx. Jahrg., i Band, 1 Heft (1890-94). *From the Editor.*

"Senckenbergische Naturforschende Gesellschaft in Frankfurt a M.—Abhandlungen." xiii Band, Zweites Heft (1894). *From the Society.*

"Sociedad Guatemalteca de Ciencias—Revista Mensual." T. ii. Núm. 6-7 (1894). *From the Society.*

PAPERS READ.

OBSERVATIONS ON THE FEMORAL GLAND OF *ORNITHORHYNCHUS* AND ITS SECRETION; TOGETHER WITH AN EXPERIMENTAL ENQUIRY CONCERNING ITS SUPPOSED TOXIC ACTION.

By C. J. Martin, M.B., B.Sc. (Lond.), and Frank Tidswell, M.B., Ch.M. (Sydney).

(From the Physiological Laboratory of the University of Sydney.)

(Plates xxviii.-xxxi.)

In the year 1801 Sir Everard (then Mr.) Home examined some specimens of Platypus sent to England by Sir Joseph Banks, and remarked* as follows with regard to the spur:—

"In the male, just at the setting on of the heel, there is a strong crooked spur ½ an inch long, with a sharp point, which has a joint between it and the foot, and is capable of motion in two directions. . . . . It is probably by means of these spurs or hooks that the female is kept from withdrawing herself in the act of copulation, since they are very conveniently placed for laying hold of her body on that particular occasion."†

In 1817 an extract from a letter written by Sir John Jamieson was read to the Linnean Society of London,‡ in which, in reference to *Ornithorhynchus*, he writes:—

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*A Description of the Anatomy of the *Ornithorhynchus paradoxus*. Phil. Trans. 1802, p. 72.

† Home's Comp. Anat. Vol. iii. p. 360 (1823).

‡ Note on the Venomous Nature of Wounds inflicted by the Spurs of the male Ornithorhynchus. Trans. Linn. Soc. Vol. xii. p. 584 (1818).

"The male of this wonderful animal is provided with spurs on the hind feet or legs like a cock. The spur is situated over a cyst of venomous fluid, and has a tube or cannula up its centre, through which the animal can, like a serpent, force the poison when it inflicts its wound. I wounded one with small shot, and on my overseer's taking it out of the water, it stuck its spurs into the palm and back of his right hand with such force, and retained them in with such strength, that they could not be withdrawn until it was killed. The hand instantly swelled to a prodigious bulk; and the inflammation having rapidly extended to his shoulder, he was in a few minutes threatened with locked-jaw, and exhibited all the symptoms of a person bitten by a venomous snake. The pain from the first was insupportable, and cold sweats and sickness of stomach took place so alarmingly that I found it necessary, besides the external applications of oil and vinegar, to administer large quantities of the volatile alkali with opium, which I really think preserved his life. He was obliged to keep his bed for several days, and did not recover the perfect use of his hand for nine weeks. This unexpected and extraordinary occurrence induced me to examine the spur of the animal; and on pressing it down on the leg, the fluid squirted through the tube: but for what purpose Nature has so armed these animals is as yet unknown to me."

This letter of Jamieson's induced Blainville to examine two specimens which were in the Paris Museum, and in May, 1817, he communicated the result of his observations to the Philomatic Society of Paris.*

Blainville commented on the similarity between the spurs of *Ornithorhynchus* and Cock Birds; but from their different position and connections in the Platypus, he considered it was neither a spur, a sixth toe, nor even a nail, but an apparatus peculiar to this particular animal. He described the canal of the spur, and a cyst at its base. He suggested that the latter was probably only a receptacle for poison manufactured elsewhere; but the

* Bull. Soc. Philomatique, 1817, p. 82.

imperfect state of his spirit specimens did not permit him to determine this point. He regarded the apparatus as a weapon compensating for the otherwise defenceless condition of a small animal destitute of teeth.

In 1822 Dr. Patrick Hill, of Liverpool, N.S.W., recorded* having examined a specimen which he shot. He found the spur was perforated, and had a cyst at its base. He mentioned being told by an aboriginal that a wound from the spur of the male is followed by swelling and great pain, but although his informant had seen many cases of it, he had never known it fatal.

In 1823 Home published his "Lectures on Comparative Anatomy." After describing the spur he refers to Jamieson's letter in which he narrated the finding of the canal in this structure. Home failed to find this in the first specimens he examined; subsequently however he succeeded. He says:—

"Upon examining the spur in a state of better preservation, I not only find a membranous tube passing through the spur, which has an orifice on one side near the point, but Mr. Clift succeeded, in my presence, in injecting a duct leading to a gland which lies across the back part of the thigh, over the muscles, an inch or more in length, and half an inch broad; the excretory duct passes like one ureter of the kidney, out of one side near the middle. The quicksilver injected immediately pervaded every part of the gland, and when the point of the pipe was turned downwards, ran readily to the root of the spur, where the duct made a turn, and formed a small reservoir. After a little time, however, the mucus being gently squeezed and pressed forward, we saw the mercury in the spur, and at last it came out of the orifice. When I first saw the spur, I had no doubt from its situation but that one of its purposes was to prevent the escape of the female during the act of the coitus; in this I was confirmed when I found in the female, exactly in the same situation, a regular socket, lined with strong cuticle, adapted to the reception of the spur."

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* On the *Ornithorhynchus paradoxus*: its Venomous Spur and General Structure. Trans. Linn. Soc. Vol. xiii. 622 (1822).

Home, after referring to other animals as frogs, sharks, earthworms, insects, &c., which also possess accessory copulatory organs, continues as follows:—

"Having ascertained that a secretion is emitted through the spur of the male into this socket, and the parts being so minute as to require glasses of considerable power, I got Mr. Bauer to examine the socket in the female; and after overcoming considerable difficulties, the parts being very much corrugated, and yet retaining their elasticity, he made out the form of this socket, which corresponds exactly in shape to the spur itself: so that, when completely introduced, it must be so grasped that the male would be unable to withdraw it when coitus was over; in this respect resembling the effect of suction. The male, it would appear—at least this is the best conjecture I can make by reasoning from analogy, there being no facts to guide us—by throwing some of the secretion of the gland in the thigh into the socket, dilates it, and releases the spur; the liquor injected being acrimonious, will also irritate the female, and make her use efforts to escape."

In 1823 Meckel described* the femoral gland and its duct communicating with the spur. He showed that the cyst described by Blainville and Hill was in reality the dilatation of the duct just before entering the canal of the spur.

He afterwards (1826) published a monograph† on the anatomy of the Ornithorhynchus, in which he gives a complete account, together with several drawings, of the femoral gland and spur.

In 1824 R. Knox published an account‡ of these glands, in which, however, we have been unable to find any points of importance not treated of by Meckel.

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* Ueber den Stachel und das Giftorgan des Ornithorhynchus. Deut. Archiv für Physiol. Bd. viii.

† Descriptio anatomica Ornithorhynchi paradoxi. Lips. 1826.

‡ Observations on the Anatomy of the Duckbilled Animal of N.S.W.—the Ornithorhynchus paradoxus of Naturalists. Mem. Wernerian Soc. Nat. Hist. 1824.

In another paper* he quotes Home's theory that the spur was used during copulation, being then received into a socket in a similar position in the female.

Knox was opposed to this view of Home's, as he had found a rudimentary spur in the corresponding position in a female Echidna. It was situated in a small cavity, and of the same texture and about ¼ the size of a full grown male spur. The other parts of the poison apparatus are wanting in the female. He considered this rudimentary spur to have the same relation to the male spur, as the male breast has to the female breast.

In 1828† Thomas Axford wrote as follows :—

"It is my firm conviction that the animal has not the power of instilling poison by its spur; and I believe this appendage is used principally for securing the female in the season of love, though it may be useful in enabling the animal to climb the steep banks of rivers. I have taken several large females, and I suppose old ones, with the hair worn off, and only a fine fur left on their rump; and although I have killed very large males, never found one in that state. The moment I saw the first old female thus denuded, it struck me that the denudation must arise from the action of the spur of the male in holding the female. If this be the principal use of the spur, and if it contained poison, I think it would be apt to wound the female at such times. I am so convinced that the spur is harmless that I should not fear a scratch from one. However, I will try and set the matter at rest the first opportunity, by causing a male to scratch a chicken."

In 1835 Owen‡ found in young specimens of Ornithorhynchus the spur more prominent and pointed in the female, and he remarked that this is in accord with the fact that secondary sexual characters are not available for distinguishing sex before puberty.

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* Notice respecting the presence of a rudimentary spur in the female Echidna. Edin. New Phil. Journal I. 1826, p. 130.

† Edin. New Phil. Journ. vi. 1829, p. 399.

‡ On the Young of the Ornithorhynchus. Trans. Zool. Soc. Vol. i. 1835, p. 221.

In the same year (1835) Dr. G. Bennett gave an account* of a specimen he shot in September. It was wounded only, and brought in by the dog. It made no attempt to use its spur, even when handled in such a way as to enable it to readily use it if it had wished to do so. He states that the blackfellows were not afraid of handling the animal alive. He says :—"I am convinced some other use must be found for the spur than as an offensive weapon." He found a small impervious depression in the female shot on the same day, situated in a position corresponding to that of the spur in the male. There was no rudimentary spur. He thought this might serve for the reception of the spur of the male.

In 1859 the same naturalist published some observations† on two of these animals (♂, ♀) which he had kept in captivity, in which he makes the following statement :—

"From my recent observations I consider the question of the spur in the male being a poisonous weapon as now decided ; for the living male specimen, though very shy and wild, can be handled with impunity. Although making violent attempts to escape, and even giving me some severe scratches with the hind claws in its attempts, still either in or out of the water he has never attempted to use the spur as a weapon of defence."

Under the heading, "The Poison of the Platypus," the following extract is quoted in the Australian Journal of Education‡ from the "Maitland Mercury" : —"On Tuesday, the 9th instant, when Mr. E. was fishing in the river near his residence, he found that a Platypus had got entangled in the net, and upon catching the animal it immediately struck the two spurs attached to its two floats or arms into the forefinger of Mr. E.'s left hand, with such force that they penetrated through the skin and into the muscles of the finger, and it was with great difficulty that Mr. E. at last succeeded in ridding himself of his unwelcome

* Notes on the Nat. Hist. and Habits of the *Ornithorhynchus paradoxus.* Trans. Zool. Soc. Vol. i. 1835, p. 229.

† Notes on the Duck-Bill *(Ornithorhynchus anatinus).* Proc. Zool. Soc. 1859, p. 213.

‡ Aust. Journ. Educ. Sydney, 1869.

intruder and eventually killed it. Mr. E. all the time suffered intense pain, and presently the wounded finger, then the hand, and ultimately the whole arm up to the shoulder swelled to a serious extent. The symptoms usually following snake bite also set in, and after a day or two Mr. E.'s state became so serious as to alarm his friends for his safety, and Dr. G. having been sent for, he applied ammonia and the usual remedies against snake poison, and we are glad to learn that Mr. E. has now entirely recovered."

In 1876 Creighton,* writing on the Mammary Glands of Echidna and Ornithorhynchus, refers to the femoral gland in the following terms:—

"The mammary gland is found only in the female Ornithorhynchus and Echidna. But the males of Ornithorhynchus and Echidna have also a gland peculiar to them, which resembles the mamma in being a sexual gland, and in being subject to periods of expansion and functional activity from season to season. This gland is the glandula femoralis, situated on each side of the back of the thigh, and discharging by a long duct which runs down the leg and opens on the plantar aspect at the 'spur.' There is a certain probability of this gland being the homologue of the female gland, and when the very singular differences between the mammæ in the male and female Cetaceans are observed, this probability becomes much stronger. I am indebted to Prof. Flower for pointing out to me the peculiarity of the mamma in the male porpoise as shown in preparations made by himself. Instead of there being a pair of ducts, one on each side, as in the female, there is only one duct which opens by a round pore without a nipple in the middle line of the body at a point much further back than in the female. Now by those two circumstances—the singleness of the duct and its caudal position—the mamma of the male porpoise is brought within reach of comparison with the femoral gland of the male duckbill. This is nothing more than a curious suggestion; but if the

* Journ. Anat. & Phys. Vol. xi. p. 29.

porpoise be represented with a pair of hind limbs, the single duct of the male mamma opening in the middle line far back on the ventral surface would then be represented by a pair of ducts going with the limbs, and that is exactly the condition in the male duckbill."

In 1876 Spicer communicated an account* of injurious effects following wounds made by a Platypus with its spurs in the hand of a friend of his. This account corroborates in every particular those previously mentioned in this paper. Mr. Spicer points out the difference between the effects in the above-mentioned case and the usual effects of lacerated wounds, and considers that the small, non-lacerated wound, the rapidity with which the symptoms follow, and their intensity indicate more than can be accounted for by a mere wound. He instances the relationship of Saurians and Ophidians to Monotremes as indicating the possible family right of the latter to the possession of a poison apparatus; but remarks that its existence in the male alone is unusual, since in cases where such is found in one sex only—as in some insects—it is usually the female which exhibits it. He refers to the seasonal variation of snake venom, and states that "its virulence depends largely on the circumstances under which it is received." He quotes the opinions of Bennett and Owen with regard to the sexual nature of the gland, and considers it possible that during the pairing season (the time of the year when the above-mentioned case occurred) the secretion "may have some peculiarly acrid or irritant property, and when injected into the human body may produce similar symptoms to those of a true poison." He also quotes Baden Powell ("New Homes for the Old Country"), who thinks that when no harm results from Platypus wounds, it is perhaps because the poison sac is empty at the time, or that the animal does not use the spur when on land (out of its proper element). Baden Powell further suggests that the spur and secretion may be used for toilet purposes, the animal being known

* On the Effects of Wounds inflicted by the Spurs of the Platypus Papers and Proc. Roy. Soc. Tasmania, 1876, p. 162.

to clean itself with its hind legs. Mr. Spicer thought such a usurpation by the male of feminine privileges would be as singular as the animal's taste in hair oils.

A Nicols* records having wounded and captured a Platypus which was lively enough to scratch him with its sharp claws, but made no attempt to use its spurs when handled. The native who accompanied him, however, expressed fear of the spur. Nicols thought that the spur and its gland might be "a remnant of conditions of life very different from those under which the animal now exists." He considered that although it might possibly be used in contests with its own kind, "there is no reason for attributing a poisonous character to this weapon."

Darwin (Descent of Man, 2nd ed. p. 502), when discussing the weapons of offence possessed by the males of various kinds of animals, mentions the spur and gland apparatus, but states that Harting has shown that the secretion is not poisonous.

In his recent Presidential Address to the Royal Society of N.S.W., Prof. Anderson Stuart† refers to the cases recorded by Jamieson and Spicer, and gives an account of the effects of the poison on dogs. One of these animals received the wounds whilst retrieving. Their infliction was rapidly followed by great swelling of the face, which was very tender. The dog became sleepy, and refused food. He had no salivation, vomiting, diarrhœa, tremor, convulsions nor staggering. He ultimately recovered.

Another Platypus hunter stated that he had lost in this way four valuable dogs of comparatively large size. On one occasion he "saw the Platypus strike, heard the dog whine, saw the wound, and the train of symptoms ending in death." In these cases the most marked constitutional effect was intense drowsiness.

In summing up on the question, Prof. Anderson Stuart says:— "We may, I think, conclude that the poison is powerful enough, at all events at certain seasons, but at what seasons the accounts

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* Zoological Notes. London, 1883. Chap iv. p. 116.

† Royal Soc. of N.S.W. Anniversary Address by the President, Prof. T. P. Anderson Stuart, M.D., 1894.

do not permit me to say, though I think it is the pairing season. I have set down these new accounts because I believe them worthy of record, and perhaps this allusion may lead to something more being done."

Still more recently other cases (two men and two dogs), displaying severe symptoms following wounds from the spurs of these animals, have been recorded by Dr. Lalor in a communication to the Victorian Branch of the British Medical Association.*

We are unacquainted with Dr. Lalor's paper, but from the abstract we have seen, the principal symptoms appear to have been great œdema and rise of temperature. In one case, that of a man, the temperature rose to 104° F.

From the above historical summary one sees that four views have been entertained concerning the function of these glands and their associated spurs, viz. :—

(1) That they are in some way accessory to the organs of generation (Home, Bennett, &c.).

(2) That they are poison glands, and as such constitute important weapons of offence (Jamieson, Blainville, Hill, Meckel, Knox, Spicer, &c.).

(3) That the secretion is used for toilet purposes (Baden Powell).

(4) That they are a remnant of conditions of life very different from those under which the animal now exists (Nicols).

We will consider the last suggestion first. This, while it is very difficult to show that it is false, does not appear to us very reasonable. It would be highly improbable that a complicated arrangement such as we are considering should be retained in such a condition of functional perfection if it were of no service to the individual or the species.

Baden Powell's notion that it may be used for toilet purposes is unlikely. Spicer pointed out that it was confined to the male sex, and Bennett observed that the specimens he had in his

* B.M.J. June 16th, 1894, p. 1332 (abstract of paper).

possession never used their spurs for this purpose, but smoothed their locks by using their claws as a comb. From its position also it is unsuited for such a purpose.

Home's suggestion, which had the powerful support of Dr. Bennett, cannot be absolutely denied, as no one has, as far as we are aware, ever seen these animals copulating. Home's main reason for such an hypothesis was that in the female there are situated in corresponding situations slight hairless depressions.

It seems to us that for the male to apply its spurs to these depressions during copulation in the manner suggested by Home would involve an amount of gymnastic ability of which even an Ornithorhynchus is incapable.

Moreover, Knox* and Owen* have shown that these depressions in the female are merely the rudiments of the male spur, and that the young female, indeed, actually possesses a spur which disappears prior to the dawn of sexual life.

Bennett did not espouse Home's theory very strongly, but having come to the conclusion that the poison hypothesis must be discarded, put forward, as a possible explanation, the suggestion that the spurs play the same part in fixing the female as the appendages of some Crustaceans and other lower animals.

The only remaining theory, that the whole apparatus forms a powerful weapon of offence (at any rate at certain periods) has a large number of facts to support it. We have the above-mentioned well authenticated cases of serious results following a wound by the spur; not to mention any amount of native tradition. As has so often been pointed out, the train of symptoms following such wounds are absolutely unlike those produced by a simple puncture or by the introduction of septic material. The almost immediate and lasting depression, the intense pain, and great œdema and absence of suppuration have led more than one observer to compare the result with that produced by snake poison. Moreover, a precisely similar train of symptoms presented themselves in every case, whether in man or animals.

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* *Loc. cit.*

In the accounts of those naturalists (Bennett, Nicols and others) who have thought the spur was not used as a weapon of offence, it is invariably stated that the animals handled by them made no attempt to use their spurs. They do not instance any cases in which wounds were made without injurious results.

This negative evidence is of little value compared to the cases quoted above. Taking all these facts into consideration, it is at least difficult to avoid the conclusion that the gland and spur constitute a weapon of offence.

Quite recently we were fortunate enough to receive, through the kindness of Dr. G. Elliott Smith, a supply of material in very fair condition for ordinary anatomical and histological investigation. At the same time Dr. Smith obtained for us a small amount of the secretion of the glands. In addition to this, we have had the use of some preserved specimens kindly placed at our disposal by Prof. Wilson. We wish here to acknowledge our indebtedness and express our thanks to these two gentlemen.

The naked eye anatomy and anatomical relations of the femoral gland and its duct and spur have been so well described by Meckel* and Owen† that we feel we have little further to add. In view of the fact, however, that these descriptions were written from the dissection of preserved specimens, we have deemed it advisable to risk repetition by giving a short account of it here.

Anatomy of the Glands.

The femoral or crural glands (Pl. XXVIII. *i*) are two whitish bodies shaped somewhat like a cocked hat, situated symmetrically one on each side of the spine over the acetabulum and femur. They are covered by skin, panniculus carnosus, and deep fascia, the latter forming a special compartment in which the gland lies. At the inner side of each, and slightly overlapping part of the inner border, is the gluteus maximus muscle; at the outer

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* Desc. anat. Ornithor. paradox.

† Todd's Cyclopædia, Art. Monotremes.

side are the muscles of the leg. Anteriorly it reaches the border of the obliquus externus abdominis muscle and posteriorly touches the biceps, under which its duct passes. From above downwards it rests on the rectus, iliacus, gluteus minimus and g. medius muscles.

A gland of average size measured 3 cm. in length, 2 cm. in breadth at its widest part, and about 1·5 cm. in thickness. The outline is somewhat reniform, the inner border being strongly convex, and the outer marked by a deep indentation about its middle, somewhat resembling the hilus of a kidney. The ends are rounded; the anterior is larger and thicker and is directed outwards; the posterior is smaller and thinner, and directed backwards. It is flattened dorso-ventrally, the dorsal surface being slightly convex and the ventral flatter. The surfaces show the lobular character of the gland. From the posterior half of the outer border the duct emerges, and passes downwards, with the nerves and vessels, on the posterior aspect of the leg. It is about 5 cm. in average length, and in an undilated state about 2 mm. in external diameter. After leaving the gland it passes down under the biceps muscle, internally to the tendons of the tibialis posticus and flexor longus hallucis muscles, then crossing obliquely the tendon of the gastrocnemius, reaches the base of the spur. Here it becomes dilated into a sac which is so deeply embedded in the ligamentous tissue at the back of the tarsus that its isolation is a matter of difficulty. From this dilatation a prolongation extends into the canal in the spur. (Pl. XXVIII.)

The nature of the spur has already been sufficiently well indicated. It is attached to a supernumerary tarsal ossicle which is articulated to the astragalus and tibia. The powerful gluteus maximus is inserted at the base of the spur, and is in all probability the muscle brought into action when the animal "strikes."

Histology of the Gland and Duct.

The minute structure of the gland and duct was studied in specimens from three adult individuals shot near Raymond Terrace, N.S.W., on June 6th, 1894. They had been placed in

92% alcohol two days after the animals were killed. The weather at the time was cold, so that the tissues were in very moderate condition notwithstanding this delay. Transverse sections of these were cut from pieces embedded in paraffin and also in gum. The sections were stained in hæmatoxylin and borax carmine.

The gland is of the compound racemose type. The duct, traced into the gland, divides repeatedly into smaller and smaller branches—the final branches opening into the alveoli. Each gland is divided into lobules (Pl. XXIX. figs. 1 and 2), all of which show numerous alveoli and ducts in a connective tissue stroma. The alveoli are dilated, and lined by a single layer of epithelial cells situated on a basement membrane.

The epithelial cells (Pl. XXX. fig. 1 *a*) are large, irregular in shape, and have flattened nuclei at the deeper part of the cell. The nucleus and that part of the protoplasm nearest the attached end of the cell take the stains readily. The rest of the cell is occupied by coarsely granular material which did not stain with nuclear stains. This appearance corresponds to the condition observed in the cells of a mucous salivary gland prior to the discharge of its secretion. The portions of the ducts seen in the sections (viz., the portions within the gland), are lined by a single layer of large columnar cells seated on a basement membrane.

The stroma (Pl. XXX. fig. 1 *b*) presents the usual characters of white fibrous tissue. It is formed by the septa passing in from the fibrous layer of the capsule which divides the gland into lobules.

The capsule consists of two coats:

(1) The fibrous one just alluded to (Pl. XXX. fig. 1 *c*), consisting like the stroma of white fibrous tissue, and containing a liberal supply of blood-vessels and nerves.

(2) A layer of unstriped muscular tissue, three or four cells deep, situated outside the fibrous coat (Pl. XXX. fig. 1 *d*).

Outside of these is the investment of fibrous tissue derived from the deep fascia, which is not shown in the drawings, having been removed in the process of dissecting out the glands.

The layer of smooth muscle fibres is no doubt brought into action to help to express the secretion when the animal "strikes." The large alveolar spaces as well as the duct serve as store-house for this fluid. When the animal contracts its powerful gluteus maximus and the other muscles at the back of the thigh, the gland would be compressed to some extent. As, however, these muscles must be constantly so contracted when the animal runs and swims without causing the discharge of the contents of the gland, such muscular contraction cannot be considered as the only cause operating. We think that the contraction of the thick panniculus, which envelopes the leg in this region, is in all probability the principal agent concerned, and that the smooth muscle of the capsule co-operates with it in effecting this end. The fact that the muscle fibres of the gland itself are of the unstriped variety, does not necessarily prevent them from being indirectly under the influence of the will. The pupil of the eye in mammals is provided with muscle of the same unstriped character, which can be brought into operation in associated action with certain voluntary muscles.

As regards the duct proper, sections were made from a portion about midway between the gland and spur. Most of these (Pl. XXIX. fig. 3) showed two channels (some, however, three and others only one) embedded in white fibrous tissue. This duplication of the lumen of the duct, which was noted by Rudolphi,* indicates that in the development of these specimens the branching of the original invagination had occurred lower down than is usual in such structures. In all cases the duct was single at the lower end. The duct contains no muscular tissue whatever. We have made serial sections from every region, including the dilatation situated at its lowest end, without discovering any trace of muscle. This seems to us the more remarkable as under ordinary circumstances it is impossible, either in the living or recently dead animal, by pressing on the gland to drive the secretion through the spur. So that the animal must possess some arrangement for obliterating the channel and so preventing undue waste of the secretion.

* Abhand. d. Berlin. Akad. 1820-21. Abtheil. i. p. 233-236.

Each of the channels is lined by four layers of epithelial cells situated on a basement membrane. Those nearest the basement membrane have large oval nuclei, and are arranged round the duct with their long axes parallel to the basement membrane on which they rest. The innermost layer consists of irregularly pear-shaped cells, with elongated nuclei arranged radially, their larger ends towards the duct of which they form the immediate lining. Between these there is a layer one or two cells deep—the cells being of an irregular rounded form and having rounded nuclei.

Sections of the saccular dilatation at the base of the spur showed similar characters to those of the duct just described, but the enclosed cavity was much larger. No muscular tissue was noted, and from the manner in which this sac is embedded in dense ligamentous tissue, muscular fibre would be of little use in this situation.

When we compared the sections obtained from these specimens with some previously obtained by one of us (M) from a fresh specimen killed in April, 1892, at Wellington, N.S.W., we noticed a very marked difference in the minute structure of the gland and in the character of the cells lining the alveoli (*cf.* Pl. XXIX. figs. 1-2, and Pl. XXX. figs. 1-2).

(1) The proportion of fibrous tissue to gland structure proper was very much greater in the latter.

(2) The alveoli also were very much smaller, and the duct leading from each alveolus, instead of being lined by columnar epithelium, showed four layers of cells as in the larger duct which delivers the poison to the spur as above described.

(3) In the latter specimen the glandular epithelial cells were smaller and more regularly cubical in shape. Their nuclei were rounded and in the middle of the cell, and they and the protoplasm stained readily throughout. The protoplasm was moreover only finely granular.

This appearance forms a marked contrast to the large elongated, coarsely granular cells, with their nuclei pushed to the attached end of the cell, which we found in our second specimens killed June 6th. The variations in structure between these two glands recall to one's mind the differences between an actively secreting mammary gland and one which has undergone retrogressive metamorphosis.

It is interesting to note that corresponding to these differences in minute structure, differences in the physiological action of the secretion obtained from them were observed.

The secretion from the first described glands in which the cells were in an "active" condition produced a marked poisonous effect when injected into rabbits, whilst that from the second gave negative results.

Note on the Chemical Composition of the Secretion.

This and the following portion of this paper dealing with the toxic action of the secretion of these glands, must, in consideration of the small amount of material at our disposal, be looked upon merely as a preliminary communication. But as we cannot tell how long it may be before we are fortunate enough to obtain further supplies, and considering the very definite nature of our results, it seems quite worth while to publish them at the present time.

More than two years ago one of us (M.) attacked this subject. A pair of glands (fresh) which were supplied through the kindness of Prof. Wilson, were chopped up and extracted with dilute salt solution, and the nature of the extract examined. This examination showed that in addition to the albumins, globulins and nucleo-albumins, which might be extracted by such treatment, there was present in the extract a small quantity of proteose.

The innoculation experiments, however, both with the first extract, and with the separated proteose, gave negative results.

As the poisonous constituents of snake venom had been shown* to be due to proteoses, and in the light of the above results, we

* Weir Mitchell, Smithsonian Contrib. to Knowledge, 1886. Wolfenden, Jour. Physiol. Vol. vii. ; Kaulback, *ibid.* Vol. xiii. Martin and Smith, Proc. Roy. Soc. N.S.W. 1892.

considered it extremely probable that the toxic properties, if any, of the glands might be due to proteoses (albumoses) also. We accordingly requested our friend Dr. G. Elliott Smith, who had heard of the slaughter of some Platypi by a friend of his up country, to express the contents of the ducts and glands into a bottle of strong alcohol, whereby all the albuminous constituents would be precipitated. This Dr. Smith very kindly did for us. The glands and ducts were carefully dissected out and a ligature applied to the periperal end of each duct, and the whole removed. The ducts, which were distended with secretion, were then cut just above the ligature, and by gentle pressure the larger alveoli of the glands and the ducts were emptied of their secretion.

Three pairs of glands were treated in this way, the liquid expressed being limpid and opalescent. The strength of the alcohol used was 92%. We received the bottle containing the alcohol and precipitated secretion four days later. The precipitate was separated from the alcohol by filtration and dried at 40° C. and powdered. We obtained in this way a little less than ·4 gramme of a pearly white powder, which was in large part soluble in water and dilute saline solutions, forming a slightly opalescent liquid.

This solution, which we found to contain the active substance of the secretion, was neutral in reaction and behaved in the following manner with reagents:—

(1) Warming with nitric acid and subsequent addition of ammonia—orange colouration (xanthoproteic reaction).

(2) On addition of Millon's reagent, it gave the usual proteid reaction.

(3) Heating (after previous acidulation with acetic acid) produced a turbidity between 75° and 80° C. At about 80° C. a considerable flocculent precipitate came down. This was filtered off, and the filtrate found to still contain a small quantity of proteid, as it gave a biuret reaction.

(4) With caustic potash and a trace of copper sulphate a violet biuret reaction was obtained.

(5) Nitric acid produced a precipitate which was not appreciably diminished by warming.

(6) Picric acid produced a precipitate which was not appreciably diminished by warming.

(7) Acetic acid produced no turbidity.

(8) Saturation with magnesium sulphate did not produce any precipitate.

(9) Saturation with ammonium sulphate produced a precipitate. This was filtered off and the filtrate contained no proteid.

From the above it is obvious that there were at least two proteids present in our original solution—

(1) A proteid coagulated by heat.

(2) A proteid soluble at 100° C.

The former appears from the above reactions to belong to the albumen class, as the presence of nucleo-albumen (nucleo-proteid, Hammarsten) was excluded by the absence of any precipitate of nuclein on submitting the clear solution of the proteid in 2 % HCl to peptic digestion for some hours (12) at 37° C. The albumen, however, had undergone digestion and had been converted into deutero-proteose and peptone, for the solution now reacted in the following manner:—

(1) Boiling acidulated solution. No precipitate.

(2) $KHO + CuSO_4$. Strong *pink* biuret reaction.

(3) HNO_3. No precipitate, but on further addition of NaCl turbidity which disappeared on heating and returned on cooling the solution.

(4) Saturation with $Am_2 SO_4$. Slight precipitate. Filtrate contained peptone.

To determine the nature of the proteid present in the filtrate after precipitation by heat, we boiled some of the solution which had been previously acidified with acetic acid, and separated the heat precipitate by filtration. An equal volume of trichloracetic acid was added to the filtrate. This caused a slight turbidity, which, however, disappeared on heating the solution, but reappeared directly it was allowed to cool.

It was filtered boiling through a funnel surrounded by a hot water jacket. The filtrate became slightly milky on cooling, and when rendered alkaline with strong caustic potash and a few drops of copper sulphate added, showed a pink biuret reaction.

By this treatment the presence of a very small quantity of proteose may be demonstrated when such is present together with ordinary proteid.*

Our conclusions as to the composition of the secretion drawn from the above experiments are:—

(1) It is a solution of proteids.

(2) That the greater portion is composed of a proteid belonging to the class of albumins, and that in addition a small quantity of proteose is present.

(3) Nucleo-albumens are absent.

The minor portion of proteid which is rendered permanently insoluble by alcohol may contain globulin, but none of this proteid went into solution subsequently.†

As we shall show in the next section, the secretion of these glands is capable of exerting a powerful toxic action on rabbits. Whether the whole of the proteids contained possess this power, or whether it is confined to the small quantity of proteose present, we are unable to state. There would, however, be no great difficulty in answering this question had we more material to work upon.

Experiments on Rabbits with the Secretion.

The small amount of the secretion in our possession necessarily limited the number of experiments on the nature of its toxic action. We were, however, able to make four experiments, the

* C. J. Martin, Journ. of Physiol. Vol. xv. p. 375.

† That a body of the albumen class, after four days' sojourn under 92% alcohol, should readily dissolve in water and dilute saline solutions is peculiar. Ordinary albumens, including the serum-albumen of the Platypus itself, are in this length of time rendered insoluble.

results of which were sufficiently definite. Rabbits were chosen for the purpose, on account of their suitable size.

The following are the details :–

Experiment I: On June 18th, 1894, a healthy rabbit of average size and in a very lively condition had ·05 gramme of the poison dissolved in 5 cc. of 75% salt solution injected under the skin of the abdomen at 2 p.m. Its temperature at the time was 102° F. During the injection the animal struggled, and afterwards remained much quieter. For the rest of the day the animal remained very quiet in its cage, but no local signs were observed.

June 19th. A swelling about the size of a duck's egg has appeared near the seat of injection. This swelling has a semi-cystic feel, is not circumscribed, is movable over subjacent tissues, but adherent to skin. It is tender to the touch. The animal is sick—it does not struggle nor attempt to escape when handled, its eye is dull, and it eats only sparingly. Temperature 102·8° F. A specimen of blood removed from the ear clotted readily in a few minutes, and was normal in microscopic appearance. At 6 p.m. the same day the swelling had slightly increased, extending upwards over thorax. The animal has been quiet all day, remaining huddled up in a corner of its cage, and passively submitting to handling. Temperature 103·1° F.

June 20th. The swelling is much smaller and is less tender. The animal is much livelier, has taken more food. Temperature 102·8° F.

June 21st. The swelling has almost disappeared. The animal is very lively, taking food well, and struggling when handled. Temperature 102·6° F.

June 22nd. The swelling has quite disappeared; the eye is bright and the animal apparently quite recovered. The seat of injection has a bruised appearance, but is not tender to the touch. After this no further symptoms appeared; the animal recovered completely from its illness in five or six days after the injection. It is at the present time (July 28th) alive and well.

Experiment II: A rabbit about 3 lbs. in weight was etherized and cannulæ inserted into the left jugular vein and carotid artery, and a small sharp pointed cannula was passed through the wall of the trachea. The cannula in the trachea was connected by a piece of rubber tube with a small tambour, covered with thin india-rubber sheeting. The movements of the india-rubber were transmitted to a lever, the end of which marked by means of a writing point, on a travelling surface of smoked glazed paper. As the animal sucked in air with each inspiration, the rubber was pulled down and the lever marked a downward stroke on the paper. When air was expelled with each expiration the rubber membrane rose and the lever described an upward stroke. In this way a record showing the extent, frequency and general character of the respiration was obtained. The interior of the artery was connected with a mercury manometer, the movements of the mercury in the distal limb of which were recorded on the paper by means of a light float and stile carrying a writing point. In this manner a record was obtained of the pressure of the blood exerted upon the walls of the vessel (aorta), as well as every variation of this pressure due to the heart's pumping fresh quantities of blood into the aorta at each beat, and to the respiratory movements of the animal.

In addition to these records, the time was marked by an electromagnet in connection with a clock, so that at each second a small vertical line was drawn. The exact movement at which the injection was commenced and ended was also indicated by another writing stile, which described a horizontal line on the travelling surface.

During the injection this stile which was connected with an electromagnet, was raised by closing the circuit and fell again at the termination of the injection when the circuit was opened, by its own weight. In this way the duration of the injection was indicated by raising this horizontal line. The writing points of all four records were previously carefully adjusted so as to register exactly in the same vertical line.

The cannula in the external jugular vein was used to introduce the solution of the gland-secretion. This was dissolved in a ·75% solution of common salt, and was of such strength that 1 ccm. contained 0·01 gramme of our dried secretion. Having started our smoked paper travelling, and arranged the respiratory and blood pressure records, we first allowed the apparatus to run in order to obtain a portion of record previous to the introduction of the solution. Of the solution 6 ccm. (= 0·06 gramme) were then rapidly introduced through the external jugular vein.

Within three seconds from the commencement of the injection, the blood pressure, which was previously equal to 97 mm. of mercury, fell almost vertically to 60 mm. (mercury), when the heart beats were seen to become much less frequent. At the same time the respiration became hurried and exaggerated, and speedily terminated in a series of expiratory convulsions. The appearance was exactly the same as if one had clamped the wind pipe and so asphyxiated the animal—only much more rapid in its onset. During this convulsive period the blood pressure rose again, even higher than before the injection, but speedily fell again to within 27 mm. of the abscissa. By this time—90 secs. from the time of injection of the solution—the records of the heart's beats disappeared from the tracing and the respiration had ceased. A post mortem examination was immediately made. The heart was still beating feebly and continued so to do when removed from the body. The right chambers of the heart, and the whole of the venous system were discovered to be full of clotted blood. The left cavities of the heart and the pulmonary veins contained fluid blood, and there was an extensive subendocardial hæmorrhage in the left ventricle. This result might perhaps have puzzled us had we not had numerous opportunities of witnessing precisely the same results after the introduction of the venom of the Australian black snake or tiger snake* into the veins of dogs and rabbits.

* C. J. Martin. "On some effects upon the blood produced by the injection of the Australian black snake." Journ. of Physiology, Vol. xv. No. 4, 1893.

Almost immediately after the injection of the solution, more or less extensive clotting of the venous side of the heart and great vessels had taken place, and the circulation of the blood had very soon been brought to a standstill. The dyspnoeic convulsions followed from the consequent deprivation of the nervous system of oxygen.

As mentioned previously, at death the blood pressure in the arteries did not fall as is usual to within a few mm. of the zero line, but remained considerably above this (27 mm.). The explanation of this is that owing to the extensive solidification of the blood, the arteries were unable to empty their contents into the veins.

Experiment III: A rabbit of 3 lbs. weight was etherized and prepared in exactly the same manner as described in Experiment ii. In this case 4 ccm. of a 1% solution (= 0·4 gramme) of the secretion were very slowly injected into the jugular vein. The blood pressure at the moment of injection was equal to 138 mm. mercury. It fell in five seconds to 76 mm., and by the end of the injection, which lasted 40 secs., was only 42 mm., *i.e.*, less than one-third of its previous height. The heart at the same time became much slower and feebler in its action.

At the end of half an hour the pressure was only 20 mm., and the heart was beating very feebly. At this point a further injection of 4 ccm. of the same solution was introduced. This was immediately followed by asphyxial convulsions and death. On opening the body, the whole of the venous system and right cavities of the heart contained solid blood, so that on cutting across the large veins not a drop of blood flowed out. The aorta and other large arteries also contained clots. The examination was made immediately, the heart continuing to beat feebly for some minutes after removal from the body. The left ventricle showed haemorrhages under the endocardium as in Experiment i.

Experiment IV: In this experiment we tried the effect of a much smaller dose of the secretion. Everything was arranged as in Experiments ii and iii. The same solution of the secretion was used (viz., a 1% solution in ·75% salt solution).

The blood pressure previous to the introduction of the solution was equal to 108 mm. mercury; the heart beats were 300 per minute and the respirations 48 per minute. Of the solution 2cc. were then introduced (·02 gramme secretion).

The blood pressure fell suddenly to 55 mm., the heart beats to 228 per minute (Pl. XXXI.). The respirations were not altered in frequency, but became slightly irregular. For 90 seconds the blood pressure continued to fall steadily, notwithstanding the heart's beats soon reached 300 per minute again; they were, however, much enfeebled. At the end of that time, the pressure was 46 mm. A further dose of ·02 gramme was then injected. There was a very slight further fall of blood pressure (to 42 mm.) and the heart's beats became reduced to 228 per minute again, the respirations also becoming irregular.

From this time the fall in blood pressure was steeper (as marked by the curve), so that at the end of $2\frac{1}{2}$ minutes from the commencement of the experiment it was only equal to 26 mm. of mercury. The heart's beats had by this time become practically obliterated on the tracing, although the heart could still be felt feebly beating.

During this time the respirations had become irregular both in frequency and depth, and gradually becoming weaker and weaker, were finally reduced to occasional inspiratory gasps.

In 26 minutes from the beginning of the experiment the animal quietly died.

A post mortem examination revealed nothing except haemorrhages under the endocardium of the left ventricle of the heart. The blood was not clotted in any of the vessels, and on being drawn off coagulated much more slowly than normally, taking 12 minutes.

These four experiments prove that the secretion of the crural gland contains some body which is capable of exerting very considerable toxic action when introduced into the body of rabbits. In the section of this paper devoted to the consideration of the composition of the secretion, we adduced evidence that it contained proteids, and we have just seen that the introduction of these proteids into the animal economy may lead to fatal results.

The possibility that the toxic agent may be of other than proteid nature, but inseparable from the proteid constituents by the means employed, must remain open. The small quantity of the secretion at our disposal (less than ·4 gramme) did not admit of any varied or extensive methods of purification. We do not, however, think that such is the case, as we have knowledge of other proteids which are capable of producing similar results to those obtained.

The close analogy between some of the symptoms observed by us and those recorded as occurring in men and dogs when poisoned by wounds from the spur, lead us to expect that had we used other animals for our experiments, the results would have been parallel.

In Experiment i, in which the poison was introduced subcutaneously, the symptoms were precisely similar to those exhibited after wounds from the spurs, in which the secretion would almost certainly be injected under the skin.

In the other experiments in which the secretion was intravenously injected, the conditions were so different that they are not comparable to the same extent.

The most striking effect is, perhaps, the almost universal thrombosis which occurred in those experiments in which the poison was rapidly introduced directly into the circulation (Exps. ii and iii).

In Experiment iv, where only ·02 gramme of secretion was injected intravenously, no intravascular clotting followed, and the condition of the blood after death was in remarkable contrast to Experiments ii and iii, for it failed to clot as rapidly as usual, twelve minutes elapsing before the onset of coagulation. These results would be almost unintelligible were they not, so far, absolutely analogous to some effects produced by the introduction of the venom of our Australian snakes which have been more fully discussed by one of us* elsewhere.

The next most striking general effect of the poison is the sudden and great fall in the pressure of the blood, which is so marked a

* C. J. Martin, *loc. cit.*

feature of the curves shown. This may be due either to weakening of the heart's action or to diminished peripheral resistance caused by a sudden paralysis of the whole vasomotor centres, or to both causes combined. We are strongly of opinion that the former is the principal cause, but as the data at our disposal do not prove this to be the case, it is useless to discuss it further.

The drowsiness and general depression which formed so prominent a feature in the recorded cases following wounds from the spurs, and was also seen in our first experiment, would result from this fall of blood pressure and the consequent diminution of blood supply to the nervous system. As in these cases the poison was injected under the skin, it would only reach the general circulation slowly, and the onset of the symptoms would be more gradual.

Our first experiment also shows the local irritant action following subcutaneous injection, which is marked by great œdema and tenderness.

The capillary hæmorrhages found in our other cases are another manifestation of this irritant action.

Altogether there appears to be a remarkable analogy between the venom of Australian snakes and the poison of the Platypus. This resemblance is indicated by the following tabular statement:—

(1) The poisons both owe their toxic properties to proteid constituents.

(2) They both markedly retard or prevent the coagulation of the blood when small doses are slowly introduced.

(3) They both cause intravascular clotting when injected intravenously in sufficient doses.

(4) They both cause an almost instantaneous drop in the pressure of the blood.

(5) They both cause capillary hæmorrhages and œdema when locally applied.

In the production of local œdema platypus poison appears to be much more powerful. Snake venom, on the other hand, is *five thousand times* as virulent as our preparation of platypus poison, and the above comparison only obtains between platypus poison and snake venom diluted to this extent.

At the conclusion of our survey of the literature of this subject, we pronounced the opinion that as far as the evidence adduced went, it presented a very strong case in favour of the contention that these glands, at any rate at some seasons, produce a poisonous secretion.

We venture to think that the results of our experiments have established the fact that the secretion is poisonous at some time of the year. Whether the animal is capable of discharging a secretion possessed of poisonous properties at all seasons of the year is not at present determined. Creighton* states definitely that the gland is subject to seasonal variations in size just as is the case with the mammary gland and testes (Bennett). We have been unable to find on what evidence Creighton makes this statement; but the differences in minute structure observed by us lend support to this view.

The idea naturally occurs to one that this apparatus, which is confined to the male sex, owes its peculiar development to the operation of sexual selection. That it is a weapon used by the males on one another when conflicting for the possession of the females, is an idea which would become extremely probable if it could be established that the gland is specially developed at or about the pairing season. This is a point which could be settled without difficulty provided specimens could be obtained in sufficient number at suitable periods of the year, say August and February.

Bennett found developing ova in the uterus as early as September, so that in all probability the animals pair during the latter part of August and earlier part of September.

That the secretion obtained by us from the glands of an animal killed in June proved actively poisonous, whilst that from an animal killed in April was innocuous, is interesting in this respect,

* *Loc. cit.*

although June would indicate a somewhat early preparation for pairing. We cannot, however, place much stress on this isolated observation, as it is quite possible that the difference in development was due to quite other causes. In the meantime the biological significance of these extraordinary organs must remain an open question.

In conclusion we wish to express our thanks to our able assistant Mr. Robert Grant for his help with the experiments.

DESCRIPTION OF PLATES.

Plate XXVIII.

Dissection of left femoral gland and duct (nat. size drawing). The leg is strongly rotated outwards. The skin, panniculus carnosus, and deep fascia have been reflected. The position and anatomical relations of the gland, duct, and spur are shown.

a., M. gluteus max. ; *b.*, M. erector spinæ ; *c.*, M. latissimus dorsi ; *d.*, M. iliacus ; *e.*, M. gluteus min. ; *f.*, M. gluteus med. ; *g.*, M. rectus ; *h.*, M. flex. long. halluc. ; *i.*, M. tibialis post. ; *j.*, femoral gland ; 2, duct (leaving gland) ; 2′, duct (near base of spur) ; 3, spur.

Plate XXIX.

Transverse sections of gland (× 10).

Fig. 1.—Section of gland of animal killed June, 1894, showing dilated alveoli.

Fig. 2.—Section of gland of animal killed April, 1892, showing fibrous condition.

Fig. 3.—Section of duct (showing two channels.

a., Epithelium of duct.

Plate XXX.

Transverse section of marginal portions of gland.

Fig. 1.—Section of gland of animal killed June, 1894.

a., Coarsely granular large alveolar cell (flat nuclei); *b.*, fibrous tissue of stroma ; *c.*, fibrous tissue of capsule ; *d.*, muscular layer of capsule.

Fig. 2.—Section of gland of animal killed April, 1892.

a., Small alveolar cell (nuclei round): *b.*, fibrous tissue of stroma ; *c.*, fibrous layer of capsule ; *d.*, muscular layer of capsule ; *ee.*, bloodvessels.

Plate XXXI.

First portion of tracing obtained in Experiment IV.

Above is the record of respiration in which the downstrokes represent inspiration and the upstrokes expiration. Underneath this, is the record of the blood pressure in the carotid artery. At the point * the injection was given as described in the text. The time occupied by the injection is represented by the raising of the signal line (*s*).

NOTES ON AUSTRALIAN SHIPWORMS.

By C. Hedley, F.L.S.

(Plate xxxii.)

(Communicated by permission of the Trustees of the Australian Museum.)

By the good offices of Dr. Stirling, C.M.G., F.R.S., Director, and of Mr. Bednall, Hon. Curator in Conchology of the Public Museum, Adelaide, the Australian Museum has recently received from that Institution a fine series of *Teredo*, under the name of *T. fragilis*, Tate, taken mining eucalypt wharf piles at Port Adelaide, South Australia.

An appeal as to its identity with *T. fragilis* to the author of that species is impracticable, since, as these lines are being penned, Prof. Tate is engaged in exploring the MacDonnell Ranges in Central Australia, and therefore inaccessible to letters.

Should other discrepancies between the specimens before me and the figures and description of *T. fragilis* (Trans. Roy. Soc. S. Australia, 1888, p. 60, Pl. xi. figs. 13*a*, 13*b*, 13*c*) be explained as relating to an immature stage, yet the palette figured by Prof. Tate cannot be reconciled with that to which I now draw attention.

Of these specimens I therefore offer the following description under the name of

Teredo edax, n.sp.

Valves in natural contact globose. Shell white under an epidermis which anteriorly is thin, membranaceous, glossy and olive-yellow, but posteriorly coarse, brown, dull, brittle and easily shredding off in patches. Sculpture: parallel to its margin the anterior area is crossed by close, delicate, most regular lamellæ, about a quarter of a millimetre apart; at right angles to these unite a series closer together and finely beaded on their umbonal aspect, which traverse the antero-median area parallel to its margin; on reaching the median area the sculpture loses its regularity, is deflected backwards and upwards, degenerating into vague striæ parallel to the margin of the posterior area. The auricles with part of the posterior and the whole of the umbonal region are too much eroded to exhibit sculpture.

Viewed from within, a prominent feature is the thin, flat apophysis which projects from the centre of the subumbonal ridge into the cavity of the shell for half the latter's length, its jagged edges parallel to the axis of the valves. From the apophysis to the posterior auricle the subumbonal ridge stretches as a shelf into the cavity of the valve. Along both anterior and posterior margins the shell is reinforced from within by a heavy layer of callus. Beyond the ventral tip each valve has projecting from within a little peg of callus, which is slightly excavated at its upper end. Hinge tubercles spiral, swollen, large, projecting downwards and interlocking each to each by spurred processes. Anterior adductor muscle scar covering most of the interior of the anterior area. Height 25, length 22, breadth 26 mm.

Palettes somewhat the shape of a cricket bat whose shoulders had been planed down; stalk with two notches at the end, from the lower of which runs a groove to the ring that marks the commencement of the blade; the latter a little concave within and convex without, shelly and like a Sepia shell for two-thirds of its length, membranous at the end. Length 27 mm. Breadth $6\frac{1}{2}$. This feature (fig. 5) ill corresponds with that drawn on Tate's plate, which rather approach the palettes of *Kuphus* (as illustrated on Pl. LXV. of Vol. XXV. of the Trans. Linn. Soc.).

As my sketch (Pl. XXXII. fig. 4) indicates, the tube of the species under discussion is for some distance partially choked by a series of imbricating plates.

From most species of its genus, this, one of the largest, is separated by the almost entire suppression of the auricle, in which respect it resembles the two species of Wright's group *Nausitora*, whose scaled palettes, however, distinguish them.

At the request of Capt. Hutton, Sir James Hector, Director of the Colonial Museum of Wellington, N.Z., kindly loaned to me for study the type of *Teredo antarctica*, Hutton. This, as I received it, is unfortunately in a poor state of preservation. The two small, separate but corresponding valves are not accompanied by tube or palettes, both are broken and much smeared with shellac. The apophyses are missing in both valves and appear to have been snapped off short at their origin: each valve has suffered fracture of the margin of the antero-median area. Enough yet remains, however, to satisfactorily establish Hutton's species; the peculiar oblique auricle and the proportion of height to breadth mark *T. antarctia* from any of the genus with which I have been able to compare it.

Under these circumstances, I content myself with offering figures of the right valve of the type and, except to state that this valve is both in height and length 12 mm., refrain from adding to the description appearing on p. 133 of the "Manual of the New Zealand Mollusca."

That is amended from the original definition in the "Catalogue of the Marine Mollusca of New Zealand," and from the French description in the Journ. de Conch. 1878, p. 43. From these accounts Smith has with hesitation identified (Report on the Zoological Collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. Alert, p. 93, Pl. VII. figs. E. E2.) specimens collected by Dr. Coppinger at Port Denison, Queensland, and also specimens dredged by H.M.S. "Challenger" off Cape York, Q. (*vide* Chall. Report Zool. xiii. p. 27) with *T. antarctica*. A comparison of the last quoted figure with those of the type now presented will, it is thought, increase to conviction the doubts expressed by the British Museum conchologist.

Besides *T. fragilis* and *T. antarctica*, three other kinds of shipworms have been mentioned from Australian seas: *T. navalis*, Linné, probably by mistake, *Nausitora saulii*, Wright (Trans. Linn. Soc. XXV. p. 567, Pl. LXV. figs. 9-15) from Port Phillip, Victoria, and *Calobates australis*, Wright, (*Op. cit.* p. 564, Pl. LXIV. figs. 1-5) from Freemantle, Western Australia. Described from a defective specimen, the latter, suggests Prof. Wright, "may prove to be only an Australian form of *Calobates thoracites*, Gould."

Capt. Ferguson, Chief Harbour Master of Williamstown, gives many interesting particulars on pp. 8-11 of Report on Class III. "Indigenous Vegetable Substances," of the Catalogue of the Victorian Exhibition of 1861, of the boring of submerged timbers in Victorian waters. The damage he records is attributed to "*Teredo navalis*," but we are not informed that any scientific examination of the pest was made or its correct name ascertained. Effects of its destruction upon Red Gum, Blue Gum, White Gum, Stringybark, Blackwood, Sheoak, Teak and Swan River Mahogany are respectively tabulated. The last-named, or Jarrah (*E. marginata*), had, as elsewhere, completely resisted attack; next in endurance was Red Gum; the worst, Teak, was completely riddled.*

In the Proc. Roy. Soc. Van Diemen's Land, 1852, pp. 74-77, Sir William Denison discusses the "Operation of *Teredo navalis* on Colonial Timber." Two trees [supposed by Maiden (Useful Native Plants of Australia, p. 34) to be *E. globulus* and *E. amygdalina*] employed as piles at the Franklin Wharf, Hobart, were much worm-eaten. In his "Census of the Marine Shells of Tasmania," Tenison Woods mentions on p. 47, "*Teredo navalis*, Linné, rare, and probably introduced." Gray alludes to a Tasmanian *Teredo* (P.Z.S. 1857, p. 246).

In N.S.W. and Queensland shipworms are by boatmen, fishermen, and the waterside folk generally, termed "cobra," a word which, like dingo, yarraman, kangaroo, &c., is considered by the Europeans to be aboriginal, and by at least most aboriginal tribes to be English. The blacks esteem "cobra" highly as an article of food, devouring them raw. Having ventured to taste, my palate compared it to an oyster.

* Sir F. von Mueller writes, Eucalyptographia, Decade iv., that, "next to the Jarrah, *E. rostrata* best resists the attacks of Teredo." For particulars of the former, see Decade iii. of the same work.

A Moreton Bay oysterman once told me that when lying on the floor of his craft, on a still summer night, he could distinctly hear the cobra gnawing in her planks.

As confirming this observation, Mr. C. W. Darley has kindly drawn my attention to Mr. Lamb's statement, Trans. Am. Soc. Civil Engineers, Feb. 1894, Vol. xxxi. p. 239. "On still summer nights I have heard them grinding their way into the wood, and the noise of their grinding would surprise you if you should put your ear to the head of a pile in which they were at work."

EXPLANATION OF PLATE.

Fig. 1.—Exterior of right valve of *T. edax* enlarged; sculpture of antero-median area magnified.

Fig. 2.—Interior of the same.

Fig. 3.—Anterior aspect of valves of *T. edax* in apposition; natural size. Type.

Fig. 4.—Tube, broken to show concamerated structure, of *T. edax*; natural size.

Fig. 5.—Palette of *T. edax*; enlarged.

Figs. 6 and 7.—Interior and exterior aspects of imperfect right valve of type specimen of *T. antarctica*, Hutton. Sculpture of antero-median area magnified.

ON FIVE INTERESTING SHIELDS FROM NORTHERN QUEENSLAND, WITH AN ENUMERATION OF THE FIGURED TYPES OF AUSTRALIAN SHIELDS.

By R. Etheridge, Junr., Acting-Curator and Palæontologist, Australian Museum; and Palæontologist and Librarian, Geological Survey of N. S. Wales.

(Plates xxxiii-xxxviii.)

It affords me much pleasure to lay before the Society descriptions of two very curious shields from the Collection of Mr. Harry Stockdale, of Sydney, to whom my thanks are due for the opportunity of so doing, and three derived from other sources.

The first to be noticed is a wooden shield from Peak Downs, Central Queensland, the second, a weapon made from the carapace of a turtle, both being a modification of the type, or form, of the *Goolmarry* shield of the Queensland Blacks. The latter is one of the cleverest adaptions of a natural object to form a weapon of offence or defence that has yet come under my notice from any part of Australia. It was obtained by Mr. Stockdale in the Cooktown District of North-East Queensland.

The wooden shield is more oval, wider, and less elongate in its general proportions than the typical form of the *Goolmarry* figured by the late Mr. R. Brough Smyth,* but like the latter, possesses the distinctive feature of being carved on both aspects —back and front—an unusual practice amongst the Australian Aborigines, except in the northern portions of the Continent. It is a solid serviceable weapon, elongately-oval in shape, with an appreciable degree of thickness, and weighs three pounds twelve ounces. The length is twenty-one and a half inches and the

* Aborigines of Victoria, 1878, I. p. 334, f. 138.

width nine and a half inches. The outer surface, or front of the shield, is fairly convex, but without any trace of a median angularity. The back is practically flat, and the hand-hole is cut out of the wood by counter-sinking, and is quadrangular, five and a half inches wide by four and a half long. On the front the rounded apices are cut off by incised cross bars, and within these spaces are two nearly equilateral triangles, also incised. No other sculpture occurs on these terminal areas, but the wavy grain of the wood adds a very pleasing appearance to the surface of the shield. The intermediate general surface is divided into eight longitudinal sections, four broad central divisions, a marginal area on each side, and an intermarginal, following the latter on either hand. To all intents and purposes, therefore, although all of the divisions are not of equal breadth, the front of the shield exhibits a bilateral symmetry as to its ornamentation. The four central divisions are occupied by irregular triangles, filled in with equidistant incised lines of the herring-bone pattern. The longitudinal sections are each bounded by two continuous lines. The intermarginal zones are somewhat similarly sculptured except that the triangular areas are defined by three incised lines, instead of two. One of the marginal zones is devoid of ornamentation, the other bears a series of small triangles succeeding one another rapidly, against the edge of the contiguous intermarginal space.

On the inner side of the shield the sculpture is of quite a different character. It is divided into five horizontal divisions, a central one embracing the handle, and counter-sunk hand-hole, quite plain, and two above and below. The apical divisions each bear six incised triangles, two immediately at the rounded apices, and four in the second row. The intermediate divisions bear eight of these incised triangular spaces four in every row.

The result of this form of sculpture is that the intermediate portions of the shield surface is left in its natural state as variously shaped rhomboidal or diamond-shaped figures, with their sharp angles cut off, the two horizontal rows at either end of the shield being separated by a broad longitudinal belt. The grain of the wood is visible on all the outstanding portions of the surface.

On the outside of the shield there are still remaining traces of red colour at either end immediately within the transverse incised bars.

Lumholtz has figured* two shields of quite the same shape from "Central Queensland," and the hand-hole is also countersunk similarly. One has transverse end bars like the present weapon, and the ornament is produced by incision—three rhombs, and two half-rhombs in the centre, and five half-rhombs along each side in vertical series. The other has a central broad plain zone divided by an incised bar. Above and below the central zone are three transverse rows of quadrangular incisions, six to eight in a row.

I am not aware that a similar adaption of a turtle-shell has been recorded amongst Aboriginal implements, but my impression is that it has not. Australian shields comprise but a limited number of forms, and so far as I know, are invariably made either of wood or prepared bark. The second shield is, therefore, a particularly interesting one. The shield is remarkably well shaped, oval in outline, and forming a very handy weapon of defence. It has been reduced from the carapace of a Green Turtle *(Chelone mydas,* Linn.) apparently by sawing, and the rough edges bevelled off. Externally, the fabricator had commenced the removal of the tortoise-shell, but apparently finding that it detracted from the beauty of the weapon desisted, and contented himself, after the manner of his race, by plastering the surface with white pipe clay, traces of which still remain in the epidermic fittings and grooves of the bone structure. The median line of the shield was traversed by a broad band of red ruddle, and there are two similar transverse bands equidistant from each end. These are now in a great measure obliterated. The weight is two and a half pounds. The style of colouring is essentially after the type of the *Goolmarry* used in the Mackay District, North Queensland, but on the inner side the weapon is obviously quite devoid of colour or ornament of any kind. The

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* Among Cannibals, 1890, p. 333.

shield consists of portions of the nuchal, and of the first and third vertebral plates. The second vertebral is the only entire plate remaining, but there are portions of the first and second costal plates on each side. Seen from below, or inside, it is found that the shield consists of portions of the nuchal, and of the first four neural plates. Part of the second dorsal vertebra, together with its anterior rib, has been cut away. The greater part of the fifth, and all the succeeding, have been entirely removed, as have also the free ends of the ribs articulating with the third and fourth vertebræ, so that the ribs between the second and third, and the fourth and fifth vertebræ form the supports for the shield handle, which consists of the vertebræ between them. A space has been cut between the latter and the carapace to admit the hand, the vertebræ forming the handle having been padded with fibre, and whipped with native string.

The total length of the carapace before mutilation was probably about three feet two inches ; now as a shield, it is seventeen inches, and the width seven and a half.

The third shield I desire to call attention to, is to all intents and purposes one of the *Goolmarry* type as regards form, but possessing only a modification of the ornamentation of the latter, and devoid of any sculpturing on the inner or flat side.

For this weapon I am indebted to Mr. L. Winter, of Bathurst, through Mr. G. K. Allen, late of the Geological Survey of N. S. Wales. It is from the Saxby River, a branch of the Flinders River near its mouth, and was picked up after an Aboriginal fight. Its genuineness is attested by the numerous spear marks, scattered over the surface.

The shield possesses all the features of the *Goolmarry* as regards form, size, and counter-sunk hand-hole, whilst both faces are very beautifully grooved by tool-marking. Ornamentation is confined to the convex or outer side, and consists of seven incised parallel cross-bars at both ends, the immediate apices being smooth. Across the centre are two complete and two half chevrons forming a continuous zig-zag figure, composed of four incised lines or grooves. The weapon is composed of a light fig-tree wood, and only weighs one pound eight ounces. It is twenty-five inches in length, and eight inches in breadth.

The fourth shield, for which I am indebted to Dr. J. C. Cox, is an exceedingly fine weapon. It is from Angledool on the Narran River. In this case the wood is of a more solid description than that of the two preceding wooden examples, and is in consequence heavier. It is also, as regards form, of the modified *Goolmarry* type, with the hand-hole counter-sunk, convex on the outer face, and flat inside, but ornamented only on the outer. The shield is two feet long, and seven inches wide, with a thickness of about three inches, and the weight three pounds eleven ounces. The outer side is both incised and painted. We again meet with the plain apices, cut off by incised cross-bars. The remainder of the surface is wholly covered with fluctuating or serpentine longitudinal grooves, meeting and retreating, and so enclosing a series of broad oval, or indefinitely rhomboidal figures, arranged in such a manner that any five are in quincunx. The edges of the shield bear longitudinal grooves only. A central longitudinal zone, of about three inches, has been blackened, but the lateral zones, of about two inches each, are coloured with red pigment, edged with white lines, somewhat wavy, and broken up into eight or nine squares on each zone by white cross-bars.

The fifth and last shield is in some respects a very remarkable one. It is the smallest, heaviest in proportion to its size, and most convex on the outside, of the present collection, and from being ornamented on the inside falls strictly within the *Goolmarry* type. The sculpture is also of a very interesting and curious kind. It is made of a heavy, close-grained wood, light in colour, and is one foot eight inches long, five inches wide, about three inches thick, seven and a half inches transversely across the centre, or point of greatest convexity, and weighs three pounds four ounces, with the usual counter-sunk hand-hole. The apices in this shield are not delimited by incised cross-bars, but are formed by bodily cutting down the convex surface. The latter, as in Dr. Cox's shield, is subdivided into three longitudinal zones, but not with the aid of colour. The central zone is two and a quarter inches wide and perfectly plain. The lateral zones are each divided down the centre by a continuous groove that forms the middle line of five chevrons on one side, and four on the other, fairly equidistant from one another. Each chevron is incised either with vertical grooves, or is cross-hatched, whilst the inter-chevron spaces are herring-boned by very regular grooves, increasing in acuteness of their angle at the two extremities of the weapon. The chevrons appear at one time to have been coloured red. The depressed apices of the shield each bear four zig-zag incised vertical grooves.

On the inner side the sculpture is very peculiar. The centre above and below the hand-hole is occupied by two and three series respectively of very irregular ovals bounded by from two to three grooves, and filled in with other obliquely directed grooves. The margins of the weapon, without the ovals, are occupied by oblique grooves, somewhat undercut, and in places anastomosing, giving rise to a reticulation in places, not unlike the net-work venation of the plant *Glossopteris*. The handle, and lateral edges of the hand-hole, are also obliquely grooved. At one end a small apical space is marked off by an incised cross-bar.

To the kindness of Mr. P. R. Pedley, I am indebted for the opportunity of describing this handy and unique weapon. Mr. Pedley informs me that this shield was formerly a cherished possession of "Paroo Jack," an Aboriginal gentleman who achieved distinction by getting five years for killing his gin. In the words of Mr. Pedley's correspondent, who obtained the weapon :—"He had a real-fine gin, and the whites used to hang about his camp ; so he killed her with a yam-stick." The shield was brought in by the trackers when "Paroo Jack" was arrested. The Paroo River rises in South Central Queensland and crossing the border between the latter and N. S. Wales unites with the Darling River at Killara. Through the authenticity of this shield, and Dr. Cox's from Angledool, we are thus able to show the extension of the *Goolmarry* type a very considerable distance to the south of Peak Downs, where Mr. Stockdale's example was obtained.

If the *Goolmarry* type is to be strictly confined to shields of this character, and of the first one described from Peak Downs, together with Brough Smyth's figured example, ornamented on both sides, whether by incision or colouration, then the third shield from the Saxby River, and the fourth from Angledool will constitute an additional type to those enumerated further on, but I think form and general proportions must be allowed to outweigh minor characters, such as the foregoing.

Even as regards outline we evidently have three varieties, the broad oval shield from Peak Downs; the intermediate one from Angledool; and the narrow from the Saxby and Paroo Rivers.

I have thus been able to demonstrate six varieties of ornamentation, including Brough Smyth's and Lumholtz's weapons, as applied to the *Goolmarry*, and a seventh is supplied in the fine shield lately described* from the Alligator River, Northern Territory.

The following epitome of Australian shields will perhaps be found of use to those who may have occasion to study the subject. Every variation is not recorded, but merely the principal types:—

a. Mulga (Smyth, Aborigines of Victoria, 1878, I. figs. 112-124, *types.*). A narrow elongate shield, slightly convex, or flattened on the obverse or outside, and roof-shaped, or angular on the reverse or inside. The handle-hole is counter-sunk, and the surface usually highly ornate with incised carving. The *Mulga* was used in single combat, and was originally termed the *Hieleman* by Surveyor-General Lieut. Col. Mitchell as early as 1836. It is the *Murgon* of the Lower Murray *(Smyth)*; the *Marr-aga* of Gippsland *(Smyth)*; and the *Carrbina* of Kimberley *(Hardman).* The same form of weapon evidently also extended to Central Australia for Angas figures one from Lake Frome†, but without name. The *Woonda*‡ of W. Australia may possibly belong to this type, or will possibly form a separate division.

* Macleay Mem. Vol. (Linn. Soc. N. S. Wales), 1893, t. 33, f. 2-4.
† S. Australia Illustrated, 1846, t. 30, f. 5 & 6.
‡ Smyth, *Loc. cit.* p. 339, f. 148.

b. Drunmung (Smyth, *Loc. cit.*, p. 231, f. 126-129, *types.*). A narrow wooden shield, angular or roof-shaped both back and front, with the front bowed in outline, and tapering rapidly to both extremities. The handle is counter-sunk. It is also used in single combat. It is the *Tawarang** from high up the Murray River, and other parts of N. S. Wales. Dr. Knight in his account of the savage weapons displayed at the Philadelphia Exhibition in 1876 called† this shield *Towerang*, and again erroneously the *Mulga*, overlooking Smyth's excellent figures of the latter, and the distinction drawn by him. It is the *Drunmung* of W. Victoria *(Smyth)*.

c. Gee-am, or *Kerreem* (Smyth, *Loc. cit.*, p. 331, p. 333, f. 131-132, *types.*; Angas, S. Australia Illustrated, 1846, t. 6, f. 2 & 3). Broad elongately rhomboidal or oval spear shields, made of gum tree bark, obtusely pointed top and bottom, flat or very slightly convex on the outside, and flat or a very little concave on the inside. The handle projects from the inner side, and is either a part of the wood of the tree next to the bark, from which the shield is made; or, consists of a separate piece of wood thrust through two holes in the weapon made for the purpose. It is used in the *mêlée*, and not in single combat. It is the *Bam-er-ook* of Gippsland (*Smyth*); and the *Carrillie* of Port Stephens, N. S. Wales *(R. Dawson)*. It is interesting to note that this is the shield always depicted in our rock carvings throughout the Sydney District,‡ and is recognisable not only by its shape, but also by the rather expanded apices or ends.

d. Mulabakka (Angas, S. Australia Illustrated, 1846, t. 6. f. 1, and 14, *types*; Smyth, *Loc. cit.* p. 333, f. 133-137.) This is a modification or variety of the *Gee-am*, and is made of wood or bent bark, with an inserted handle, distinct from the shield. It should properly, perhaps, be included under the *Gee-am*, but possesses a more graceful outline, and is longer at the projecting ends. This form of shield is both carved and painted, and is furthermore

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* Angas, S. Australia Illustrated, 1846, t. 47, f. 5.
† Ann. Report Smithsonian Inst. for 1879 [1880], p. 283, p. 285. f. 134.
‡ *See* Records Geol. Survey N. S. Wales, 1890, ii. Pt. 1, t. 2, f. 809.

ornamented with two or more incised half ovals, drawn at the sides, or top and bottom. It certainly forms a transition between the *Gee-am* and the much better marked shield to follow next in order, the *Wakkalte*. The *Mulabakka* was used by the Mount Barker, and certain of the Darling and Murray Scrub Tribes *(Angas)*, but in other parts of *S. Australia* was called *Tar-ram* *(Eyre.)*.

e. Wakkalte (Angas, S. Australia Illustrated, 1846, t. 6, top r. h. fig., *type*). A short and very much expanded form of the *Gee-am*, made of bark, and bent. The handle is formed by insertion through previously prepared holes, similar to that of one form of the true *Gee-am*. It is also generally a painted weapon. The *Wakkalte* shield was used by the Lake Alexandrina, Encounter Bay and Corong Tribes of the south-east coast line of S. Australia *(Angas)*. The method of manufacture is well described by Mr. Edward Stephens* in an interesting account of the Aborigines of that district.

f. Goolmarry (Smyth, *Loc. cit.*, p. 334, f. 138, *type*). A smaller and neat long-oval shaped or elliptical shield, flat or a little rounded on the back, and gently convex, or subangular on the front, with the handle formed by counter-sinking; variously incised and painted on both aspects. The distribution of this shield appears to be somewhat extensive; thus, at Mackay on the north-east coast it is, according to Smyth, called *Goolmarry*; we next know the same weapon from the Alligator River, Port Darwin†, but unfortunately I am unacquainted with the local name.

g. ? (Smyth, *Loc. cit.*, p. 334, f. 139, *type*). For the seventh type I am quite unprovided with a name. The shields of this type are restricted to Queensland, and consist of large irregularly oval weapons, made from a light, possibly fig-tree wood. The outer side is more or less convex, and often with a central knob or boss. The inner side is flat, and the handle projects, being formed by cutting away the wood on both sides. On

* Journn. R. Soc. N.S. Wales for 1889 [1890], xxiii. p. 487.
† Etheridge, Macleay Mem. Vol. 1893, p. 241, t. 23, f. 2-4.

the outer side, the surface is ornamented by concentric or irregular lines painted in red, white, and yellow, dividing the surface more or less into fields. These shields differ from all others over the Continent, and form very striking objects. Smyth figures one from Rockingham Bay, and Lumholtz* from Herbert Vale, Central Queensland. The latter author remarks that the pattern differs on each shield, thereby indicating ownership.

h. ? (Wood, Nat. Hist. Man, Vol. Australia, 1870, p. 55, f. 1 and 2, *type.*) A large oval shield flat or nearly so on the outer side. Straight along the lateral edges, and rounded top and bottom, with incised ornament on the outside. The hand-hole is countersunk. Neither dimensions nor locality are given by the Rev. G. Wood, but a similar weapon is figured by Dr. Knight† as the "heilaman, or war-shield of N.S. Wales," and is said to be made of the wood of the "gigantic nettle tree." These are the only references relating to this very marked weapon with which I am acquainted. Knight appears to confound it with the *Gee-am*, but judging from his figure, which quite corresponds with that of Wood, it certainly is not.

i. ? (Wood, *Loc. cit.*, p. 56, f. 1, *type.*) A short broad, roundly quadrangular shield somewhat convex outside, almost flat inside, and with a countersunk hand-hole. Wood's illustration is the only figure of this shield I am acquainted with. It partakes to some extent of the characters of *h*, but is much shorter and broader in proportion. The district in which this shield is used, and the name have yet to be ascertained.

A tenth well marked type would exist could we accept figures given by Dr. Knight in his description of the Philadelphia weapons previously referred to. He there describes,‡ as shown in the Victorian section of the Exhibition, and therefore ostensibly from Victoria, large oval cricket bat-shaped shields with a distinct handle, and said to be made of bark. Slight ornamentation occurs

* Among Cannibals, 1890, p. 120.

† Ann. Report Smithsonian Inst. for 1879 [1880], p. 285, f. 135.

‡ Ann. Report Smithsonian Inst. for 1879 [1880], p. 286, f. 136.

at one end. I have never seen a shield of this description, nor heard of one, and it is singular that Mr. B. R. Smyth, in his excellent work so often quoted by me, makes not the slightest allusion to such a form occurring in any part of Australia, much less in Victoria, to the Aborigines of which his book was more particularly devoted. The shape of these "shields," provided as they are with a projecting handle at one end, and well compared by Dr. Knight to a cricket bat, reminds one of some of the large wooden so-called swords in use amongst Northern Tribes. I think, however, the matter may be set at rest by the acute observations of the late John Macgillivray, during the voyage of H.M.S. "Rattlesnake." Under the name of "clubs" he notes* three kinds in use at Port Essington, one like a cricket bat with a short handle. Corroborative evidence is afforded by an illustration of Smyth's. He distinctly figures† such a weapon, with a short handle, and a cricket bat blade from Rockingham Bay. Here we have two localities in the north country, both well authenticated, and on this account I cannot accept Dr. Knight's reference of such weapons either to Victoria, or to the category of shields. At the same time the great comparative breadth represented in Dr. Knight's figure is somewhat of a stumbling block, and his statement that such weapons are made of bark, requires I think corroboration.

I may also add that Lumholtz mentions swords made of hard wood, "with a short handle only for one hand,"‡ and gives a plate§ representing a warrior armed with one of these, working himself into a state of excitement previous to the *Borbory* contests (*i.e.*, duels).

I wish it to be distinctly understood that this epitome is not to be regarded as an exhaustive enumeration of all the types of Australian shields—far from it. There are several others already

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* Voy. "Rattlesnake," 1852, ii. p. 147.

† Aborigines of Victoria, 1878, i. p. 303, f. 67.

‡ Among Cannibals, 1890, p. 121.

§ *Ibid.* pl. opp. p. 122.

known to me, but from the want of adequate information I have refrained from referring to them, but this I may have an opportunity of doing on a future occasion.

I am indebted to Mr. Edgar R. Waite for kindly identifying the tortoise-shell, and again to Mr. C. Hedley for the excellent drawings accompanying these notes.

PLATE XXXIII.

Fig. 1.—*Goolmarry* shield (broad form); front view. Central Queensland.
Fig. 2.—The same; side view.

PLATE XXXIV.

Back view of the shield represented in Plate XXXIII.

PLATE XXXV.

Tortoise-shell shield; front view. Cooktown District.

PLATE XXXVI.

Back view of the shield represented in Plate XXXV.

PLATE XXXVII.

Fig. 1.—*Goolmarry* shield (narrow form); front view. Saxby River.
Fig. 2.—*Goolmarry* shield (intermediate form); front view. Angledool.

PLATE XXXVIII.

Fig. 1.—*Goolmarry* shield (narrow form); front view. Paroo River.
Fig. 2.—Back view of Fig. 1.
Fig. 3.—Side ,,

ADDITIONAL NOTES ON THE PALÆONTOLOGY OF QUEENSLAND.

PART I.—PALÆOZOIC.

(Plates XXXIX.–XLI.)

BY R. ETHERIDGE, JUNR.

(PALÆONTOLOGIST TO THE AUSTRALIAN MUSEUM, AND GEOLOGICAL SURVEY OF NEW SOUTH WALES.)

1.—INTRODUCTION.

During the preparation and publication of the "Geology and Palaeontology of Queensland,"* a large number of additional fossils were obtained by Mr. R. L. Jack, Government Geologist for that Colony, his Assistant, Mr. W. H. Rands, and the Survey Collector, the late Mr. James Smith, of Rockhampton. These came to hand too late for incorporation in the work named, but the Linnean Society having generously undertaken the publication of an elaboration of this additional material, it is my intention to offer a few notes to the Society, as occasion may arise, supplementing them with information gleaned from the Queensland gatherings of Mr. George Sweet, Brunswick, Melbourne, who was good enough to place his collection in my hands. I shall also take the opportunity of correcting a few inaccuracies into which I fell, when engaged in the work above referred to.

2. THE RAGLAN LIMESTONE.

In the "Geology and Palaeontology of Queensland and New Guinea,"† my co-writer (Mr. R. L. Jack) places the Raglan Lime-

* The Geology and Palaeontology of Queensland and New Guinea. By R. L. Jack, &c., and R. Etheridge, junr., &c. (3 vols. Brisbane, 1892.)

† P. 89.

stone on the horizon of the Gympie beds (Permo-Carboniferous), chiefly relying apparently on the opinion of the Survey Collector, the late Mr. James Smith. At the same time I pointed out in a foot-note that the unpublished fossils, so far as I had seen them, appeared to indicate the Burdekin beds as the more appropriate horizon to which the Raglan Limestone should be referred. The fossils collected by Mr. Smith consist of a massive *Favosites*, and Cystiphylloid corals apparently referable to the Genus *Actinocystis*.

The *Favosites* present all the characters of the specimens described by Prof. H. A. Nicholson and the writer* from the Burdekin beds of the Broken River, as *F. gothlandica*, in flat, or more or less hemispherical expansions. The thin walls of the corallites are well preserved, the latter being very regularly pentagonal, hexagonal, or at times even heptagonal. The corallites measure one line or less, in diameter. The tabulæ are mostly horizontal, a few oblique, or convex upwards, again here and there a rolling or imperfect and vesicular tabulum may be seen, but interlocking and strictly concave tabulæ I have not observed. The walls have undergone so much alteration during their conversion into granular calcite that all trace of pores is obliterated.

The *Actinocystis* will be found described on p. 524.

The fossils are from Langmorn Creek, Raglan, twelve miles west of Keppel.

Under the Gympie Series was also provisionally included the Chillagoe Limestones, near Zillmanton.† Mr. Jack made the following remarks on this subject :- "Near the Dorothy Mine I obtained some specimens of Corals and Encrinite stems, but from their state of preservation I do not think that the most expert Palæontologist could determine either genus or species. Similar fossils were obtained from the quartzites associated with the limestones near Zillmanton, but in no more recognizable condition. . . . . . It may be observed that the Mitchell and Palmer Limestones bear a very marked lithological resemblance to the

* *Ibid.*, p. 50.

† *Ibid.*, p. 120.

limestones of Chillagoe. . . . . The limestones of both regions, as well as the associated strata, present, as regards organic remains, a most striking contrast to the Devonian Limestones of the Broken River and the Burdekin, both of which teem with Corals and Brachiopods in perfect preservation."

As Mr. Jack very justly observed, the calcareous stems from the Dorothy Mine, and the silicious from Zillmanton, are past recognition, although in the former case the entire limestone is made up of fragments of stems and separated ossicles. But we now possess this much information as to the age of these limestones. A portion of the Zillmanton stone bears the impression, in excellent preservation, of the surface of a colony of *Heliolites porosa*, on which both sets of tubes, the autopores and siphonopores, are distinctly visible. Now, as *Heliolites* is a genus not known above the Middle Devonian, it would seem very probable that the Chillagoe and Zillmanton Limestones will also fall to the same horizon as those of the Burdekin Downs and Reid's Gap, near Townsville, &c.

3. Descriptions of the Species.

DEVONIAN.

Class—Actinozoa.

Order—**ZOANTHARIA.**

Section—Zoantharia Perforata.

Family—FAVOSITIDÆ.

Genus—Romingeria, *Nicholson*, 1879.

(Tabulate Corals Pal. Period, p. 114).

Romingeria Foordi, *Eth. fil.*

R. Foordi, Eth. fil., Geol. and Pal. Q'land and N. Guinea, 1892, p. 56, t. 1, f. 18.

Obs.—Another example of this interesting form occurs in Mr. Sweet's Collection. It is of a less branching habit than that figured above, and the corallites are more bunched together; several mural pores are also visible within the weathered mouths of the latter. The characters of this specimen seem to confirm the reference of the fossil to *Romingeria.*

Loc. and Horizon.—Reid's Gap, near Townsville (*G. Sweet*, Colln. Sweet, Melbourne). Middle Devonian.

Section—RUGOSA.

Group—CYATHOPHYLLOIDEA.

Family—CYATHOPHYLLIDÆ.

Genus—CYATHOPHYLLUM, *Goldfuss*, 1826.

(Petrefacta Germaniæ, i., 1 Theil, p. 54.)

CYATHOPHYLLUM SWEETI, *sp.nov.*

(Pl. XL., figs. 3 and 4; Pl. XLI., fig. 1.)

Cyathophyllum, sp.ind., Eth. fil., Geol. and Pal. Q'land and N. Guinea, 1892, p. 59, t. 3, f. 11 and 12.

Sp. Char.—Corallum turbinate, or slightly cornute, stout, about two inches long; section oval; wall thick; septa from fifty-eight to sixty; primary septa extending to the centre, where they intermingle, a few from the sides confluent round the fossula, straight or direct in the outer dissepimental area, curved in the tabulate area; slightly thickened with stereoplasma, but the primordial septa not visible. Counter septum exceedingly long, ventral, extending quite to the centre of the calice. Secondary septa extending a little beyond the dissepimental zone. Fossula not particularly specialised, unless by a lateral tabulate depression, containing five primary septa, including the counter septum. Dissepiments plentiful, forming a peripheral zone of about half

* In the "Geology and Palæontology of Queensland and N. Guinea," the heading "Family Cyathophyllidæ" was inadvertently left out before "Genus Cyathophyllum," on p. 59.

the width of the corallum, those forming the inner half of the zone always convexly angled outwards, but those in the outer moiety imperfect and variously directed. Rugæ corresponding to the septa.

Obs.—Specimens in Mr. Sweet's Collection enable me to give a more precise diagnosis of the *Cyathophyllum* occurring in the Devonian beds near Townsville, than did the originals collected by Mr. R. L. Jack. I now propose for it the name of *C. Sweeti*. This is a form of no great outward distinctive features, but possesses a very remarkable long counter septum. The septa within the dissepimental zone are direct, although slightly flexuous, and do not evince any curvature until this zone is passed, and even then not all of them. One group in particular, one of the alars, curves round the supposed fossula. A peculiar character, not readily explicable, is a bifurcation of the septa within, and slightly without the dissepimental area, unless it be an abortive attempt at dissepimental growth. The longest septum, which I take to be the counter septum, is on the ventral or concave side.

No definite theca is present, but the thickened proximal ends of the septa form the outer wall, in places nearly one millimetre thick.

Loc. and Horizon.—Reid's Gap, near Townsville (*G. Sweet*, Colln. Sweet, Melbourne). Middle Devonian.

Group—**ZAPHRENTOIDEA**.

Family—ZAPHRENTIDÆ.

Genus—CAMPOPHYLLUM, *Edw. and Haime*, 1850.

(Mon. Brit. Foss. Corals, Pt. 1, p. lxviii.)

CAMPOPHYLLUM GREGORII, *Eth. fil.*

(Pl. XL. fig. 2.)

C. Gregorii, Eth. fil., Geol. and Pal. Q'land and N. Guinea, 1892, p. 60, t. 3, f. 15-18.

Sp. Char.—Corallum elongate, two and a half inches long, cylindrical, or at times rather tortuous, gradually tapering to a pointed base; section circular. Calice deep with high erect walls. Septa about thirty-four, delicate, with an equal number of secondary lamellæ. Proper wall, or theca, much thickened, with immediately within a single circlet of strong quadrangular vesicles, succeeded by a number of ordinary lenticular vesicles. Tabulæ irregular and incomplete, sometimes extending almost from wall to wall, at other times lenticular, and either close together or separated by marked loculi.

Obs.—I take this opportunity of figuring in section a more complete specimen than I was formerly able to do. *C. Gregorii* is a very peculiar species, of which much of the structure has yet to be elaborated. The calice is deep and nearly as broad at the bottom as at the top.

Loc. and Horizon.—Reid's Gap, near Townsville (*G. Sweet*, Colln. Sweet, Melbourne). Middle Devonian.

Group - **CYSTIPHYLLOIDEA.**

Family—CYSTIPHYLLIDÆ.

Genus—CYSTIPHYLLUM, *Lonsdale*, 1839.

(Murchison's Silurian System, p. 691.)

CYSTIPHYLLUM AUSTRALE, *Eth. fil.*

C. americanum, var. *australe*, Eth. fil., Geol. and Pal. Q'land and N. Guinea, 1892, p. 58, t. 3, f. 13 & 14.

Obs.—The corallum in this species is shortly turbinate, or cornute, becoming elongate, and often twisted, or curved, and at times even vermiform. It is never of any great diameter, and the surface bears regular, sharp without becoming prominent, more or less equidistant accretion rings, separated by lesser concentric laminæ. The entire structure is vesicular, the vesicles variable in size but large in comparison with that of the corallum, and their walls often become much thickened. There appear to have been a thick outer wall, and an epitheca, but even the former at times becomes vesicular. I previously recorded this as a variety of the American *C. americanum*, Hall, but I think now that perhaps it had better be entirely separated.

C. australe seems to have been a variable species as to its form. The specimen originally figured was of much larger growth, and probably represents the adult condition.

Loc. and Horizon. Reid's Gap, near Townsville *(G. Sweet*, Colln. Sweet, Melbourne). Mid. Devonian.

Genus—Actinocystis, *Lindström*, 1882.

(Ofvers. K. Vet.Akad. Handl., 1882, No. 3, p. 21.)

Actinocystis? terra-reginæ, *sp.nov.*

(Pl. xxxix. figs. 1 and 2.)

Sp. Char.—Corallum simple, large, cono-cylindrical. Outer zone wide, composed of successive cycles of upwardly directed vesicles; inner zone with from sixty-five to seventy septa, much thickened towards their distal ends by stereoplasma. Fossula apparently existing on the ventral side and containing a counter-septum.

Obs.—I am not aware that this genus has before been recognised in Australian rocks. The genus is typically an Upper Silurian one, but other Devonian forms have been published by Mr. F. Frech.*

I have not been fortunate enough to see a perfect corallum, and our best specimen so far as the internal structure is concerned is rather distorted in shape. The demarcation between the two zones is well marked, the outer or vesicular area diminishing rapidly in size downwards, the peripheral vesicles being the largest, and diminishing in size inwards. The septa extend to the centre of the corallum without coalescing, and not only are they thickened with stereoplasma, but the interseptal loculi become filled up, producing a more or less solid mass. The largest specimen is four and a quarter inches long, the width of the

* Dames and Kayser's Pal. Abhandlungen, 1886, Bd. iii., Heft 3, p. 107.

vesicular zone being three-quarters of an inch, and that of the septal area one and a half inches.

As compared with the British *Actinocystis cylindricum*, Lonsd.sp., our form appears to have a larger central septate area.

Loc. and Horizon.—Langmorn Creek, Raglan, twelve miles west of Keppel (*The late J. Smith*, Colln. Geol. Survey Queensland, Brisbane). Raglan Limestone (Middle Devonian).

Family—CALCEOLIDÆ.

Genus—RHIZOPHYLLUM, *Lindström*, 1865.

(K. Vet. Akad. Forhandl., 1865, No. 5, p. 287.)

RHIZOPHYLLUM, *sp. ind.*

(Pl. XLI., figs. 2 and 3.)

Obs.—A rather fine example of this genus, in all probability, although the structure as exhibited in the truncated base, and along the calicular edge is dense and non-vesicular. This would place the fossil nearer *Calceola*, were it not that the latter has a pointed base, and is said to be free. The specimen is, unfortunately, an only one, and the calice is so infilled with irremoveable matrix that a more detailed examination cannot be made. In shape it corresponds with the mature condition of *R. interpunctatum*, De Kon., with ill-preserved traces of exothecal imbricating laminæ on the lateral angles, between the convex upper and flat under surface. The base is truncated, probably by fracture from the original attachment, and certainly shows no sign of any epithecate covering, but a dense homogeneous appearance.

This coral is larger than any individual of *R. interpunctatum* I have seen, but resembles it in outline. In the absence of intermediate forms it is not advisable to unite it with that species, but simply to figure it for future reference.

Dr. G. Lindström has advanced* the extraordinary opinion that *R. interpunctatum*, as figured by De Koninck, is but the

* Richthofen's Beiträge zur Pal. von China (Richthofen's China, Band iv.), 1883, Abth. 4, p. 71.

internal cast of an *Orthis*. I can assure him that such is not the case, and that I have seen similar casts associated with other examples in full possession of their calcarous envelopes.

Loc. and Horizon.—Reid's Gap, near Townsville (*G. Sweet*, Colln. Sweet, Melbourne). Middle Devonian.

PERMO-CARBONIFEROUS PLANTÆ.

Section—PHANEROGAMIA.

Class—DICOTYLEDONES.

Order—**CYCADACEÆ ?**

Family—NOEGGERATHIOPSIDÆ.

Genus—NOEGGERATHIOPSIS, O. *Feistmantel.*

(Pal. Indica [Gondwana Flora], 1879, iii. Pt. 1, p. 23.)

(Pl. XL. fig. 1.)

Obs.—A peculiar leaf has been obtained from the Permo-Carboniferous beds near Townsville, which is tentatively referred to this genus. It is spathulate and acutely triangular, with the distal end wanting, and tapering proximally to an obtusely pointed petiole; in all, as preserved, three inches long. A median, longitudinally impressed line exists, similar to those seen in some of the late Dr. O. Feistmantel's figures of Australian *Noeggerathiopsis*,* on each side of which the veins arrange themselves with a certain degree of bilateral symmetry. The veins are coarse and somewhat far apart, about fourteen on each side the median groove, and the interspaces flattened.

This leaf seems to approach nearest to *Noeggerathiopsis*, so far as the material at my command enables me to judge, but it is different from any figured by Feistmantel in either his Indian, Australian, or Tasmanian Memoirs. Possibly it may be an undescribed genus.

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* Mem. Geol. Survey, N.S. Wales, Pal. No. 3, 1890, t. 21, f. 3-5.

Loc. and Horizon.—Railway Cutting on Townsville and Charters Towers Railroad, six and a half miles from Townsville, at Stewart's Creek (*R. L. Jack*, Colln. Geol. Survey Queensland, Brisbane). Upper Bowen Series.

ANIMALIA.

Sub-Kingdom—CŒLENTERATA.

Class—ACTINOZOA.

Obs.—Four additional specimens of Rugosa have been obtained by Mr. Jack; three of them are from the Middle Bowen Series at Kyunga, near Banana, and were presented to the Queensland Geological Survey Collection by Mr. — Sutherland, whilst the fourth is from the same series in the type district, and was collected by Mr. Jack four and a half miles up Parrot Creek, Bowen River.

Two of the Kyunga corals possess the same robust turbinate appearance, thick wall, and stout septa as those of *Zaphrentis robusta*, De Kon., of the N.S. Wales Permo-Carboniferous. If anything, the accretion growths are a little more marked, but the rugæ are identical, and so appear to be the transverse frills ornamenting the latter. On the other hand, the septa are increased to fifty, which is a marked departure from the number present in the species named.

The third coral although of sufficiently well marked character to pass for a more slender individual of *Z. robusta*, possesses but forty-five septa. With this discrepancy, in an otherwise apparently similar series, it may perhaps be well to pause before definitely referring the specimens to *Z. robusta*, and await the advent of additional material.

The coral from the type district is also a turbinate, and little curved form, possessing fifty-eight septa. In the robustness of its habit it resembles the preceding specimens. The calice is deep with a very thick wall, the rugæ corresponding in part with the interseptal spaces. The septa in the calice are short, thick and somewhat wedge-shaped, and much thickened with stereoplasma, but the primordial septa still plainly visible. The wall, or more properly speaking the theca, is formed by septal outgrowths infilled with stereoplasma, and its thickness, combined with the brevity of the septa, tends to impart a markedly sturdy appearance to the corallum.

These notes may tend to call the attention of Collectors to these corals, and perhaps facilitate further acquisition.

Sub-Kingdom—ANNULOSA.

Class—CRUSTACEA.

Order—**TRILOBITA**.

Family—PRŒTIDÆ.

Genus—GRIFFITHIDES, *Portlock*, 1843.

(Geol. Report Londonderry, &c., p. 310.)

GRIFFITHIDES SWEETI, *Eth. fil.*

(Pl. XXXIX. fig. 3.)

Griffithides Sweeti, Eth. fil. (ms.), Mem. Geol. Survey N. S. Wales, Pal. No. 5, Pt. 2, 1892, p. 125.

Sp. Char.—General form oblong. Cephalon not fully preserved, but the glabella pyriform-oval; basal lobes oval, large and prominent, deeply divided off, with a small supplementary lobe beneath, and at outer upper end of the neck segment, which is convex, and longer fore and aft than any of the thoracic segments; surface of all lobes highly granulate. Thoracic axis very convex, of ten segments; pleuræ angularly bent downwards along the middle line. Pygidium semicircular, large; axis of twelve, and pleuræ apparently of ten segments; limb wide, convex, and well arched downwards.

Obs.—This is an abnormal form, departing both from *Phillipsia* and *Griffithides* in possessing ten instead of nine thoracic segments, and in the presence of the supplementary basal lobes on the cephalon. So far as I can see there is no clear evidence of such supplementary lobes in Dr. H. Woodward's excellent figures of either *Phillipsia* or *Griffithides.* The one preserved is, however, very distinct in our specimen, quite separated from the basal lobe on the one hand, and the neck segment on the other. The glabella is densely ornamented with very minute prickles (pits in the cast), but although these are not certainly visible on the thorax and pygidium, still a roughening of the surface may, perhaps, indicate their former presence.

The supplementary lobe is present in some *Proeti*, such as *P. bohemicus*, Corda,* for instance; and the late Mr. J. W. Salter made the following remarks on the subject†:—"A very usual character of this genus [*Proetus*] is the possession of a strong tubercle, terminating the neck segment on each side, and nearly separated from it. Burmeister, however, in his second edition, has considered the species having this thickening, and the obscure glabella furrows more strongly marked, as forming a distinct genus, which he calls *Æonia.* McCoy had anticipated him by a few months in the name *Forbesia*, without referring to *Proetus*."

Loc. and Horizon.—Crow's Nest Creek, near Mount Morgan (*G. Sweet*, Colln. Sweet, Melbourne). Trilobite-bed, Gympie Series.

Sub-Kingdom—MOLLUSCA.

Class—BRACHIOPODA.

Family—ATHYRIDÆ.

Genus—ATHYRIS, *McCoy*, 1844.

(Synop. Carb. Limest. Foss. Ireland, p. 146.)

ATHYRIS ROYSII, *Leveillé, sp.*

(Pl. XXXIX. fig. 4.)

A. Roysii (Leveillé), Eth. fil., Geol. Pal. Q'land and N. Guinea, 1892, p. 243, t. 11, f. 15.

Obs.—I take a second opportunity of figuring an *Athyris* with circlets of attached spines, contributed in this instance by Mr.

* Syst. Sil. Bohême, I. Atlas, t. 16, f. 1, 6, 8, 10, 11.

† Mem. Geol. Survey Gt. Brit. 1858, ii. Pt. 1, p. 337.

de Vis. In the present case the spines seem to be a part of the laminar expansion, without that degree of individuality possessed by those of *A. Roysii*, but at the same time hardly exhibiting the same continuity of expansion visible in the lamellar frills of *A. planosulcata*, Phill. I therefore prefer to retain the Queensland example under the above name. The preservation of the specimen appears to represent a circular or orbicular shell, such as the previously mentioned species, rather than a transversely elliptical form similar to the N. S. Wales Permo-Carboniferous *A ? crebristria*, Morris,* sp.

Loc. and Horizon.—Rockhampton District (*C. W. de Vis*, Colln. de Vis). Gympie Series.

Family—PRODUCTIDÆ.

Genus—Productus, *J. Sowerby*, 1814.

(Min. Con., I. p. 153.)

Productus ? *sp.ind.*

Productus, sp.ind. (*b*), Eth. fil., Geol. Pal. Q'land and New Guinea, 1892, p. 255, t. 12, f. 15.

Obs.—In 1892 I described what was taken to be portion of a *Productus* with spine bases and a few attached spines, after the type of *P. fimbriatus*, Sby. At the same time I expressed doubt as to the reference of the specimen to that genus, and also remarked —"the spines are too coarse and much too far apart for either an *Athyris*, such as *A. Roysii*, or a *Reticularia*, like *R. lineata*."

A further examination, through the courtesy of Mr. R. L. Jack, has led to me to doubt the propriety of referring the shell to *Productus*, and I now think that it may really be a *Reticularia*, but one possessing much larger and more widely separated spines than generally seen in *R. lineata*. It is evidently a portion of the ventral valve with a shallow sinus.

* Strzelecki's Phys. Descrip. N. S. Wales, &c., 1845, p. 279, t. 15, f. 2.

Loc. and Horizon.—Stony Creek, Stanwell, near Rockhampton (*The late James Smith*, Colln. Geo. Survey Queensland, Brisbane). Gympie Series.

Class—PELECYPODA.

Order—LUCINACEA.

Family—ASTARTIDÆ.

Genus—CYPRICARDELLA, *Hall*, 1858.

(Trans. Albany Inst., 1858, iv. Pt. 1, p. 17.)

CYPRICARDELLA RECTANGULARIS, *sp. nov.*

(Pl. XXXIX. fig. 5.)

Sp. Char.—Shell small, generally rectangular, short, rather produced antero-ventrally. Hinge line or cardinal margin short, much less than the width of the shell; ventral margin wide and rounded, graduating into the antero-ventral extremity, which owing to the deep excavation of the anterior margin appears produced; posterior margin straight, at right angles to the hinge line. Diagonal ridge prominent, but obtusely rounded; posterior slope flattened, forming almost an equilateral triangle. Surface bearing between thirty and forty regular, close, rounded, concentric rugæ, sharply bent on crossing the posterior slope.

Obs.—This little shell, referred to *Cypricardella* purely on external form, is allied to *C. bellistriatus*, Conrad, sp.,* and is also allied to *Cypricardia rhombea*, Phill.,† of the British Carboniferous Limestone, which in all probability is a *Cypricardella* also. Prof. James Hall‡ even figures a short variety of Conrad's species, very like the present shell, were it not for the produced anterior end of the latter. Still in this respect it may be compared with *C. tenuistriatus*, Hall,§ and although the before-

* Pal. N. York, 1885, v. Pt. 1, No. 2, p. 308, t. 73, f. 21.

† Ill. Geol. Yorksh., 1836, Pt. 2, p. 209, t. 5, f. 10.

‡ *Loc. cit.* t. 74, f. 7.

§ *Loc. cit.* t. 73, f. 23.

mentioned *C. bellistriatus* is a remarkably variable shell, there is no figure of Hall's showing so short an individual as *C. rectangularis*, mihi. A comparison with Phillips' *Cypricardia rhombea*,* possibly referable to the present genus, at once dispels any relation between the two forms, especially the length of the British shell from anterior to posterior.

In outline *C. rectangularis* is not unlike *Cypricardella rhomboidea*, mihi,† but in the former the antero-posterior angle is much more rectangular, and it possesses a strong diagonal ridge, absent in the latter.

Loc. and Horizon.—Rockhampton District (*C. W. de Vis*, Colln. de Vis). Gympie Series.

Order—**MYACEA.**

Family—ANATINIDÆ.

Genus—CHÆNOMYA, *F. B. Meek*, 1866.

(Pal. Up. Missouri, p. 42.)

CHÆNOMYA? ETHERIDGEI, *De Koninck*.

(Pl. XL. fig. 5.)

Sanguinolites Etheridgei, De Koninck, Foss. Pal. Nouv. Galles du Sud, 1877, Pt. 3, p. 262, t. 17, f. 2 (? t. 16, f. 2).

Chænomya? Etheridgei, Eth. fil., Geol. & Pal. Q'land and N. Guinea, 1892, p. 279.

Obs.—Under the first of the above names De Koninck figured two bivalves, which, it appears to me, must with our present knowledge be kept distinct. If of the same species, they can only be regarded as oppositely extreme members of it. The specimen formerly described by me did not exhibit the cincture, or sulcus proceeding from the umbo to the ventral margin in each valve, but this is visible in the present example. The latter coincides

* Ill. Geol. Yorkshire, 1836, Pt. 2, t. 5, f. 10.
† Geol. Pal. Q'land, &c., 1892, t. 14, f. 15.

with De Koninck's figure, Pl. 17, f. 3, except that the posterior hinge line has a less elevation, and the cincture is less obliquely directed.

I was for a long time in doubt as to the generic identity of this and similar other bivalves found in the Permo-Carboniferous rocks of Eastern Australia, and for the want of a better resting place referred them to Meek's genus *Chænomya.* This group of shells is in accord, with the diagnosis of the latter, in every particular but two—the presence of the cincture, and the "broad shallow sinus" of the pallial line. The former point is not, from its variability in this group, one of much moment, and even the pallial line of our shells may be very openly sinuate, but is so faintly impressed that it is difficult to distinguish it. At the same time the posterior gape of the valves would lead one to expect a sinupalliate character. Should any other observer be in a better position to demonstrate the generic relations of *Chænomya ? Etheridgei*, and its allies, more correctly, I am quite open to conviction. Perhaps, after all, as in so many other cases in Australian Palæontology, a new generic name will be the more appropriate course.

The presence of the cincture indicates an alliance with *Grammysia.*

Loc. and Horizon.—Woodleigh Creek, one and three quarter miles above Bent's Farm (*W. H. Rands*, Colln. Geol. Survey Queensland, Brisbane).

Genus—EDMONDIA, *De Koninck*, 1842.

(Descrip. Anim. Foss. Terr. Carb. Belgique, 1842, p. 66.)

EDMONDIA ? SMITHII, *sp.nov.*

(Pl. XXXIX. fig. 6.)

Undescribed Bivalve, Geol. Pal. Q'land and N. Guinea, &c., 1892, t. 39, f. 8.

Sp. Char.—Shell ovate-oblong; valves more or less compressed. Hinge line or cardinal margin straight, shading off posteriorly into the posterior margin; ventral margin very gently rounded; anterior end small, its margin rounded; posterior end flattened, the margin insensibly passing into the dorsal and ventral outlines, but more obliquely into the former. Umbones anterior, but not terminal. Surface bearing concentric corrugations or rugæ, increasing in size and distance from one another posteriorly, steep on the sides, and themselves delicately concentrically striated.

Obs.—*Edmondia? Smithii* was figured by an oversight without name or description. The nature of the hinge is not apparent, but the general outline reminds us of *Edmondia*, such forms for instance as *E. sculpta*, De Koninck,* or *E. scalariformis*, De Koninck.† The hinge line in the present specimen, however, is proportionately shorter, and the posterior ventral end more produced.

Loc.—Rockhampton District (*C. W. De Vis*, Colln. De Vis, Brisbane). Gympie Series.

Class—GASTEROPODA.

Order—PROSOBRANCHIATA.

Family—PLEUROTOMARIIDÆ.

Genus—PTYCHOMPHALINA, *Bayle*, 1885.

PTYCHOMPHALINA RANDSI, *sp nov.*

(Pl. XLI. figs. 4 and 5.)

Sp. Char.—Shell large, turbinate-conical, of four whorls, rapidly increasing in size, so much so that the second and third are quite disproportionate. Whorls convex, the two first less so than the third and last; both the latter are deep and massive, and either flattened or slightly concave below the suture, forming a kind of shoulder; apex slightly depressed; base gently convex. Inner

* Faune Calc. Carb. Belgique, Pt. 5 (*Ann. Mus. R. Hist. Nat. Belgique*, XI), t. 11, f. 45.

† *Ibid.*, t. 11, f. 40.

lip gently receding inwards, except at quite the anterior, where it is sharp and prominent; outer lip not preserved; mouth apparently round oval. Band narrow in proportion to the size of the shell, but probably in the perfect shell prominent; sinus not preserved.

Obs.—The specimen is both at the same time an internal cast and a decorticated shell, weathering having removed every trace of sculpture, leaving only a faint indication of the band. The shelly covering remaining exhibits the weatherworn, almost eroded and cracked appearance characteristic of the Yatton fossils. The outer lip is quite imperfect, and as regards the band it is decipherable to the eye in front on the third whorl as a dark line, and to the touch as an obstructing ridge. On the body whorl, and on the third just below the suture the surface is depressed, either flattened or slightly concave.

I should have referred this shell to *Pleurotomaria rotunda*, Etheridge,* from Crocow Creek, had it not been for the following reasons:—1. In the latter the whorls appear to be wholly rounded, without any flattened surface below the suture; 2. the great relative disproportion in size between the second whorls of the two shells; 3. the more oblique inner lip in *Ptychomphalina*; 4. the more depressed outline in *P. rotunda*, and consequently different apical angle.

The present fossil by the position of the band and want of an umbilicus falls within Bayle's genus *Ptychomphalina* (*Ptychomphalus*, De Kon., non Ag.), and is akin to *P. gigas*, De Kon., in size, although it is larger.

Named in honour of Mr. W. H. Rands, Assistant Government Geologist, Queensland.

Loc. and Horizon.—Yatton Gold-field (*W. H. Rands*, Colln. Geological Survey Queensland, Brisbane). Gympie Series.

* Quart. Journ. Geol. Soc., 1872, xxviii. p. 336, t. 18, f. 3. The generic position of this fossil is somewhat doubtful. In his original description Mr. Etheridge leaves the question of an umbilicus in doubt. From the appearance of the type figure the shell appears to be non-umbilicate, but its general features and absence of any band induced me to refer it to *Platyschisma*, McCoy. In the description of Plate 15 of the Queensland Geology and Palæontology this is called *rotundata*. It should be *rotunda*.

Family—PYRAMIDELLIDÆ.

Genus—LOXONEMA, *Phillips*, 1841.

(Pal. Foss. Devon., p. 98.)

LOXONEMA, *sps. ind.*

(Pl. XXXIX. fig. 7; Pl. XL. fig. 6.)

Obs.—I have already recorded the occurrence of a species after the type of *L. rugifera*, Phill., in the Gympie beds of the Rockhampton District. Mr. De Vis has now communicated two other species from the same strata, but unfortunately both are too insufficiently preserved to warrant the application of specific names, although they must not be passed over in silence.

The larger of the two (Fig. 6) possesses seven whorls with a total length of two inches, but the apex and body whorl are wanting. Sufficient of the sculpture remains to show that each whorl was traversed by a large number of close set, somewhat sigmoidally curved costæ, extending completely from suture to suture.

The second fossil is the impression (Fig. 7) of a comparatively small shell, similar in character to Pl. XL. fig. 6. The impression is nine-sixteenths of an inch long, and consists of thirteen whorls, similarly sculptured to Fig. 6, but with the costæ less sigmoidally curved.

Both specimens are of a type common in Devonian and Carboniferous rocks, and may be considered as appertaining to that section of the genus represented by *L. Lefevrei*, De Kon. The second may also be compared to *L. pulcherrima*, McCoy. The larger of the two specimens (Pl. xl. fig. 6) is also closely related to a shell I described* some years ago as *L. sulculosa*, Phill., from near Lake Bathurst, N.S. Wales, but in the case of the latter the sigmoidal rugæ are much coarser and less numerous. The shell

* Journ. R. Soc. N.S. Wales for 1880 [1881], xiv. p. 251, Pl. f. 1.

just named I now find comes from a much lower horizon than I thought in 1880, and is probably from one of our Siluro-Devonian Limestones, although I then doubtfully referred it to the Carboniferous. This fact, however, tends to point out the persistence of the type.

Loc. and Horizon.—Rockhampton District *(C. W. De Vis*, Colln. De Vis). Gympie Series.

Family—BELLEROPHONTIDÆ.

Genus—Bellerophon, *De Montfort*, 1808.

(Conch. Systématique, 1. p. 51.)

Bellerophon, *sp. ind.*

(Pl. xxxix. fig. 8.)

Obs.—A small and well marked form occurs in limestone, but unfortunately only the back is visible. A raised, square-edged keel exists, bearing traces of recurved striæ. The back and sides are crossed by sharp, straight, transverse ribs, with here and there a few faint intervening striæ. Apparently the umbilicus was overlapped by an alar expansion. The characters of this specimen indicate the group of *B. tangentialis*, Phill., as its resting place, particularly the subimbricating costæ at right angles to the keel. A resemblance is also borne to *B. stanvellensis*, mihi,* more particularly from traces on one side of an alar expansion of the inner lip.

Loc. and Horizon.—Rockhampton District *(C. W. de Vis*, Colln. de Vis). Gympie Series (in limestone).

* Geol. Pal. Queensland, &c , 1892, t. 15, f. 11-13.

EXPLANATION OF PLATES XXXIX—XLI.

Plate xxxix.

Actinocystis ? terra-reginæ, *Eth. fil.*

Fig. 1.—Portion of the corallum, the upper surface cut rather obliquely.
Fig. 2.—The upper surface enlarged twice.

Griffithides Sweeti, *Eth. fil.*

Fig. 3.—Portion of the cephalon with the thorax and pygidium—× 2.

Athyris Roysii, *Léveillé*, sp.

Fig. 4.—Impression of a valve, with its concentric laminæ and spinose frills.

Cypricardella rectangularis, *Eth. fil.*

Fig. 5.—The two valves displaced.—× 2.

Edmondia ? Smithii, *Eth. fil.*

Fig. 6.—Right valve rather compressed, and the umbone hidden.—× 2.

Loxonema, *sp. ind.*

Fig. 7.—Cast taken from an impression.—× 2.

Bellerophon, *sp. ind.*

Fig. 8.—Back of shell exhibiting the raised keel, and nearly straight transverse ribs.—× 2.

Plate xl.

Noeggerathiopsis ? *sp. ind.*

Fig. 1.—Spathulate, triangular frond, with attenuated curved base.

Campophyllum Gregorii, *Eth. fil.*

Fig. 2.—Slightly imperfect corallum, seen partly in weathered and partly in polished section.—× $1\frac{1}{2}$.

Cyathophyllum Sweeti, *Eth. fil.*

Fig. 3.—Exterior of an ill-preserved corallum with the remains of rugæ.
Fig. 4.—Transverse section of the corallum.

CHÆNOMYA? ETHERIDGEI, *De Kon., sp.*

Fig. 5.—Left valve with the umbo removed.

LOXONEMA, *sp. ind.*

Fig. 6.—Specimen seen partly as an internal cast, and in part with remains of the sculpture.

PLATE XLI.

CYATHOPHYLLUM SWEETI, *Eth. fil.*

Fig. 1.—Four septa, and interseptal loculi enlarged showing the angular and sometimes irregular dissepiments.—× 6.

RHIZOPHYLLUM? *sp. ind.*

Fig. 2.—Corallum showing the form of the calice.
Fig. 3.—Opposite side of the corallum, with the imbricating laminæ, and truncated base.

PTYCHOMPHALINA RANDSI, *Eth. fil.*

Fig. 4.—Imperfect shell with obscure traces of the band on the body whorl.

Fig. 5.—The non-umbilicate base.

NOTES AND EXHIBITS.

Mr. Froggatt exhibited a collection of Coleoptera from Coolgardie and the Fraser Range, W.A., comprising fifteen species of *Stigmodera* and two of *Cetonia.*

Mr. A. H. Lucas exhibited specimens of *Typhlops* from Castlemaine, Victoria, and from Queensland.

Mr. Brazier exhibited a curved specimen of *Kuphus arenarius,* Linné, 19 inches long, with a septum at the smaller end, diameter of the larger end $1\frac{1}{4}$ inch; also portion of another specimen with a diameter of $2\frac{1}{4}$ inches at the larger end, the length of the complete tube, as originally obtained, being 5 feet; the specimens were found by him on the reef at Mboli, Florida Island, Solomon Islands, in 1865.

In reply to a remark made by Mr. Hedley at last Meeting as to the occurrence of *Patella kermadecensis* at Raoul or Sunday Island, Mr. Brazier said that he was still of the opinion that the correct habitat of the species was South Africa, *not* the Kermadec Islands.

Mr. N. Hardy exhibited several Aboriginal Shields from Victoria and Queensland.

Mr. Etheridge exhibited the five Shields, with drawings, described in his paper.

WEDNESDAY, AUGUST 29TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

The Rev. G. D. Shenton and Dr. Hardcastle were present as visitors.

Dr. F. Tidswell, Randwick, and Dr. E. Grafton-Smith, Sydney University, were elected Members of the Society.

The President called attention to the arrangements for the Sixth Session of the Australasian Association for the Advancement of Science to be held at Brisbane in January, 1895, as set forth in the provisional programme, copies of which were laid on the table.

DONATIONS.

"Geological Survey of India—Records." Vol. xxvi. (1894), Part 2. *From the Director.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 13-15. *From the Government Secretary.*

"Botanischer Verein in Landshut — Dreizehnter Bericht, 1892-93." *From the Society.*

"L'Académie Royale des Sciences des Lettres de Danemark, Copenhague—Bulletin pour l'Année, 1893." No. 3; 1894, No. 1. *From the Academy.*

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), Nos. 7-8 (July-August, 1894). *From the Editor.*

"British Museum (Nat. Hist.)—Catalogue of Birds." Vol. xxiii.: "Monograph of Lichens found in Britain." Part 1: Catalogue of Mesozoic Plants—Wealden Flora." Part 1. *From the Trustees.*

"Royal Society of London—Proceedings." Vol. lv. No. 333. *From the Society.*

"Royal Microscopical Society—Journal, 1894." Part 3 (June). *From the Society.*

"Royal Irish Academy—Transactions." Vol. xxx. Parts 11-12 (1894): "Proceedings." (Third Series). Vol. iii. No. 2 (1894). *From the Academy.*

"Zoologischer Anzeiger." xvii. Jahrg. Nos. 450-452 (June-July, 1894). *From the Editor.*

"Société d' Horticulture du Doubs, Besançon—Bulletin." n.s. No. 42 (June, 1894). *From the Society.*

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Bd. xxi. (1894), No. 6: "Zeitschrift." Bd. xxix. (1894), No. 2. *From the Society.*

"Naturwissenschaftlicher Verein in Hamburg — Verhandlungen, 1893." Dritte Folge i. *From the Society.*

"Indian Museum — Natural History Notes from H.M.S. 'Investigator.'" Series ii. No. 1 (1891-94). *From the Trustees.*

"Institut Météorologique Central de la Société des Sciences de Finlande—Observations Météorologiques," 1881-82, 1883-84, 1885-86, 1887-88: "Observations Faites à Helsingfors" en 1887, 1888, 1889 et 1892. *From the Society.*

"Australian Museum, Sydney—Report of Trustees for the Year 1893." *From the Trustees.*

"Zoological Society of London—Abstract, 19th June, 1894." *From the Society.*

"Journal of Conchology." Vol. vii. No. 11 (July, 1894). *From the Conchological Society of G. B. and I.*

"Société des Sciences Naturelles de l'Ouest de la France—Bulletin." T. iii. Nos. 3-4 (1893); T. iv. No. 1 (1894). *From the Society.*

"Museo Zoologia, &c., della R. Università di Torino—Bollettino." Vol. ix. Nos. 166-178 (1894). *From the Museum.*

"Victorian Naturalist." Vol. xi. No. 4 (July, 1894). *From the Field Naturalists' Club of Victoria.*

"Australasian Journal of Pharmacy." Vol. ix. No. 104 (August, 1894). *From the Editor.*

"Agricultural Gazette of N.S.W." Vol. v. (1894), Part 7. *From the Hon. the Minister for Mines and Agriculture.*

"American Naturalist." Vol. xxviii. No. 331 (July, 1894). *From the Editors.*

"Johns Hopkins University Circulars." Vol. xiii. No. 113 (June, 1894). *From the University.*

"Société Scientifique du Chili—Actes." T. iv. (1894) 1er Liv. *From the Society.*

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), No. 8. *From the Editor.*

"College of Science, Imperial University, Japan—Journal." Vol. vi. Part 4; Vol. vii. Part 1 (1894). *From the Director.*

"Linnean Society of London — Transactions: Botany." Second Series. Vol. iii. Parts 9-11; Vol. iv. Part 1; "Zoology." Second Series. Vol. v. Part 11, Vol. vi. Parts 1-2. *From C. Hedley, Esq., F.L.S.*

"Naturhistorischer Verein der Preussischen Rheinlande, Westfalens und des Reg. Bez. Osnabrück — Verhandlungen." Funfzigster Jahrg., Zweite Halfte (1893). *From the Society.*

THE *KŪDITCHA* SHOES OF CENTRAL AUSTRALIA.

By R. Etheridge, Junr.

(Acting Curator, Australian Museum, &c.)

It is now known that certain tribes of the Aborigines towards the centre of the Continent manufacture a very beautiful shoe, chiefly composed of emu feathers. Two entirely different uses have been ascribed to these. On the one hand, the late Mr. E. M. Curr stated* that the Blacks of the Musgrave Ranges wear the shoes "when they attack their enemies by stealth at night." On the other hand, Mr. C. French, Government Entomologist, Melbourne, has more recently referred† them to a portion of the stock-in-trade of the "rain-maker" of the MacDonnell Ranges.

I am indebted to Mr. H. Y. L. Brown, Government Geologist of South Australia, for a pair of these very interesting articles, procured from Barrow Creek, near Central Mount Stuart, on the Overland Telegraph Line. As I have never seen a detailed description of these novel articles of native apparel, a few notes on the subject will probably be of interest.

The Musgrave Blacks, according to Curr, call the slippers *Kooditcha*, and assume them with the view of preventing the wearer from being tracked. "It is," says Curr, "only on the softest ground that they leave any mark, and even then it is impossible to distinguish the heel from the toe; so that the Blacks say they can track anything that walks, except a man shod with *Kooditcha*." This word signifies an invisible spirit, hence the adoption of the name to the shoes.

The entirely different use ascribed to these articles by Mr. French is expressed by him in the following words:—"It is believed amongst the natives of certain tribes in Central Australia

* The Australian Race, 1886, i. p. 148.
† Vic. Nat. 1892, ix. No. 6, p. 79.

that droughts are caused by the swallowing up of all moisture by a rain-devil. If, however, this personage can be captured and made to disgorge, rain follows at once. The feather boots are worn by the native rain-maker in order that he may steal noiselessly and unawares on the author of the drought and consequent misery."

The shoes are ten inches in length, by four inches wide, the sole being about two inches thick. The groundwork is, as stated by Curr, made of human hair, and in the sole thickly interlaced and matted together with emu feathers to such an extent that the latter predominate over the former. The uppers, however, are wholly of hair-twine, knitted together, with an occasional feather thrust in here and there. The free sides are from one to one and a quarter inches high, whilst the toe and heel portions are covered or decked-in as it were, leaving a foot-opening, oval in shape, and six inches long, but what I take to be toe-cap longer than the heel-piece. The shoes are held on the feet by instep straps, not unlike the similar fastenings to a child's shoe. The straps are excentric with regard to the longitudinal measurement, and are near to what I take to be the heel, the other end being certainly a trifle wider, and are also made of hair-string whipped upon itself. Curr says that the component materials of the soles are "stuck together with a little human blood, which the maker is said to take from his arm." There is certainly some black coagulated substance mixed with the feathers and hair in the soles of the shoes from Barrow Creek. This my colleague, Dr. T. Cooksey, has submitted to chemical examination, and made the following tests:—

1. A portion was extracted with glacial acetic acid, and the extract evaporated with a little sodium-chloride, when micro-crystals of hæmine-hydrochloride were obtained.

2. A second portion was boiled with acetic acid and diluted, and on the addition of ferro-cyanide of potassium, albumen was precipitated.

These results would appear to indicate that the black cementing medium is blood.

It is of course difficult to adjudicate between the rival statements of Messrs. Curr and French—whether the slippers are used in blood revenge, or rain-making. We now know only too well the superstitions entertained by the Aborigines over the whole Continent regarding the cause of death, and the action almost universally taken to avenge that of a near relative or connection. We are likewise acquainted with many and varied extraordinary proceedings adopted, in their belief, to produce rain. So far as I am aware, however, the use of shoes in either of these directions has not been recorded, with the exception of the two quotations already given. Under these circumstances, I felt I could not do better than consult my ever obliging friend, Mr. A. W. Howitt, whose knowledge of the habits of many of the Central Australian Tribes is second to none. Mr. Howitt, who possesses a pair of these shoes from Charlotte Waters, wrote me as follows:—"It is said they are used by the 'Doctors' when seeking out the evil being who has swallowed the rain, and thus caused droughts. I never knew of them in the Cooper's Creek Tribes, and I doubt very much whether they were used in the *Pinya*, but the Yantrowinta (Cooper's Creek) told me that when they went on their expeditions to obtain *Pitcheri* they passed through country where there were people whose tracks were the same before and behind. I have also thought their statement referred to the tribe in which the *Kūditcha* shoes were used by the 'Doctors.' The same custom probably extends north and south of Charlotte Waters, even down to the Peake and up to the Finke River. From the latter place I learn that the tribes and customs over the area referred to are similar, if not the same."

Mr. Howitt's supposition that the use of the *Kūditcha* shoes extends to the north of Charlotte Waters is quite borne out by the locality of the present slippers, Barrow Creek being a very considerable distance to the north of that place.

In a second and later communication Mr. Howitt tells me "that the feather shoes are also said to be worn at Charlotte Waters by men who mean to kill others, and that where such tracks are seen about people are much alarmed, but do not follow them, the wearers being tabooed."

It would appear, therefore, from the information supplied by Mr. Howitt, that the *Kūditcha* shoes are almost certainly used by the rain-maker, and possibly also by the authorised agents in attaining blood-revenge. At the same time, thinking it very desirable that definite information should be obtained from the most reliable local source, I communicated with Mr. J. J. East, Registrar of the School of Mines, &c., Adelaide, and who possesses the advantage of several years' experience in Central Australia.

Mr. East has most obligingly sent me a very interesting cutting from the Adelaide *Evening Journal* of Dec. 3rd, 1892, on the "Curious Customs of the Natives of Central Australia," by R.O. This he has supplemented with his personal experience and views.

Mr. East informs me that "R.O." is an old bushman named Richard Oldfield, and that Mr. Thomas Gill, the Under Treasurer of S. Australia, well known for his Ethnological and Bibliographical researches, has full faith in the authenticity of his statements.

Mr. Oldfield's account of these shoes is as follows, when speaking of inter-tribal wars:—"Should it happen that one of the tribes is greatly superior in numbers to the other, the weaker tribe invites one of the young warriors of the opposite tribe to hunt in their country for a euro, or kangaroo, at the same time sending one of their own tribe to hunt in the country of the stronger tribe. The warrior of the weaker tribe crosses the boundary line into the country of the stronger tribe, and after proceeding a mile or two he doubles back, and finding the track of the other warrior, he puts on a pair of large soft shoes made out of emu feathers, stuck together with blood, gum, &c. As these shoes leave no track the natives call them Kooditcha shoes (Kooditcha means devil). With these appendages he follows the tracks of his adversary with extreme care and caution, until his victim has killed a euro, and when the unsuspecting man is busily engaged in securing the euro, the warrior with the Kooditcha shoes steals up silently and spears him in a vital place. Having despatched his victim, he immediately obtains a firestick, and while the body is still warm he applies the firestick to the wound, taking care not to scorch the flesh. By this means he causes the wound to rapidly heal up outwardly, and no trace of any external wound can then be found. Having accomplished his object, he travels back in a circuitous way, and killing another euro himself, he takes it to his own tribe. The opposite tribe seeing that their warrior does not return, send out in search, when several of the tribe are invited over the boundary to look for him. They soon track him and find his body with the euro he had killed, but as no wound can be seen, nor can they find any evidence of his death, they conclude that Kooditcha has seized him, and as Kooditcha appears to be in the locality and may seize others of their tribe, they hasten away with all despatch. By stratagem, aided by superstition, the weaker tribes secure their ends without losing any of their number, and a war is averted."

Mr. East next informs me that he cannot agree with Mr. Oldfield that the word *Kūditcha* means devil. He says:—"The name is foreign, as I believe, and I am of opinion that both the article and its use is an importation from the Queensland Blacks."

My informant likewise reminds me that Mounted-Constable W. H. Wilshire, in his interesting pamphlet "The Aborigines of Central Australia,"* speaks of the devil, or the Aboriginal conception answering to his Satanic Majesty, as *Arumya*. In his own interesting account† of the Central Tribes, Mr. East also makes use of this term, "Their religious ideas are very primitive, believing only in an evil spirit or *Arumya*." In that most extraordinary of tribes, the *Dieyerie*, the word for devil, or evil spirit, is *Kootchie*,‡ whilst in the MacDonnell Ranges the term *Eringa* is used. Mr. East concludes that Mr. Oldfield has erred in translating the word *Kūditcha* into devil, from its apparent resemblance to the term employed in the well-known Dieyerie dialect.

* P. 10 (16mo. Adelaide, 1888).

† The Aborigines of South and Central Australia, p. 9 (16mo. Adelaide, 1889).

‡ Police-Trooper S. Gason—The Manners and Customs of the Dieyerie Tribe of Australian Aborigines. *Wood's Native Tribes of S. Australia*, 1879, pp. 284 and 299.

I will now give the remainder of Mr. East's interesting statement in his own words:—

"Mr. Tom Coward, now of Adelaide, but formerly of the Queensland and South Australian Police, tells me that the slippers properly belong to the tribes occupying the inland slope of the Queensland Cordillera, and their principal use is to *disguise tracks when 'wife hunting.'* The abductor must conceal himself in the neighbourhood of the camp, but once he has obtained his bride speed is the urgent need of the moment. My own informants—the native black trackers—say they are used to disguise tracks and that rain-makers also *sometimes* use them. On all points, I have come to the conclusion that their use is not general, and hence can have no great ethnological significance.

"Mr. Coward states that the feathers are stuck together with a pitchy substance similar to that used for fastening spear heads. (This in Central Australia is obtained by burning spinifex and digging up the pitch from the sand around the roots.)

"The pair of slippers or 'Cooditchies' (as I have spelled it) in our Museum are not made in this manner, but are built at the soles by tying the tufts of feathers together with a white string apparently the same as that used by the natives of Stuart's Creek (L. Eyre) in the manufacture of aprons. (These aprons are made from the fibres of the cotton bush mixed with human hair.) The upper part is made of netting formed by twisting human hair with a brown fibre which resembles cocoanut fibre in appearance.

"The collection of a sufficient quantity of netting to make these slippers must have occupied a very long time, and is a valid reason why they are not common or in general use.

"In conclusion, I would suggest that the primary use of the slippers is not to hide tracks, but simply to disguise the direction in which the traveller went. The stony tablelands of Central Australia and the rocky ranges reveal few signs of a nature which even a blackfellow can trace as footprints, but at intervals a river channel must be crossed, and here the Aboriginal is confronted with an obstacle which in other countries can be turned to advantage. The Finke, Goyder, Hamilton, &c., are typical of the

Central Australian rivers, and their dry channels are filled with a white sand analogous to that of the sea shore. No track can be hidden here. All that can be done is to cause uncertainty as regards the direction. Time is the great factor for the fugitive. It is known whence he came and to where he will return, but were these the outward or the returning tracks? While this point is being cleared up by a circle of observations, the fugitive gets back to his own tribe and is no longer in *individual* danger. The customary challenge and tribal fight ensues, and peace follows."

Tucked inside each of the shoes from Barrow Creek, both at the toes and heels, I found several examples of a well-marked *Helix*, that Mr. Charles Hedley informs me is *H. perinflata*, Pf., a characteristic desert species hitherto known to range from the MacDonnell Ranges to the Victoria Desert, W.A. Whether these shells are fortuitous, or were placed in the shoes by their former sable owner for some occult reason, I am unable to say. My informant, Mr. Brown, was unable to solve the riddle, but simply says that the shells were in the shoes when he obtained them; and further that the Blacks of this part of the country eat snails as we do oysters, but after cooking them. He saw a number of camps, one hundred miles west-nor-west of Oodnadatta where a feast had taken place.

ON THE FORMATION OF A MACKEREL SKY.

By A. H. S. Lucas, M.A., B.Sc.

On Friday, April 20th of this year, Sydney was favoured with a remarkably extensive and regular display of alto-cumulus clouds, forming a very complete example of that phenomenon which is very rarely seen in these latitudes, a well-developed Mackerel Sky.

I am indebted to Mr. H. C. Russell, F.R.S., the Director of the Sydney Observatory, for the following description of the clouds, taken from his notes made at the time of the appearance.

"In the forenoon a batch of well defined narrow stratus 10 wide and extending from S.S.W. to N.W., appeared low down W.S.W., and rose gradually, and at noon began to show signs of the cirro-cumulus character. At 2 p.m. this was much more decided, and by 3 p.m. the whole W. sky from horizon to zenith, and from N. to S., was covered by the alto-cumulus of the Photograph No. 31. At the time we were in the middle of a spell of fine weather with W. winds and clear skies. An anticyclone resting over Australia with its centre in lat. 30 . Photograph No. 32 was taken 30 minutes after No. 31. At this time the clouds seemed to have grown larger or nearer. The clouds passed gradually over to the E., and at night, with the moon behind them, looked if anything finer than when the Photographs were taken. No immediate change of weather took place ; it was fine and clear before and after. The cloud band was not a feature of the anticyclone then lying over Australia."

The unusually close and regular banding of the clouds, the long parallel rows, rank behind rank, covering more than half of the visible sky, naturally and strongly fixed the attention, and the question arose in the mind—How is this wonderful grouping of the clouds produced? Presently the close resemblance of the arrangement of the lines of cloud to that of the low crests of sand on the ripple-marked floor of a wide and shallow bay, forced itself upon me, and led me to consider whether there might not be some real analogy between the two phenomena.

First, then, what are the conditions under which sand ripple-mark is produced? We will take the case of ripple-mark formed under water as being more pertinent than that of the ripple marking of blown sand. There are three layers of descendingly denser free particles, a layer of air above, then a layer of water, and a layer of sand grains below. The uppermost layer, of air, moves with a gentle velocity over the surface of the middle layer, of water, and throws this surface into a succession of more or less parallel wavelets. In the open these wavelets range themselves at right angles to the direction of the wind, but near land they tend to conform to the shore-line. If the water is shallow, and the particles of sand are small enough, these last, too, acquire the wave-motion, but with a much slower rate of propagation and with a shorter wave-length.

Have these conditions any correspondence with those under which alto-cumulus clouds are formed? Here too we have a number of horizontal layers of free particles increasing in density as we descend. If an upper layer of the air be moving horizontally over one below it, the lower layer will acquire a wave-motion in precisely the same way as that in which a water surface is thrown into waves by the wind. That this must be the case has been shown mathematically by von Helmholtz. To what vertical depth this wave-motion may extend will depend upon the numbers, depth, density, and the relative motion of the underlying naturally defined layers which may be present.

The wave-lengths of these air-waves will be much greater than those of water-waves, and, of course, very much greater than those of sand-ripples. With a strong horizontal movement of the upper stratum or strata, the wave-lengths of the undulations set up in the lower strata will be greater, and will be accompanied by a rapid motion of propagation, or drift. But with a more moderate velocity of the upper layers, the undulations will be on a smaller scale, and the advance correspondingly slower. In a storm, under the influence of a gale of wind water-waves assume their largest dimensions and advance with a greatly increased velocity. When a breeze springs up on a calm day, or as the wind lulls or dies down after a more violent disturbance of the atmospheric equilibrium, smaller, even relatively tiny, wavelets are produced in the water, and these advance with a greatly diminished velocity. It is these lesser wavelets which contribute to the formation of ripple-mark, and similarly, we conclude, it is the lesser atmospheric waves which contribute to the formation of alto-cumulus clouds.

The wave-motion becomes visible under certain conditions. When an air stratum is thrown into waves, the pressure of the air in the ridges of the waves will become less, while the pressure of the air in the troughs of the waves will become greater, than the previous mean pressure of the stratum. The air in the crests will then expand, and its temperature will consequently fall. If an undulating stratum be so nearly saturated with water-vapour that a slight reduction of temperature will be sufficient to cause partial condensation, the parallel lines of cloud so formed will reveal to the eye the actual position of the crests of the air-waves.

If, as must happen only rarely, the horizontal layers of different densities are uniformly thick and similar over a wide area, and the horizontally directed wave-motion is not interfered with by uprising vertical currents over a vast stretch of sky, we shall have such a grouping of the clouds as was seen in our typical and magnificently developed Mackerel Sky of April 20th.

The general idea of this explanation of the phenomenon occurred to me whilst admiring this remarkable spectacle, and I mentioned it to others who were with me at the time, including Dr. Harris, the Head Master of the King's School, and Mr. Robin, M.A., of Newington College. About a month after, I observed from a short notice in "Nature" of an important paper published in the

February number of "Himmel und Erde," that a somewhat similar explanation had therein been advanced by the eminent meteorologist, Professor von Bezold. When in Melbourne recently, I obtained access to the periodical in question by the kindness of Mr. R. L. J. Ellery, F.R.S., of the Melbourne Observatory. The subject of von Bezold's paper is Cloud-Building in General, and, amongst the other kinds of cloud, he discusses the mode of formation of the varieties of wave clouds.

After referring to the investigations of Professor von Helmholtz, in which he showed mathematically that waves are produced by the stroking movement of one air-stratum over another of different density and temperature, he writes :—"Diese Wellen werden nun sichtbar sowie die beiden Schichten genügende Feuchtigkeit besitzen. Es werden nämlich an jenen Stellen, welche den Wellenkämmen entsprechen, Massen der einen Schict in die andere hineingetrieben ; infolge dessen bilden sich Wolken, welche die Gestalt paralleler Wülste oder Streifen zeigen und für welche Herr von Helmholtz die treffende Bezeichnung der Wogenwolken eingeführt hat."

It will be seen that Professor von Bezold attributes the condensation of the vapour into water or snow particles in the crests of the air-waves to the intermingling of the masses of the air of the two strata, to the forcing of masses of the lower into the upper. He has, however, previously, in another connection, drawn attention to the fact that condensation is exceptionally due to mixture of masses of nearly saturated air at different temperatures. The view I have advocated above, in which condensation is ascribed to the necessary expansion and consequent cooling of the air in the crests, seems more feasible.

Von Bezold remarks upon the sudden and simultaneous formation of these parallel rolls over a large spread of sky :—"Zunächst haben diese regelmässig angeordneten Streifen die Eigenthümlichkeit, dass sie auf grosse Erstreckung hin beinahe gleichzeitig, wie mit einem Schlage entstehen, sei es, dass sich ein grösserer Theil des vorher klaren Himmels plötzlich mit solchen Wolken bedeckt, sei es, dass eine bereits vorhandene Wolkendecke sich mit einem Male mit Furchen durchzieht, während die Wolken selber nur langsam weiter schreiten.

"Diese momentane Entstehen paralleler Reihen von Wolken findet sein vollkommenes Analogon in dem Vorgange, der eintritt, wenn ein plötzlich einfallender Wind eine glatte Wasserfläche trifft und dadurch in einem Augenblicke die Fläche mit vielen hunderten von Wellen bedeckt."

This regular and simultaneous starting into view of the rows of clouds seems again to agree better with condensation by expansion in the crests than with mixture of the masses. In the particular exhibition of this form of wave cloud of April 20th the actual formation of the clouds was not witnessed. Mr. Russell noticed them early in the day far away in the W.S.W., when being seen end on as it were, the clouds seemed to form a band of narrow stratus, which on coming nearer resolved itself into Wülst-Cumulus.

As points in favour of the wave theory of formation of these clouds, may be added—

(1) That the general trend of the cloud bands was at right angles to the direction of the air in the upper stratum.

(2) That the drift of the clouds was very slow. It took nearly the whole of the day for them to pass over Sydney.

We have no measurements of the actual height at which the clouds passed, but it must have been considerable.

Mr. Ralph Abercromby in his book "Weather," 1887, calls the Mackerel Sky "one of the rarest skies." Certainly the display of April 20th was on the most unusual scale. The photographs published with von Bezold's paper, and in the "Specola Vaticana," show very much less extensive banding than do those taken by Mr. Russell on this occasion. While the phenomenon of wave-clouds may be seen almost every day on a small scale, it must be only exceptionally that a wide horizontal stretch of air, even at a great height, is absolutely free from disturbance by uprising currents, and particularly if this be over a diversified land surface.

In conclusion, I have to express my indebtedness and thanks to Mr. Ellery and to Mr. Russell for advice and assistance in preparing this statement of the theory. Mr. Russell has most generously allowed me to make use of his photographs and of the notes which he made at the time of the phenomenon.

The ripple-cloud, or wave-cloud, or, to coin a corresponding term, *Undulus*, should take its place in the classification of clouds by the side of the *Stratus*, *Cumulus* and *Cirrus*, for out of combinations of these elemental forms can be derived most of the diversified and ever-changing cloud-groups which never cease to delight and astonish the eye and mind of man.

A LIST OF EXOTIC TREES AND SHRUBS AFFECTED BY AUSTRALIAN LORANTHS AND VISCUMS.

By Fred. Turner, F.L.S., &c.

It is now some years since I began to make observations on exotic trees and shrubs which have become hosts for certain Australian parasitical plants.

During the past year I have had peculiar facilities for making extended observations, having travelled nearly all over the Colony; and for a great part of that time I was engaged in reporting on the capabilities of Crown lands, and the best means of utilising them, for the Government of New South Wales.

I am not aware that any observations have hitherto been published on this subject in New South Wales. Therefore I have written this paper with a view to placing on record such exotic trees and shrubs as I have seen the indigenous parasitical plants growing upon, so that persons who are interested in the subject may be induced to make new observations.

Although I have recorded twenty-seven species, besides numerous varieties of exotic trees and shrubs which are hosts for certain Australian parasitical plants, it must not be thought that the list is exhaustive. What appears to me to be very remarkable is the great dissimilarity between the exotics upon which Australian parasitical plants have established themselves.

In the coastal districts, as far as my observations go, it would appear that exotic trees and shrubs are more infested with indigenous parasitical plants than in the interior. This, however, is, I think, easily accounted for. Orchards and gardens have not only been longer established in the coastal districts than in the interior, but the number of exotics, in proportion to the indigenous vegetation, is much greater in the former than in the latter portion of the Colony.

It does not appear that exotic trees and shrubs having a rough bark, which one would naturally suppose offered greater facilities for the seeds of parasitical plants to lodge and germinate, are more suitable as hosts than those having a smooth bark. An illustration of this is found in the oriental plane (*Platanus orientalis*, Linn.), on the very smooth bark of which I have seen many Loranths growing. Many smooth-barked deciduous fruit trees appear to be particularly infested with species of the genera *Loranthus* and *Viscum*.

Since I have drawn attention to these parasitical plants in different parts of the country, it has often been a fruitful source of conjecture as to how they became established on exotic trees and shrubs. After giving some thought to this subject, I think there can be little doubt that birds, some of which are known to eat the fruits of the species of the genera *Loranthus* and *Viscum*, void the seeds, or carry the one-seeded viscid crushed fruits in, or attached to, their claws, or on the sides of their beaks, and leave them on the branches or in the forks of the trees and shrubs when visiting them, either to eat the fruits they yield or to rest themselves.

Several writers have asserted that the leaves of the indigenous Loranths assume the character of those of their hosts, more particularly when growing upon different species of *Eucalyptus*, *Casuarina*, *Banksia*, &c. However this may be with regard to the indigenous vegetation, this leaf-mimicry, so far as my observations go, does not take place when the native parasitical plants are growing upon exotic trees and shrubs. It seems to be a matter of very little consequence what kind of exotic tree or shrub the native parasitical plants may grow upon, their botanical characteristics are not altered to any very great extent.

The indigenous parasitical plants which I have seen growing on exotic trees and shrubs in this country are—*Loranthus celastroides*, Sieb., *L. pendulus*, Sieb., and *Viscum articulatum*, Burm., the first two named being much more common than the last.

The following are the botantical names, common names, and also the habitats of the trees and shrubs upon which I have seen Australian parasitical plants growing.

Order—MAGNOLIACEÆ.

ILLICIUM ANISATUM, Linn. ; Star Anise ; China and Japan.
MAGNOLIA FUSCATA, Andr. ;* Chinese Tulip-tree ; China.
LIRIODENDRON TULIPIFERA, Linn. ;† Tulip-tree ; N. America.

Order—RUTACEÆ.

CITRUS AURANTIUM, Linn. ; Orange, in var. ; S. Asia.

Order—LEGUMINOSÆ.

ROBINIA PSEUDACACIA, Linn. ; Locust-tree ; America.
GLEDITSCHIA TRIACANTHOS, Linn. ; Honey Locust ; N. America.
INGA PULCHERRIMA, Cerv. ; Soldier-bush ; Mexico.

Order—ROSACEÆ.

PRUNUS PERSICA, Benth. et Hook. ; Peach‡ and Nectarine, in var. ; Persia and China.
PRUNUS DOMESTICA, Linn. ; Plum, in var. ; Europe.
ARMENIACA VULGARIS, Lam. ; Apricot, in var. ; Central Asia.
PYRUS COMMUNIS, Linn. ; Pear, in var. ; Europe.
PYRUS MALUS, Linn. ; Apple, in var. ; Europe.
PYRUS CYDONIA, Linn. ; Quince, in var. ; Europe.
CRATÆGUS OXYACANTHA, Linn. ; Hawthorn ; Europe.

Order—OLEACEÆ.

OLEA EUROPEA, Linn. ; Olive, in var. ; Europe.

Order—APOCYNACEÆ.

NERIUM OLEANDER, Linn. ; Oleander, in var. ; East Indies.

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* The Honorable Dr. J. Norton, M.L.C., first called my attention to the *Loranthus* growing upon this shrub.

† Mr. C. Hedley, F.L.S., first directed my attention to the *Loranthus* growing upon this tree.

‡ Mr. J. J. Fletcher first called my attention to *Viscum articulatum*, Burm., growing on this tree. I do not remember ever having seen this parasitical plant growing upon any other exotic tree or shrub in Australia, nor upon any native tree but *Doryphora sassafras*, Endl.

Order—EUPHORBIACEÆ.

STILLINGIA SEBIFERA, Michx.; Tallow-tree; China.

Order—URTICACEÆ.

ULMUS MONTANA, Sm.; Mountain elm; Europe.
PLANERA ACUMINATA, Michx.; Japanese elm; Japan.

Order—BETULACEÆ.

ALNUS GLUTINOSA, Linn.; Alder; Britain.

Order—PLATANACEÆ.

PLATANUS ORIENTALIS, Linn.; Plane-tree; S. Europe.

Order—JUGLANDEÆ.

JUGLANS CINEREA, Nutt.; Butter-nut; N. America.
JUGLANS REGIA, Linn.; Walnut; Persia.

Order—CUPULIFERÆ.

QUERCUS COCCINEA, Wnghm.; Red oak; N. America.
QUERCUS PEDUNCULATA, Willd.; Oak; Europe.
QUERCUS LUSITANICA, Willd.; Portugal oak; Portugal.

Order—SALICINEÆ.

SALIX BABYLONICA, Tourn.; Weeping willow; Levant.

It will be observed, in the above list, that the species and varieties arranged under the Order *Rosacea* furnish more host plants than do the species and varieties arranged under any other Order. I do not take this as an indication that Australian parasitical plants prefer, or grow better upon, Rosaceous plants than upon those that are arranged under any other Order. I would rather look at it from a different stand-point. When it is taken into consideration that the greater number of orchards in New South Wales are planted with Rosaceous trees, and that many Australian birds are so fond of the fruits which they bear, I think that the feathered tribe, as I have already explained, is the principal cause of so many Rosaceous trees being infested with Australian parasitical plants.

NOTES AND EXHIBITS.

Mr. Brazier, who had previously recorded the occurrence of pearls in *Trigonia Lamarcki*, and *Chione callophylla*, Phillipi, exhibited a double white pearl taken from *Tapes turgida*, Lam., at Goonamatta Bay, Port Hacking; a small black pearl taken from *Ostrea cucullata*, Born, found at the Bottle and Glass Rocks, Vaucluse, Port Jackson; three specimens taken from *Ostrea subtrigona*, Sowb., (sometimes called drift oysters by the oyster dealers, as they sometimes are when heavy freshes come down the rivers and dislodge them from the shallow beds; but it is a mere variety of *O. cucullata*, Born.) Mr. Brazier stated also that a large quantity of *Ostrea cucullata*, taken off the rocks on the sea coast and placed in one of our southern lakes, had developed into the fine large variety *O. subtrigona*.

Mr. Brazier also exhibited a pale brownish sinistral variety of the introduced *Helix similaris*, Fér., found among some hundred specimens of the dextral form in Mr. J. A. Thorpe's garden at Paddington; white sinistral varieties of *Marginella De Burghiæ*, A. Ad., and *Marginella capensis*, Dunker; a sinistral variety of *Marginella apicina*, Menke, from the Bahamas, West Indies; and a sinistral variety of *Columbella (Atilia) filosa*, Angas, from the Sow and Pigs Reefs, Port Jackson, 4 fathoms.

Also, examples of *Stilifer tumida*, Petterd, found by Mr. T. P. Hitchcock in beach shingle, half a mile north of Wollongong, in January, 1892. Originally described from North Tasmania, the same species has been found by Mrs. Kenyon at Flinders, Victoria, so that it has a wide range along the South-East Coast of Australia.

Mr. Fred Turner exhibited plants of *Trachymene incisa*, Rudge, forwarded to him by Mr. McKern, who reports that children eat quantities of the roots of this plant, and that they call them "wild carrots."

Also fresh branches of the Japanese Elm (*Planeria acuminata*, Michx.), of the Mexican Soldier Bush (*Inga pulcherrima*, Cerv.)

and of the Star Anise (*Ilicium anisatum*, Linn.) infested with Loranths.

Mr. R. Etheridge, junr., showed a pair of Kūditcha shoes from Barrow Creek, near Central Mount Stuart, on the Overland Telegraph Line; the second examples only which he had had the opportunity of seeing.

Mr. Edgar R. Waite exhibited two species of Mulluscs (*Potamides ebeninum*, Brug., and *Arca trapezia*, Desh.), respectively known as "whelk" and "cockle," which are to be seen exposed for sale in quantity at the Central Fish Market. The whelk is cooked before being eaten, but according to the fishermen the cockle is eaten both cooked and raw, though opinion is divided as to its value as a comestible. Both species are also used for bait.

WEDNESDAY, SEPTEMBER 26TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

Mr. J. W. Grimshaw was introduced as a visitor.

DONATIONS.

"Agricultural Gazette of N.S.W." Vol. v. (1894) Part 8. *From the Hon. the Minister for Mines and Agriculture.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 16-17. *From the Government Secretary.*

"Naturwissenschaftlicher Verein für Steiermark—Mittheilungen." Jahrg. 1893. *From the Society.*

"South Australia—Annual Report of Government Geologist for the year ending June 30th, 1894." *From the Author.*

"Geological Society of London—Quarterly Journal." Vol. l. Part 3 (1894). *From the Society.*

"Zoological Society of London—Proceedings, 1894." Part 2. *From the Society.*

"Royal Society of London—Proceedings." Vol. lv. No. 334 (1894). *From the Society.*

"Linnean Society of London—Journal: Botany." Vol. xxvi. No. 177; Vol. xxx. Nos. 205-208 (1894); "Zoology." Vol. xxiv. Nos. 155-157; "Proceedings, November, 1890—June, 1892; and November, 1892—June, 1893": "List of Fellows, &c. 1893-4." *From the Society.*

"Zoologischer Anzeiger." xvii. Jahrg. Nos. 453-454 (July-August, 1894). *From the Editor.*

"Société Royale des Sciences à Upsal—Nova Acta." Vol. xvi. (1893). *From the Society.*

"Asiatic Society of Bengal—Journal." Title page and Index of Vol. lxii. Part i. (1893): Vol. lxiii. Part i. Nos.1-2; Part ii. No. 1; Part iii. No. 1 (1894); "Proceedings, 1894." Nos. 2-6. *From the Society.*

"Société Belge de Microscopie—Bulletin." Tome xx. (1893-94), No. 9. *From the Society.*

"Royal Physical Society, Edinburgh—Proceedings." Vol. xii. Part 1 (1892-93). *From the Society.*

"Nederlandsche Entomologische Vereeniging—Tijdschrift voor Entomologie." Dl. xxxv. Afl. 3-4 (1892); Dl. xxxvi. Afl. 1-4 (1893). *From the Society.*

"Société Royale Linnéenne de Normandie—Mémoires." Vol. xviii. 1er Fasc. (1894). *From the Society.*

"American Geographical Society—Bulletin." Vol. xxvi. No. 2 (1894). *From the Society.*

"Indian Museum, Calcutta—Natural History Notes from H.M.S. 'Investigator.' Series ii. Nos. 11-13 (1894). *From the Trustees.*

"Geological Survey of Queensland—Annual Progress Report for the year 1893; "Report on Ulam Gold Field." By A. Gibb Maitland; "Report on the Towalla and Mareeba Gold Fields." By W. H. Rands; "Report on the Deep Lead, Pentland, Cape River Gold Field." By W. H. Rands. *From the Government Geologist.*

"Sociedad Guatemalteca de Ciencias—Revista Mensual." Tome ii. Núm. 8-9. *From the Society.*

"Victorian Naturalist." Vol. xi. No. 5 (August, 1894). *From the Field Naturalists' Club of Victoria.*

"American Museum of Natural History—Bulletin." Vol. vi. (1894), Sheets 13-15. *From the Museum.*

"American[1] Naturalist." Vol. xxviii. No. 332 (August, 1894). *From the Editors.*

"Nederlandsche Dierkundige Vereeniging—Tijdschrift." 2[de] Serie. Dl. iv. Afl. 1-3 (1893-94). *From the Society.*

"Naturwissenschaftlicher Verein des Reg.-Bez. Frankfurt a/M.—Helios." ix. Jahrg. Nos. 7-12 (1891); x. Jahrg. (1892); xi. Jahrg. No. 1 (1893); xii. Jahrg. Nos. 1-3 (1894): "Societatum Litterae." v. Jahrg. Nos. 9-12 (1891); vi. Jahrg. Nos. 1-12 (1892); vii. Jahrg. Nos. 1-3 (1893); viii. Jahrg. Nos. 4-6 (1894). *From the Society.*

"Natuurkundig Tijdschrift voor Nederlandsche Indië." Deel ii. Afl. 1-5; Dl. iii. Afl. 4-7; Dl. iv. Afl. 1-4; Dl. v.; Dl. vi. Afl. 1-4; Dl. vii. Afl. 3-4; Dl. viii. Afl. 5-6; Dl. x-xv.; Dl. xvii. Afl. 1-4; Dl. xviii-xix.; Dl. xx. Afl. 4-6; Dl. xxi-xxix.; Dl. xxx. Afl. 3-6; Dl. xxxi.; Dl. xxxii. Afl. 1-3: Dl. xxxiii-xlvii (1851-1887). *From the Society.*

"Royal Microscopical Society—Journal, 1894." Part 4 (August). *From the Society.*

"Australasian Journal of Pharmacy." Vol. ix. No. 105 (September, 1894). *From the Editor.*

ON THE CORRECT HABITAT OF *PATELLA KERMADECENSIS*, PILSBRY.

By John Brazier, F.L.S., C.M.Z.S.

At the Meeting of this Society held on April 25th last, I read a short communication on a certain large *Patella* said to be from the Kermadec Islands, which from the presence of two adherent specimens of a second *Patella* (unfortunately in a very bad state of preservation, but allied to if not identical with the South African *P. cochlear*, Born), I was led to believe to be the *P. kermadecensis* of Pilsbry said to be from the same locality.

At the June Meeting Mr. Hedley stated that he had been informed by a New Zealand collector that *P. kermadecensis* had been found at Raoul or Sunday Island, by Captain Fairchild's party.

In reply to that statement I again upheld my conviction at the following Meeting for the reason above stated. Since then I have been able to see Mr. Percy Smith's pamphlet "The Kermadec Islands; their capabilities and extent" (Wellington, 1887), on pp. 26 and 27 of which will be found a description of Macauley Island, one of the Kermadec Group, with the following reference: "The quantity of fish and crabs in the rocky pools on the shore and the number of large limpets (as big as small saucers, and good eating) would serve as food for a length of time to any castaway here."

I have, therefore, arrived at the conclusion that the shell referred to in the foregoing extract is none other than the species under consideration for the following reasons:—

1. It is unlikely that a gigantic *Patella* such as this would have been overlooked by such collectors as Mr. John Macgillivray and other residents on Raoul or Sunday Island for many years.

2. That we have no authentic record of its occurrence on that island.

3. That the only shell which answers to the description from these seas is that referred to by Mr. S. Percy Smith from Macauley Island.

TROCHUS ADAMSI FROM PORT JACKSON, AND NEW VARIETIES OF *BULIMUS MILTOCHEILUS* FROM THE SOLOMON ISLANDS.

By John Brazier, F.L.S., C.M.Z.S.

The *Ziziphinus comptus*,* of A. Adams, has been severally stated to occur in New Caledonia and Port Jackson. It is probable that the type of Adams' species was collected by Mr. Fred. Strange in Port Jackson and not in New Caledonia, just as *Z. scitulus* (= *Astele scitula*) was collected in Port Jackson and not in New Zealand, and *Pisania reticulata* in Tasmania and not New Caledonia as quoted by Adams, as has been definitely ascertained. From a careful comparison of specimens with the several descriptions and figures I feel convinced that the shells characterised by these three authors refer to one and the same species.

The late Dr. Fischer of Paris was the first to confound the *Z. comptus* of Adams with *Trochus Poupineli*, Montrouzier, from New Caledonia, misled, no doubt, by the erroneous locality recorded by Adams, and through not giving due credence to the excellent figure by Reeve.

It is very evident that Fischer never compared a specimen of Adams' species with either the descriptions or figure of *Z. comptus*, otherwise he would have doubtless noticed that the beaded or granulose liræ are much coarser and larger on *comptus*, and that those above and below the suture are much larger; that it is distinctly canaliculated at the suture; that the last whorl possesses nine rows of brown-spotted liræ.

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* Specimens of this species found by me living on Shark Island, Port Jackson, and sent to Mr. Angas in 1870, were determined by him as the same as the type of *Z. comptus*, A. Ad., in the Cuming Collection, British Museum.

Now as the specific name *comptus** has already been bestowed upon a species of *Calliostoma* described by Philippi under the genus *Trochus* about the year 1849, it follows that the *Z. comptus* of Adams must receive a new specific name. Hence I would suggest that this species be hereafter known as *Trochus (Calliostoma) Adamsi*, Brazier. I am indebted to my kinsman Mr. R. C. Rossiter of Noumea, New Caledonia, for sending me a typical specimen of *Trochus (Calliostoma) Poupineli*, Montrouzier, from Isle Nou, New Caledonia, which has enabled me to compare the species under notice.

TROCHUS (CALLIOSTOMA) ADAMSI, BRAZIER.

Ziziphinus comptus, A. Adams, Proc. Zool. Soc. p. 38, No. 4, 1854; Reeve, Conch. Icon. Vol. xiv. pl. VII. fig. 48, 1863; Angas, "Additional Species of Marine Mollusca to be included in the Fauna of Port Jackson," Proc. Zool. Soc. p. 96, No. 73, 1871; *Trochus Poupineli*, Fischer (*non* Montrouzier), Journ. de Conch. p. 210, 1878.

Shell imperforate, acutely conical, rather thick; apex blackish-purple, granulated; whorls seven, flat, white or brownish; first two whorls with three rows of spiral granose cinguli, next with five the intermediate ones being finer, next two with six those above and below the canaliculated suture being the largest, last whorl with seven terminating at the periphery with two rows of the cinguli spotted with reddish-brown the intermediate ones white; last whorl slightly rounded; base convex and lirate with nine liræ brown-spotted; aperture orbicularly quadrate, sulcate and nacreous within, having four elongated sulci, two on the base and two on the wall of the last whorl; lip thin at the edge, thickened internally; basal margin crenulated; columella pearly white, subhorizontal, arcuate, subtruncate at the base, obtusely denticulated.

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* Since this paper was read, I have received a letter (10, xi. 1894) from Mr. Edgar A. Smith pointing out that Adams' specific name *comptus* must stand, as the species was described in 1854, whereas *T. comptus*, Philippi, was published in Lieferung 144 of the Conchylien Cab., issued in 1855, one year later. I concur in Mr. Smith's views.

Alt. $11\frac{1}{2}$, diam. 9; alt. 11, diam. $8\frac{3}{4}$ mm.

Alt. 8, diam. $6\frac{3}{4}$; alt. 8, diam. $6\frac{1}{2}$ mm.

Hab.—Cook's landing place, south side of Botany, in shell sand (1864); Shark Island, Port Jackson, found living under stones, low water, spring tides *(J. Brazier*, 1869); Long Bay, 9 miles south of Sydney; Middle Harbour in shell sand and beach shingle *(Henn and Brazier)*.

To the Proceedings of the Zoological Society of London, 1869, (p. 162) I communicated a paper on the distribution of *Bulimus miltocheilus*, Reeve, wherein I stated that specimens vary much both in size and colour.

Mr. E. A. Smith in 1885, (Proc. Zool. Soc. p. 595), recorded a collection of shells from the Solomon Islands collected by Dr. H. B. Guppy who found the variety with white lip at Santa Anna, a small island at the south end of San Christoval. I have seen the white variety very common from the above island, but none of the typical form with the vermilion lip have I ever seen from there. I now divide the varieties under a new distinguishing name with the habitat where each variety is found.

Bulimus (Aspastus) miltocheilus, Reeve.

Bulimus miltocheilus, Reeve, Conch. Icon. pl. 49, fig. 322; Deshayes in Fér. Vol. ii. p. 105, pl. 154, figs. 3, 4; Pfeiffer, Mon. Helic. Vol. iii. p. 372, Vol. iv. p. 440, Vol. vi. p. 77, Vol. viii. p. 108; Pfeiffer, Zeits. für Malakozool. Bd. v. p. 120, No. 35, 1848; *Aspastus miltocheilus*, Chenu, Man. de Conch. Part i. fig. 3216, 1859; Albers, Heliceen, 1st ed. p. 149, 1850; *Eumecostylus miltochilus*, Albers, 2nd ed. p. 186, 1869; *Otostomus miltocheilus*, H. and A. Adams, Recent Mollusca, Vol. ii. p. 151; *Bulimus (Aspastus) miltocheilus*, Tryon, Structural and Systematic Conchology, Vol. iii. p. 53, pl. 97, fig. 7, 1884.

Type white, with brilliant vermilion peristome. Long. 67 mm.

Hab.—San Christoval, found on the leaves of bushes and trees.

Var. *stramineus*.—Shell straw-yellow rather short; peristome darkish-red not so bright and brilliant as the type. Long. 53 mm.

Hab.—Ugi or Gulf or Golfe Island; found on the trunks of palm trees some four or five feet from the ground.

Var. *minor.*—Shell small, narrow, white; peristome pale orange-yellow. Long. 45 mm.

Hab.—Ulana or Ulaua or Contrariété Island; found on the trunks of palms.

Var. *albolabris.*—Shell white covered with a pale yellowish epidermis; peristome opaque white. Long. 55 mm.

Hab.—San Christoval and Santa Anna, found on the trunks and leaves of trees.

OBSERVATIONS ON *DENDROLAGUS BENNETTIANUS*, DE VIS.

By Edgar R. Waite, F.L.S.

(Zoologist, Australian Museum.)

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(Plates XLII.-XLIII.)

About a year ago Mr. D. le Souëf spent some time in Northern Queensland for the purpose of collecting Tree Kangaroos and other animals for the Melbourne Zoological Gardens. He was very successful, and obtained six examples of *Dendrolagus*, four of which reached Melbourne alive. Mr. le Souëf has published an interesting account of his experiences,* wherein he mentions that the kangaroos were identified by Mr. C. W. de Vis as the supposed species he had tentatively named *D. bennettianus*.

The daily papers of September 18th last announced that a steamer had arrived at Sydney from the North with eight cages of Tree Kangaroos. These animals, about sixteen in number, were captured, after considerable difficulty, on the Bloomfield River, and were shipped at Cooktown for delivery to the Zoological Gardens, Melbourne.

While on board, one of the smaller animals escaped from confinement and immediately jumped into the rigging, up which it went with amazing speed, and seemed perfectly in its element when in the vicinity of the mast-head.

* Victorian Naturalist, xi. No. 1, p. 3.

I regret that I missed the opportunity of seeing the animals alive. They were visited by my colleague, Mr. Robert Etheridge, jun., and our Taxidermist, Mr. J. A. Thorpe, and to them I am indebted for the following observations made upon them while in port :—

During the voyage the Tree Kangaroos were fed upon milk and unripe bananas, and, with one or two exceptions, appeared to be doing well. Their behaviour gives one the idea that they are nocturnal, or at least crepuscular animals. While in daylight they seem inclined to sleep; in this condition the body is bent forward until the snout is almost between the thighs, the fore feet being placed close to the cheeks.

Normally the ears have a horizontal aspect, but are drooped somewhat during sleep. When the animal is alarmed they are suddenly pricked, but never pressed backwards; in this respect they resemble the Phalangers.

Although the arrangement of the hair was particularly observed, I am told that where the hair of the back and the face meet very little indication of a crest was noticed in the living animal.

It was further observed, and special stress is laid upon this point, that the tail was usually passed under the body and carried in front; also that it occupied a similar position when the animal slept. So constantly was the tail carried in this manner that my informants consider it an habitual trait of the creature.

This position would bring the ventral side of the tail uppermost, a peculiarity which will be further noticed. This habit, if such it proves to be, albeit somewhat curious, is not without parallel. We shall recall the habits of the *Lemuroidea*, members of which habitually sleep with their tails beneath them, but as this member is frequently passed round the neck or disposed of about some other part of the body, it does not follow that the aspect of the tail is reversed as in the *Dendrolagi*.

Mr. le Souëf also observed that these animals carried their tails differently to other *Macropodidæ*, for he writes* :—" When on

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* *Loc. cit.* p. 13.

the ground their tails are curved upwards, and do not as a rule rest on the ground as with ordinary kangaroos."

Mr. Robert Grant, one of the Museum collectors, tells me that when engaged in obtaining *D. lumholtzi* in company with Mr. E. J. Cairn, he seldom saw them at rest, and never on the ground excepting when driven from a tree. He did, however, on one or two occasions observe them sitting on branches in the peculiar attitude mentioned.

He has given me some interesting information respecting the capture of this species in the Herberton district which it may not be out of place to mention here.

The native name is Mapi (Marpee, according to English pronunciation), and the animals are difficult to procure, as the blacks esteem them a delicacy and only surrender their captures when compelled. When a Mapi is discovered, a fence five or six feet in height and several feet in diameter is built of rattan or lawyer canes (*Calamus*) and bushes around the tree. Some of the blacks enter the enclosure, ascend the tree, and drive the animal down; it usually jumps to the ground, often from a height of twenty feet. Should it elect to descend the trunk, it does so tail foremost. On reaching the ground, the animal is eventually caught by the men surrounding the enclosure, generally by the tail, which member is dragged through the fence, the unfortunate Mapi being despatched with blows from a nulla nulla. The blacks will not venture within the fence on account of the dread in which they hold the powerful claws of the animal. The natives who hunted for Dr. Lumholtz called the animal Boongary, and adopted a somewhat different method of capture.*

A specimen of *D. dorianus* captured by Sir Wm. Macgregor and party during their ascent of Mt. Owen Stanley was described by Mr. C. Kowald to my colleague, Mr. Charles Hedley, as leaping down twenty feet or so from the tree when attacked by the hunters. Marks on the ground round the tree seemed to show that this was its usual mode of descent. Though too famished to

* *Vide* "Among Cannibals," p. 231.

be critical, the explorers considered the flesh of this animal very palatable.

Our Tree Kangaroos were obtained through the instrumentality of Mr. George Hislop, who, in response to my queries, has given me the following additional opinions or information respecting these interesting animals. He writes:—"In its native state I do not think the Tree Kangaroo would drink much water, if any, for the simple reason that it is generally found on the coast mountains about 1500 feet above sea level, and, as far as I know, well within the tropics. The vegetation at that altitude is almost invariably enveloped in moisture all night, just at the time when these animals are out feeding on it, so that they must get nearly all the water they require with their food. In captivity I have known them drink large quantities of water.

"I have skinned twenty or thirty of these Tree Kangaroos, but have never noticed any parasite under the skin."*

My correspondent referred me to his son, Mr. Robert Hislop, for further information, who kindly wrote to me from the Bloomfield River as follows:—

"The native name of the climbing kangaroo is Tcharibeena. The blacks hunt them with dogs and are very fond of the flesh. I had often heard the blacks talking about them, but though I have been here nearly ten years, it was only about three years ago that I succeeded in obtaining one. In the day time they are found among the top branches of the trees and come down in the evening to feed upon creepers, ferns and fruit. I have found several down on the flat land, but as a rule they seem to be most numerous on or near the top of the hill ridges here, which are about 1500 to 2500 feet high. When found in the day time, the animals are generally asleep with the heads hanging on the breasts between the fore limbs, and the tail is used as a balancing pole.

"At first I could not induce the blacks to catch any of the Tcharibeenas, as they said that a full grown one would show fight, but when I went with them and caught the first one myself with

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* *Cf.* "Among Cannibals," p. 235.

a lasso, they saw how easy it was and have since always caught them in this manner, excepting when out of reach; in this case they make the animal jump: as soon as it reaches the ground one boy holds its head down with a forked stick while another passes a bag over its hind quarters and slips it over its head.

"The best time to hunt them is early in the morning while the scent is fresh. A dingo or mongrel, the former preferred, is used, and follows the scent to the foot of the tree which the kangaroo has climbed to camp for the day. If the tree be a low one, it is tolerably easy to find the animal, but it often happens that they go from one tree to another before they find a suitable 'camp,' and then it becomes necessary for a native to ascend a high tree in the vicinity so as to be able to look down on the surrounding trees, as the kangaroo sits right out in the sun and is more easily seen from above than from below. If one approaches quietly, it is quite easy to catch the animal by the tail and slip it into a bag while up the tree; but the least noise rouses them, and it is surprising how quickly they can travel, jumping sometimes twenty to thirty feet from one tree to another, and I have seen one jump fully sixty feet from a high tree to the ground and not hurt itself at all. When jumping it seems always to land on its fore feet, and though I have repeatedly shaken them down from great heights I have never seen one injured, as they always, like a cat, fall on their feet.

"The tail is never used to hang by, only to balance with, though I have often seen one bend its tail over a branch while it reached down below the branch upon which it was sitting to secure some berries. The kangaroos can stiffen the tail so that it stands straight out like a rod. When caught and kept in captivity they soon become quiet and take readily to eating bread, sweet potatoes, apples, oranges, mangoes and the rinds of sweet potatoes and yams; also the leaves of several of the Eucalypti, white cedar (*Melia composita*, Willd.) and many other trees, the names of which I do not know. In the scrub they seem to have a partiality for the bird's nest fern (*Asplenium nidus*), the moustera (? *Rhaphidophora pinnata*, Schott), and a small climber like the pepper plant, and eat almost any of the wild fruits which are so plentiful here.

"The males are very pugnacious, and if two of them be put into an enclosure together will often fight until one is killed. They spar with the fore paws in quite a scientific manner, uttering grunts all the time, till one sees an opportunity of closing with the other, when he makes straight for the back of the neck, and if he succeeds in getting a grip with his teeth he shakes the other like a dog does a rat. Some of the old males have quite a harem and keep their wives from straying apart and do not let any other males go near them. I have found several of these families numbering from three to five females and one male. The young males, and also the very old ones, are generally found by themselves, or two or three of them together without any females. I think they breed twice a year and have only one young one at a birth. . . .

"The kangaroos are most plentiful among rocky hills where the scrub is thick and stunted, and though they feed both on the ground and in the trees and among rocks, I fancy that they feed mostly in the two latter places.

"The only enemy they have, as far as I can find out, is the animal my father told you about, which must be some kind of tiger-cat.* The glands situated immediately under the root of the tail contain a strong smelling yellow fluid in both male and

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* There can be little doubt that the animal referred to is identical with the one mentioned in the Proc. Zool. Soc. 1871, p. 629, by Mr. Brinsley G. Sheridan. He gives an interesting account of a "Native Tiger" having been seen by his son on the shores of Rockingham Bay, who thus described it:—"As big as a native dog; it's face round like that of a cat, it had a long tail, and its body was striped from the ribs under the belly with yellow and black."

In P. Z. S. 1872, p. 355, the "Tiger" is again referred to from Cardwell, and although the animal was not seen, its footprint was sketched, and is reproduced. Mr. W. T. Scott, who contributed the note, ventured the opinion that it might be allied to the Tasmanian Tiger (*Thylacinus cynocephalus*), remarking "that a bullock-driver of ours, as long ago as 1864, came in one day with a story that he had seen a Tiger; but as he was a notorious liar we did not believe a word of it at the time."

female. I notice in the very old males that the smell from these when cut is almost overpowering."

Of the sixteen animals previously mentioned, two died before reaching Sydney, an adult female and a half-grown male. These, together with two roughly prepared skins, were offered to the Australian Museum and purchased.

At the first glance it was apparent that the species was perfectly distinct from the Queensland form *D. lumholtzi*, Collett.* Further examination showed that it could not be reconciled with the descriptions of the Papuan forms *D. ursinus*, Müller and Schlegel, *D. inustus*, M. and S., and *D. dorianus*, Ramsay.

We find the animal again incidentally mentioned in the P. Z. S. 1873, p. 518, as follows:—"A letter was read from Dr. G. Bennett, referring to the supposed existence of a species of Tree Kangaroo (*Dendrolagus*) in Northern Queensland, some such animal being apparently well known to the blacks of Cardwell. Mr. Sclater remarked that this might account for the stories of the supposed 'Native Tiger' in the same country."

Dr. Bennett evidently also inclined to this opinion, for in P. Z. S. 1885, p. 65, while writing about the Tree Kangaroo he says:—" . . . I may further remark that the size and deep scratches observed on the bark of the trees, gave rise to a report that a tiger-like animal was to be found in Northern Queensland, as no one believed that kangaroos could climb trees, being ignorant of the existence of arboreal kangaroos in New Guinea. . ."

That the scratchings were caused by Tree Kangaroos is probably correct, but that the *scratchings* gave rise to such a report is, as we may see by the passages quoted, quite incorrect. It is positively asserted by the blacks over wide-spread districts, that some large carnivorous animal does exist in the higher part of the ranges, but nothing can induce them to visit these spots on account of the dread in which they hold the animal. As is well known, the natives believe in certain mythical creatures, the Bunyip for example, but which none claim to have ever seen. Respecting the "Tiger," however, collectors and settlers have met several blacks who affirm that they have seen the animal, and agree in describing it as large, with a big mouth and teeth.

Mr. Broadbent was specially deputed by the Queensland Museum to investigate the subject, but after much search he concluded that the animal was a myth, probably founded on *particularly* large Dasyures.

Considering how long other creatures have remained unknown, it is quite reasonable to suppose that such an animal may yet be found inhabiting the

* Proc. Zool. Soc. 1884, p. 387.

Mr. C. W. de Vis hesitatingly named an imperfect skin *D. bennettianus*,* and although the description is necessarily somewhat meagre, it is, I think, sufficient to justify me in regarding our specimens as identical with it. I am pleased to be able to more fully establish the species, and as we possess excellent material, I submit the following as a description of the adult female before mentioned. The measurements were made in the flesh.

Description.

Head and body...	610 mm.	Tail	631 mm.
Ear.................	38 mm.	Hind foot.........	134 mm.

Rhinarium tolerably clothed with short hairs, space between the nostrils naked. Fur soft and long, especially on the back and sides. The hair radiates from a point some distance behind the shoulders, whence it is directed upwards to the head; it meets the hair of the face in front of the ears and forms a tortuous crest, the central point directed backwards to between the ears; on the under side of the throat the hair is also reversed. Ears naked within excepting towards the tip, where they are scantily provided with long silky hairs. Tail cylindrical, thick at the base, tapering;

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thick scrubs of Queensland, and the following account by Mr. Robert Hislop, who evidently fully believes in the existence of the animal, certainly appears to be most circumstantial:—"The blacks say that they have watched this animal's mode of attacking the kangaroo. It only does so when its victim is isolated from its mates and then only by stealth. It keeps at a distance from its prey until it can frighten it by suddenly rushing towards it, uttering screeches. As soon as the kangaroo turns its back or is in the act of jumping away, the cat springs on its back and crushes the base of its skull in its jaws, which the blacks describe as being very powerful. I have never seen this animal myself, but I have seen its tracks, which are very similar to those of a large dog and seem to be provided with long claws. The blacks describe it as about the size of a bulldog with long brindled fur and very large eyes. They are very frightened of it and will not go near any cave or hole where they think one might be, as they say it does not hesitate to attack a man and often kills their dogs."

* Proc. Roy. Soc. Queensland, iii. 1886, p. 11.

fur harsher than on the body, it gradually lengthens towards the tip and forms a distinct tuft.

Colour.—Face grey, passing into chestnut and rufous on the head, upper surface of body dark warm brown, black at and around point of radiation, and generally dark on the vertebral line; this colour passes into a lighter tint on the sides, haunches and rump; back of neck rich reddish-brown, fading into chestnut at the sides, but again becoming redder on the throat; this colour also extends along the front edge of the fore limbs. Eyebrows, eyelashes and whiskers black and scanty: the chin has also black whisker-like hairs. The lower surface is generally darker from the chest to the pouch, thence more rusty and lighter beyond. Fore feet black; hind feet black with lighter hairs above. All the toes and claws black. At the upper base of the tail is a conspicuous reddish-brown patch passing abruptly into black, which colour extends for four or five inches and almost as suddenly gives place to light rufous-brown; this tint extends to within a third of the tip and insensibly merges into black. The ventral surface is black throughout its length.

In the young male the colours are not nearly so rich, the back is grey, becoming lighter on the sides and rump, an ill defined vertebral line much darker: dorsal surface of tail darker than in the adult. The division between the colour of the limbs and the feet much more strongly marked.

The two skins purchased with these specimens are somewhat intermediate in age and colour. In both, the dorsal surface of the tail is very light, but all agree in having the entire ventral surface black.

The dorsal surface of an animal, including the tail, is usually darker than the ventral surface. To this rule exceptions are extremely few; an excellent instance is *Grisonia vittata*, Schreb. In both the Queensland *Dendrolagi* the colouration of the tail is reversed, the ventral surface being the darker. From the habits of *D. bennettianus*, observed by Messrs. Etheridge and Thorpe, and of *D. lumholtzi* by Mr. Grant, it may be inferred that the change in posture caused this change in the disposition of colour.

Skull.—

Basal length	105	mm.
Greatest breadth	66	,,
Nasals, length	45	,,
,, greatest breadth	24·5	,,
,, least breadth	12·5	,,
Constriction, breadth	20·5	,,
Palate, length	63	,,
,, breadth outside M^2	32	,,
,, ,, inside M^2	21	,,
Palatal foramen	5·4	,,
Diastema	19·2	,,
Basicranial axis	36	,,
Basifacial axis	71	,,
Facial index	197	,,
Teeth, length of I^3	3·2	,,
,, ,, P^4	8·5	,,
,, ,, M^{1-3}	17·2	,,

Skull robust, more slender in the facial region, sides of muzzle concave; a pair of small prenasals (7 mm. in length) are separated from the nasals by a transverse suture. Nasals expanded behind, gently bowed in the middle, narrowest anteriorly: posterior suture somewhat recurved. Ascending processes of premaxillæ slightly broadened above, premaxillo-maxillary suture but little inclined. Naso-premaxillary short, little more than two-thirds the length of the naso-maxillary suture. Interorbital space narrow and concave. Frontal region not swollen. Fronto-parietal sutures produced backwards until they meet in a very acute angle. The median frontal suture does not reach this point, but at a distance of 10 mm. is interrupted by a distinct transverse suture which thus forms a small postfrontal. Temporal crests defined but not prominent. Interparietal large; its anterior suture forms a straight line. Foramen magnum broader than high.

Teeth.—The teeth are generally similar to those of *D. lumholtzi.* The canines are larger than I^2 and the main crest of the premolar appears to be rather more external. The relative position of each row of teeth is slightly different owing to the narrower snout; instead of forming nearly straight lines, they converge somewhat anteriorly. In the lower jaw the premolar is in the same line with the molars, whereas in *D. lumholtzi* it inclines outwards. In this species also the external opening of the dental foramen is large and constitutes a direct perforation. In *D. bennettianus* it is small and deeply sunk, and the mental foramen is placed more forward, quite in advance of the premolar.

Being suspicious that this skull was abnormal as far as the prenasals and postfrontal are concerned, I had one extracted from a dried skin. This is unfortunately so battered about the muzzle as to render that portion useless for comparative purposes. There is no postfrontal and the fronto-parietal suture is rounded behind: it is therefore highly probable that the prenasals of the skull first examined may be only a dismemberment of the nasal. The damaged skull is from an immature animal and differs from the adult in having the fronto-parietal crests scarcely discernible and widely separated. The interorbital space is also proportionately broader.

Collett writes of *D. lumholtzi**:—"Somewhat to the front end of the interparietale, each parietale is perforated by a foramen [which I cannot discover in the other *Macropodidæ* which have come under my notice]; in the skull of a young individual [length 106 mm] it is indistinct on one side."

In all our specimens this foramen occurs on both sides, but not in all cases in the same relative position. Such foramina also exist in *D. bennettianus* and are placed slightly behind the front front edge of the interparietal.

Collett also says—"The palate is entire, and has no foramina palatina." One only of our examples shows a single inconspicuous foramen, but in both our skulls of *D. bennettianus* the posterior palate is perforated by two vacuities many times larger than the posterior palatine foramina.

* Zool. Jahrb. ii. 1887, p. 900.

In the generic description of the skull, Mr. Oldfield Thomas writes* :—"Posterior palate complete, without vacuities." This will therefore require to be slightly amended in order to receive *D. bennettianus.*

The distinguishing features may be summed up as follows:—

External Characters.

Fur on the back directed backwards, body brown, neck rufous, tail black ventrally, lighter dorsally.

Cranial Characters.

I^1 but little exceeding I^2 and I^3 in its downward projection. Canine larger than I^2. Forehead not inflated. Fronto-nasal suture recurved forwards in the centre.

Externally the species appears to most nearly resemble *D. inustus.* The skull also agrees with that species and with *D. ursinus* in the non-inflated forehead, but differs from these and agrees with *D. lumholtzi* in the formation of the fronto-nasal suture.

I am much indebted to Mr. J. J. Fletcher, who has very kindly lent me his copy of Schlegel and Müller's work,† a reference to which has enabled me to compare *D. bennettianus* with the descriptions and figures of *D. ursinus* and *D. inustus*, therein described.

DESCRIPTION OF PLATES.

Dendrolagus bennettianus, De Vis.

PLATE XLII.

Fig. 1.—Skull in profile; natural size.

PLATE XLIII.

Fig. 2.—The same from above; reduced.

Fig. 3.—The same, from below; reduced.

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* B. M. Cat. Marsupialia, 1888, p. 93.

† Verh. Nat. Ges. Ned. (1839-44).

NOTES AND EXHIBITS.

Mr. Brazier exhibited typical specimens of *Bulimus miltocheilus*, Reeve, and the varieties mentioned in his paper, and of *Trochus Adamsi*, Brazier, and *Trochus Poupineli*, Montr., from Isle Nou, New Caledonia.

Mr. Hedley remarked that an inspection of *Calliostoma Poupineli*, handed round by Mr. Brazier, and which he had not before seen, proved that the Australian species certainly differs from the New Caledonian. He failed, however, to distinguish specifically the species re-named *C. Adamsi* by Mr. Brazier from that recently figured and described by himself as *C. purpureocinctum*.

Mr. Maiden exhibited specimens of *Litsæa (Tetranthera) reticulata* (N. O. Laurineæ), a plant new for the Colony, from Lismore, Richmond River, where it is known as "She Beech," and (with larger leaves) from Port Macquarie, where it passes under the name of "Scaly or Yellow Beech."

Mr. Fred. Turner exhibited specimens of *Morchella conica*, Pers., collected by him on a grassy shady flat and on the side of a shady hill, near Junee. Some of the specimens were five inches long, and one and a-half inches in diameter. So far as he was aware this fungus has only hitherto been known to occur in New South Wales by a single specimen which was sent to him for identification from the south coast district about five years ago. Dr. Cook, in his "Handbook of Australian Fungi," gives as the habitat of the species only Victoria, South Australia, and Tasmania.

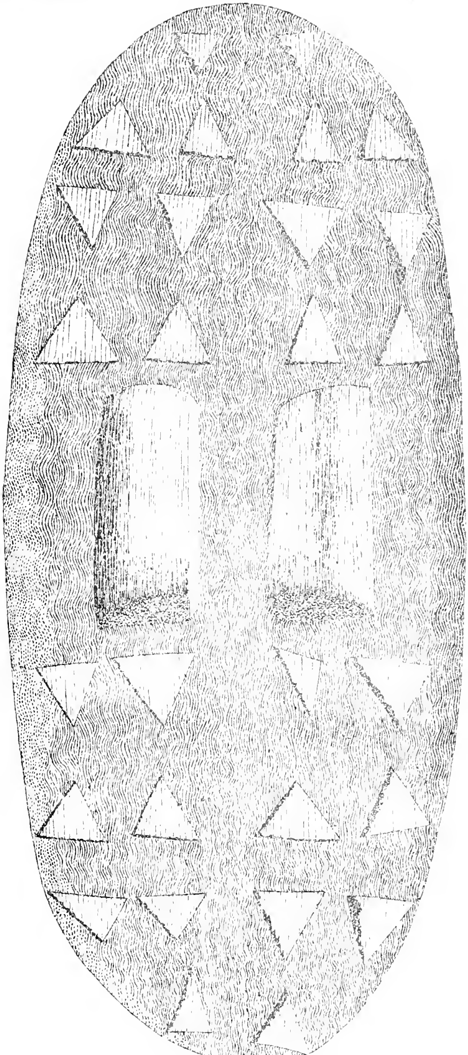
Mr. Waite exhibited a mounted specimen, and a skull of *Dendrolagus bennettianus*, in illustration of his paper.

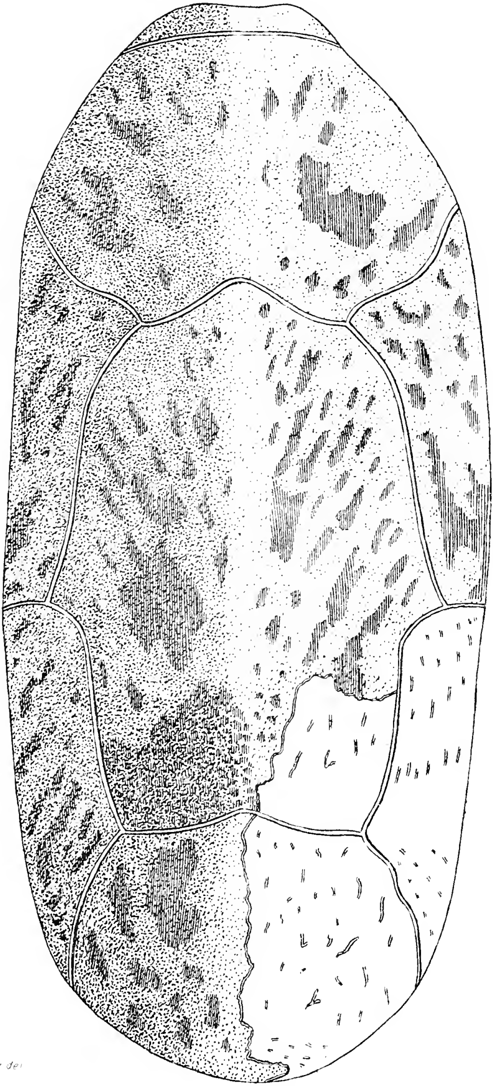
Mr. A. G. Hamilton sent the following note on *Pittosporum undulatum*, Andr. :—

"Recently, in examining some flowers of this plant, I found the anthers very slightly developed, and the stigma mature, suggesting that the plant was strongly proterogynous. In flowers from another tree, however, the anthers were found to be well developed, while the stigma was immature. Further examination of similar specimens has led me to the opinion that in this species a differentiation of the sexes is going on. The short stamens contain pollen in an undeveloped state; and honey is freely secreted. I have been unable to find any record of this fact, or any figure of the flowers with short stamens. Trees with flowers bearing short stamens are very plentiful here at Mt. Kembla, and Mr. E. Betche, to whom I pointed out the facts, informs me that trees about Sydney also exhibit the same peculiarity. Mr. Thomson (Trans. N.Z. Institute, 1880) says that the flowers of *P. tenuifolium* are proterogynous, and that *P. eugenioides* inclines to separation of the sexes."

Dried specimens, pistils and stamens of both in preservative liquid, and drawings were exhibited in illustration.

Mr. North exhibited a male and female of the common Shoveller, *Spatula clypeata*, Brisson; also a male and female of the long-tailed Cuckoo, *Urodynamis taitensis*, Sparrm., and read the following note:—"The specimens exhibited this evening were recently presented to the Trustees of the Australian Museum by the Hon. C. R. Swayne, H.B.M.'s. Resident at the Gilbert Group—England's latest annexation in the Pacific. The female Shoveller was shot on Big Makin Island by Captain J. G. Bremer, R.N. of H.M.S. "Ringdove," on the 22nd of June, 1894, who also succeeded on the following day in procuring the male which is in full adult livery. This species is common in Europe, Northern Africa, and Southern Asia, and has been recorded as a winter visitant to China and Japan. Previously this species had never been seen on the island, and the natives expressed an opinion that they had been probably blown there by one of the westerly gales which are experienced about once in two years. Mr. Swayne informs me that Big Makin Island or "Butari-tari" of the natives, is an atoll of the usual crescentic form situated immediately on the equator, and is about twenty-five miles in length, and averages six hundred yards in breadth. It is only eight feet above the level of the sea, and in parts is covered with grass or a low dense scrub, in which the cocoanut palm flourishes. On the same island on the 1st June of the present year, Mr. Swayne procured





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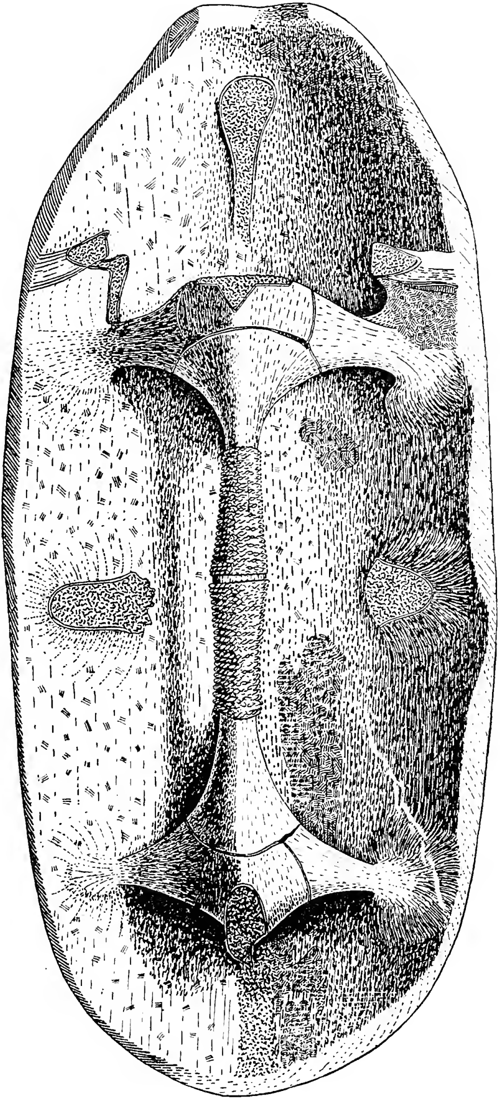

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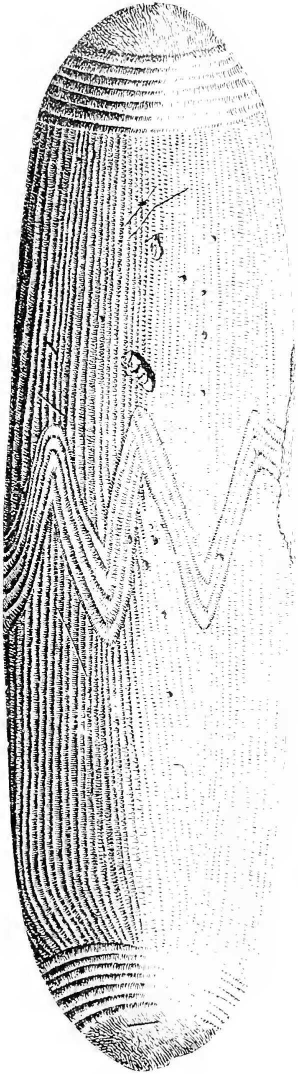

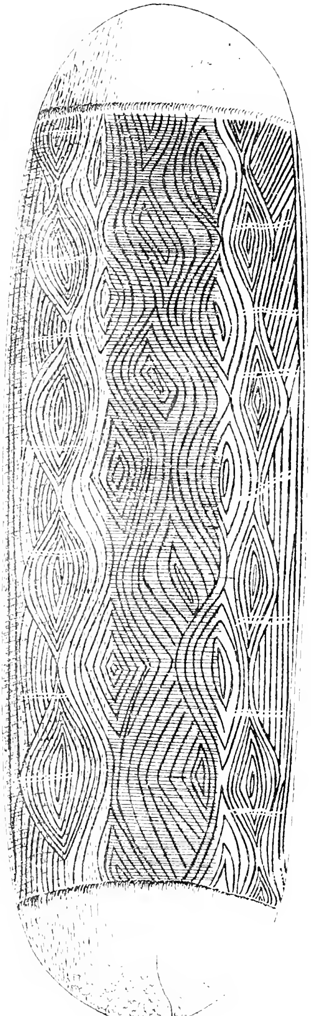
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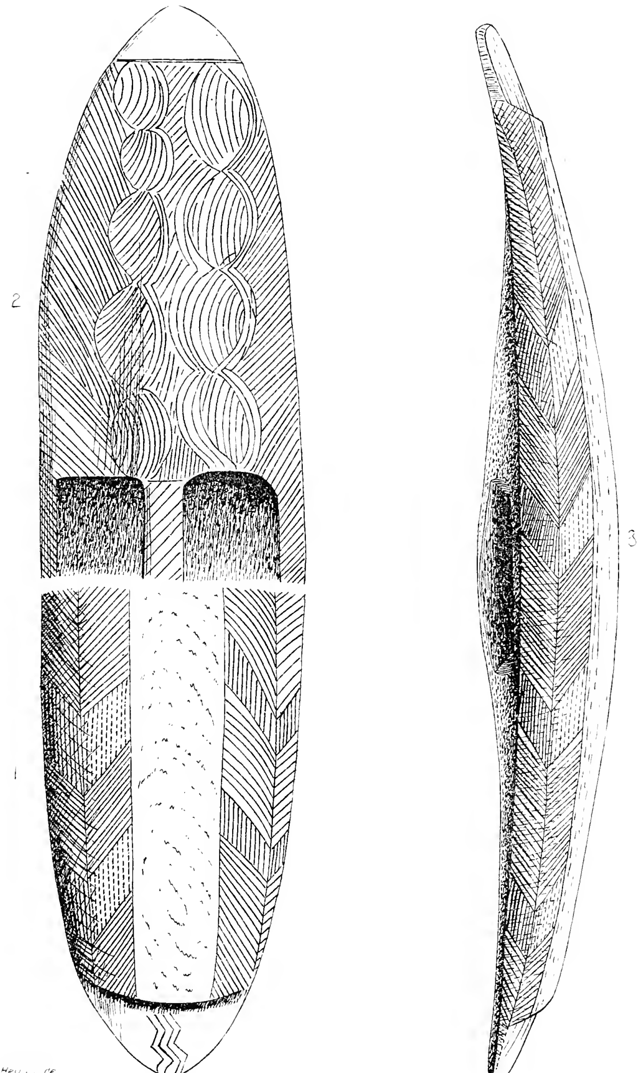

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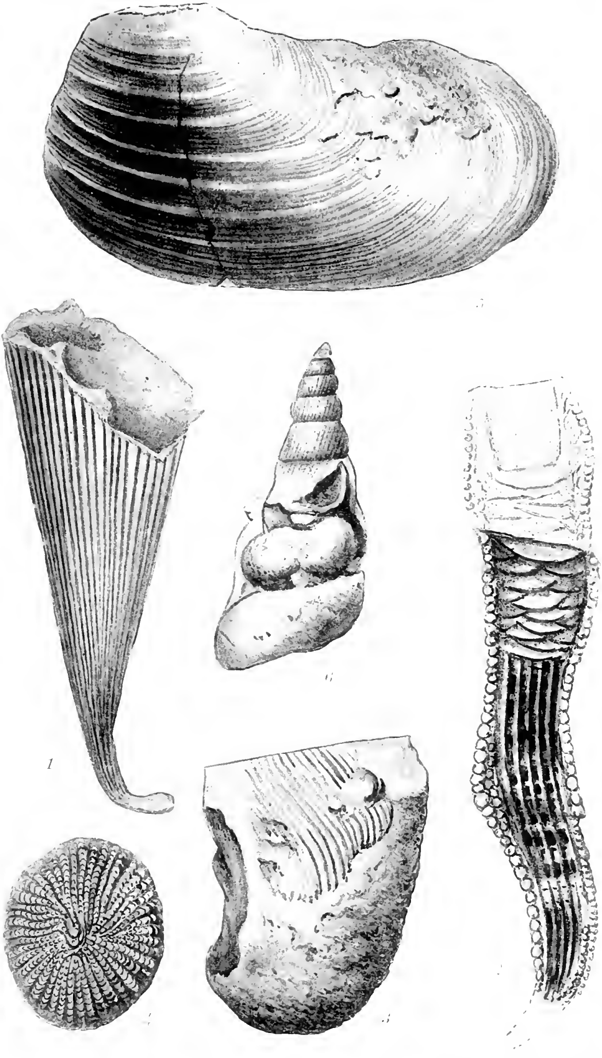

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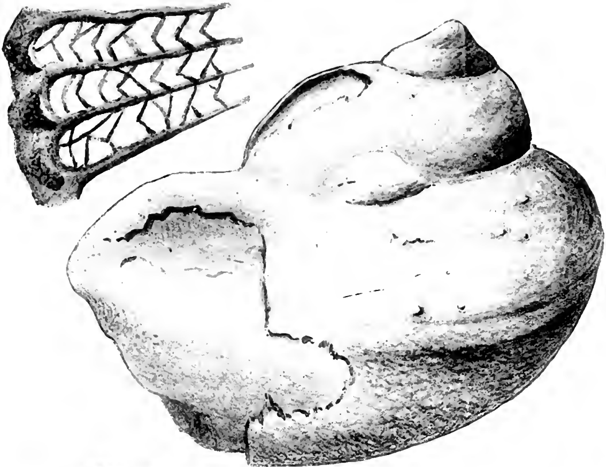

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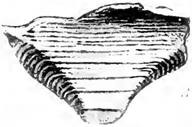

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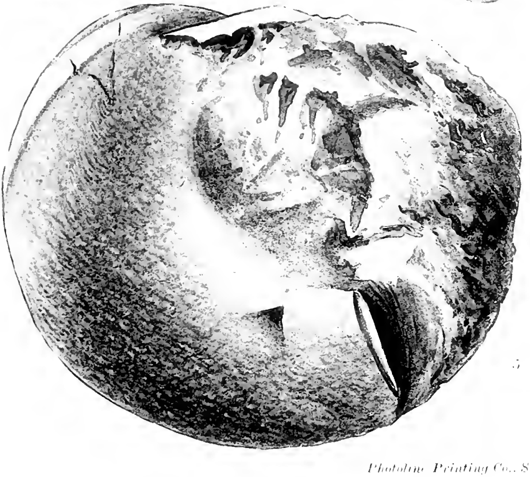

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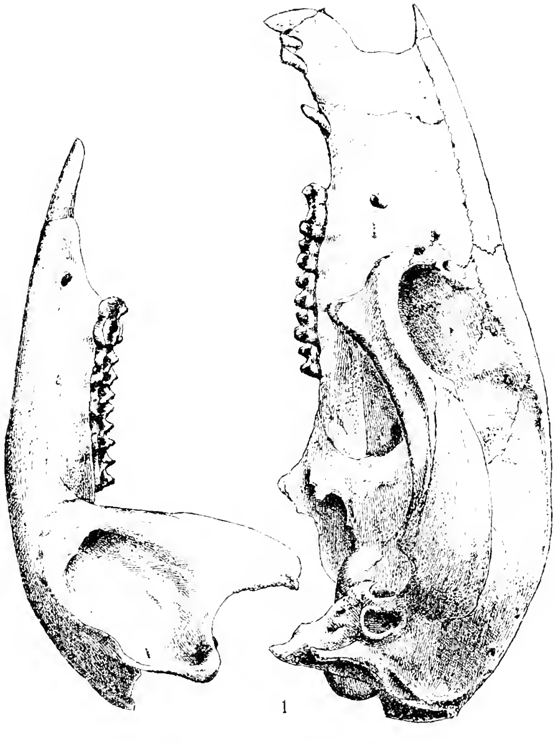

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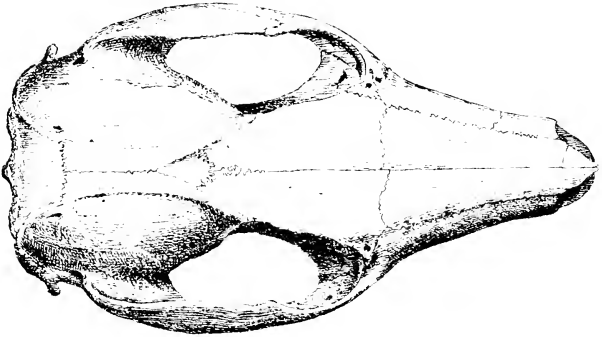
Edgar R. Waite del.

DENDROLAGUS BENNETTIANUS De Vis.



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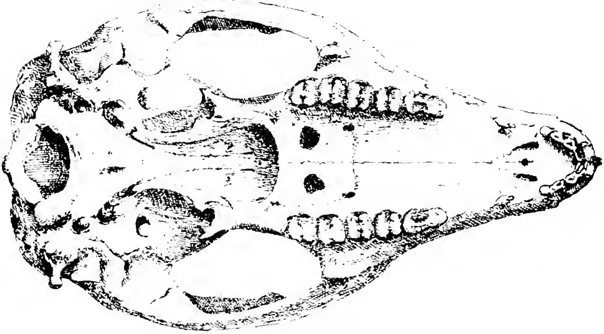

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Edgar R. Waite, del. DENDROLAGUS BENNETTIANUS, De Vis.

the male and female *Urodynamis taitensis.* This species is a regular visitant to New Zealand, arriving there early in October and departing again at the end of February. According to Sir Walter Buller it is parasitic in habits, and in his second edition of the "Birds of New Zealand," he gives an interesting account of an egg of this Cuckoo being hatched out by a Wood Robin, *Miro albifrons,* in whose nest it had been deposited. He has also frequently seen the little Grey Warbler, *Greygone flaviventris,* feeding the young of this Cuckoo. It is truly a nomadic species, wandering over many islands of the South Pacific, having been recorded from Norfolk Island, Samoa, Fiji, the Friendly Islands and the Solomons. In 1892 a specimen was also obtained on Lord Howe Island by Mr. T. R. Icely, the Visiting Magistrate. Previously this species has not been recorded so far north as the Gilbert Islands. Mr. Swayne informs me that it is the only land bird found on the group, and that it seldom makes its appearance except just before rain sets in. The natives, who have never seen the egg of the long-tailed Cuckoo, look on the bird with some awe, and the tradition current among them is, that the female strips a portion of the cloth-like covering of the young palm leaf and flying up with it deposits it on a cloud, lays her egg on it and leaves it to be hatched by the sun."

Mr. North also exhibited the head, crop, and gizzard of a Wonga-wonga pigeon (*Leucosarcia picata,* Lath.), shot by Mr. H. J. McCooey in a myrtle scrub at Upper Burragorang on the 21st instant. The crop is absolutely crammed with dipterous larvæ (*Habromastix cinerascens,* Sk.), and undigested portions of them mixed with seeds, berries, and earth appear also in the gizzard. As the dipterous larvæ are known to be destructive to grass, the Wonga-wonga would appear to be deserving of consideration.

WEDNESDAY, OCTOBER 31st, 1894.

Professor Haswell, M.A., D.Sc., Vice-President, in the Chair.

The Chairman reminded Members that the Current Session would close with next month's Meeting.

DONATIONS.

"Public Library, Museums, and National Gallery of Victoria—Report of the Trustees for 1893." *From the Trustees.*

"Department of Mines, Sydney—Records of the Geological Survey of N.S.W." Vol. iv. Part 2 (1894). *From the Hon. the Minister for Mines and Agriculture.*

"Pharmaceutical Journal of Australasia." Vol. vii. (1894), Nos. 9-10. *From the Editor.*

"Société Hollandaises des Sciences à Haarlem—Archives Néerlandaises." T. xxviii. 2me Liv. (1894). *From the Society.*

"Société d'Horticulture du Doubs, Besançon—Bulletin." n.s. No. 44 (August, 1894). *From the Society.*

"Royal Dublin Society—Transactions." Second Series. Vol. iv. Part 14; Vol. v. Parts 1-4: "Proceedings." Second Series. Vol. vii. Part 5; Vol. viii. Parts 1-2. *From the Society.*

"Royal Society of Queensland—Proceedings." Index to Vols. vii-ix. (1890-93); Vol. x. (1892-94). *From the Society.*

"Zoologische Station zu Neapel—Mittheilungen." xi. Band, 3 Heft (1894). *From the Director.*

"Zoologischer Anzeiger." xvii. Jahrg. Nos. 455-456 (August-September, 1894). *From the Editor.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 18-20. *From the Government Secretary.*

"Royal Society of Canada—Proceedings and Transactions for the year 1893." Vol. xi. *From the Society.*

"Geological Survey of India—Records." Vol. xxvii. Part 3 (1894). *From the Director.*

"Société Royale Linnéenne de Bruxelles—Bulletin." xix^{me} Année. No. 9 (1894). *From the Society.*

"Royal Geographical Society of Australasia—Proceedings and Transactions of the Queensland Branch." Vol. ix. (1893-94). *From the Society.*

Société Royale de Géographie d'Anvers—Bulletin." T. xix. 1er Fasc. (1894). *From the Society.*

"Australasian Association for the Advancement of Science—Report of the Meeting held at Adelaide, September, 1893." Vol. v. *From the Association.*

"Victorian Naturalist." Vol. xi. No. 6 (September, 1894). *From the Field Naturalists' Club of Victoria.*

"New Zealand Institute—Transactions and Proceedings." Vol. i. (1868). Second Edition. *From the Director.*

"New Zealand Institute—Transactions and Proceedings." Vol. vi. (1873). *From the Auckland Museum.*

"Agricultural Gazette of N.S.W." Vol. v. (1894), Part 9. *From the Hon. the Minister for Mines and Agriculture.*

"Museum of Comparative Zoölogy at Harvard College—Bulletin." T. xxv. No. 7 (August, 1894). *From the Museum.*

"Australasian Journal of Pharmacy." Vol. ix. No. 106 (October, 1894). *From the Editor.*

"Natural History Society of New Brunswick—Bulletin." Nos. vi.-xi. (1887-93). *From the Society.*

Menke's "Molluscorum Novæ Hollandiæ Specimen." 4to. (1843). *From C. T. Musson, Esqr., F.L.S.*

"Tufts College Studies." Nos. i.-ii. (1894). *From the College.*

"Indian Museum—Natural History Notes." Series ii. No. 14 (1894). *From the Trustees.*

"Société des Naturalistes de la Nouvelle-Russie—Mémoires." T. xviii. Part 2 (1894). *From the Society.*

"Department of Mines, Perth—Mining Handbook to the Colony of Western Australia (1894): Geological Sketch Map of Western Australia (1894); Mining Leases at Coolgardie and Kalgoorie; Plans Showing Routes to Yilgarn, Coolgardie, Dundas, and Murchison Gold Fields." *From the Secretary for Mines.*

PAPERS READ.

DESCRIPTIONS OF NEW SPECIES OF AUSTRALIAN COLEOPTERA.

By Arthur M. Lea.

The species described below are all from New South Wales, the majority of them collected by myself.

Staphylinidæ.

Xantholinus olliffi, n.sp.

Black, shining; elytra with a bronzy or purplish tint. Antennæ reddish-piceous, the first three joints shining, the last tinged with red at the apex; tibiæ and tarsi reddish-piceous, palpi red. Scutellum greenish-black. Head, first three joints of antennæ, prothorax, elytra, femora and tibiæ with a few scattered blackish hairs; eight distal joints of antennæ densely pubescent; abdominal segments with long brownish hair, shortest above; tibiæ densely spinose and setaceous.

Head subquadrate; in ♀ as broad, in ♂ broader than prothorax, slightly emarginate, and with a row of rather coarse punctures at the base, several large punctures behind and at the sides of the eyes, (sometimes connected) the frontal sulci short and terminating in a shallow depression; the head is also extremely minutely punctate on the disk, sides and beneath; antennæ slightly longer than the head, the first three joints with a few punctures; 1st joint as long as 2nd-4th, 2nd not much shorter than 3rd, 4th-10th cylindrical and transverse. Prothorax about as long as head or elytra, at the base narrower than the elytra, considerably narrowed behind, minutely punctate like the head, the lateral margin with an irregular row of punctures, with some irregular punctures on each side in front; there is also on the disk, at a short distance obliquely from the anterior angles, a small puncture in the centre of a shallow depression. Scutellum depressed, with three irregular rows of punctures. Elytra very minutely and shallowly punctate, each with three irregular rows of stronger punctures, the strongest touching the suture, the middle on the disk, and the third (which perhaps should be regarded as two), at the sides, base also irregularly punctate; abdomen beneath minutely punctate. Anterior coxæ, sides of the femora, and the tibiæ punctate. Length, 10-13, width $1\frac{3}{4}$-2 mm.

Hab.—Tamworth.

Obtained during a flood in the Peel River. In two of my specimens there is a coppery tinge along the suture and rows of punctures on the elytra.

PARNIDÆ.

ELMIS V-FASCIATUS, n.sp.

Elongate, subdepressed, subshining. Black; antennæ, palpi, tarsi, trochantins, coxæ and undersurface (except at sides) testaceous-red; sides tinged with piceous; femora dark reddish-brown, tibiæ paler; prothorax narrowly margined at apex with red, the extreme sides brownish; scutellum dark red; elytra narrowly margined with red; with a number of elongate, pale-yellow markings, forming an irregular V, each elytron having five to seven, the 3rd from the suture being the longest, sometimes two or three are united at the shoulders; towards the apex also there is a somewhat triangular mark, very indistinctly connected with the 3rd and 4th stripes. Covered all over with extremely short pubescence. Head densely and minutely punctate; prothorax less densely and distinctly; elytra extremely minutely and obsoletely punctate, with striæ distinct and strongly punctured at base, becoming feebler and less strongly punctured towards apex; middle of the pro-, meso-, and metasternum and basal abdominal segment strongly punctured, the sides minutely punctate.

Head longer than wide; antennæ slender, slightly passing prothorax. Prothorax longer than wide, much narrower in front than behind, base shallowly bisinuate; the disk with two transverse impressions, the anterior deep, commencing at the sides in front, continuous across and slightly in front of the middle; the posterior impression shallow, feebly, or not at all connected with the anterior along the median line. Scutellum round, shallowly impressed in the middle. Tarsi longer than tibiæ. Length 3, width $1\frac{1}{5}$ mm.

Hab.—Tamworth.

E. 9-notatus, King, differs in being broader and more robust, differently marked and punctured, prothorax without discal impression, metasternum sharply sulcate, legs thicker, tarsi shorter than tibiæ, darker beneath, &c.

SCARABÆIDÆ.

DIPHUCEPHALA LATICOLLIS, n.sp.

♂. Above bright coppery-red, viewed endways or from the sides with a greenish reflection; undersurface and legs brassy-green, legs with occasional bluish and coppery tints, tarsi greenish-black. Prothorax with sparse, extremely minute erect pubescence. Undersurface on the pro- and pygidium (except apex) and legs with rather long and not very dense whitish hairs.

Head densely punctate, punctures largest towards the base, clypeus deeply emarginate and reflexed; an indistinct impression between the eyes. Prothorax densely covered with small, round, shallow, punctate foveæ; dorsal channel shallow, irregular, widest at base; lateral impressions deep, feebly connected across the disk and terminating outwardly in a small, obtuse projection. Scutellum depressed, very minutely and densely punctate behind, highly polished in front. Elytra densely and rugosely punctate, punctures large, decreasing in size towards apex; 3rd and 5th interstices slightly elevated. Pygidium densely and very minutely punctate. Beneath minutely punctate, punctures almost concealed by the hairs. Legs long, minutely punctate; anterior tibiæ bidentate, the teeth small, red. Length $6\frac{1}{2}$, width $2\frac{1}{2}$ mm.

♀. Differs in being duller, broader, legs shorter, less densely pilose, the clypeus flat and scarcely emarginate. Length $6\frac{1}{2}$, width $3\frac{1}{4}$ (vix) mm.

Hab.—Galston. (On flowering shrubs in a deep gully.)

The above species will come in Sir Wm. Macleay's Sec. ii., and the second division of Sub-sec. B. Of my five specimens, three males agree in having the eyes of a chestnut colour, while in the females they are black.

Liparetrus tuberculatus, n.sp.

Smooth and shining. Head, prothorax, undersurface, and femora black; elytra, tibiæ and tarsi dark reddish-brown; apical abdominal segment tinged with red. Undersurface of the head, pro-, meso-, and metasternum covered with long yellow hair, less densely on the legs, a few also on the abdominal segments, tarsi densely spinose.

Head densely and deeply punctate (except at the base where it is very shallowly punctate), clypeal suture not straight. Prothorax not so densely nor deeply punctate as the head, a shallow depression at the base, median line unmarked. Scutellum triangular, impunctate. Elytra with the punctures stronger than those of the prothorax, weakest on the disk, and with four geminate striæ; shoulders prominent. Pygidium punctate and carinated in the middle, propygidium large, punctate (except at the sides), and with a distinct rounded tubercle in the middle. Anterior tibiæ tridentate, the 3rd from the apex very small. Length 6, width $3\frac{1}{4}$ mm.

This species evidently belongs to Sir Wm. Macleay's Sec. i, Sub-sec. 3, c. It may be readily distinguished from all others of the genus by the tubercle on the propygidium. I have but one specimen, given me by Mr. Kershaw, senr., of Melbourne, who thinks he obtained it near Newcastle.

BUPRESTIDÆ.

Trachys socialis, n.sp.

Short, subdepressed, the derm shining. Above brassy, with purplish reflections; undersurface, legs and antennæ bluish- or coppery-black. Upper surface with rather short, decumbent, golden pubescence, becoming paler towards apex of elytra; on elytra the pubescence is in irregular fasciæ; lower surface without pubescence. Head and prothorax minutely punctate: elytra rather densely and towards base coarsely punctate, the punctures in irregular rows; on the undersurface the marking is only distinctly visible when viewed sideways, consisting of numerous extremely shallow lanceolate impressions, in the centre of each of which is a small puncture.

Head depressed in the middle, median line feebly marked, a small fovea on each side close to apex of eyes. Prothorax widely transverse, much broader behind than in front, deeply and semicircularly emarginate in front, anterior and posterior angles acute, sides depressed behind anterior angles. Scutellum small, elongate-triangular, base rounded, feebly impinging on prothorax, without punctures or pubescence, highly polished. Elytra nearly thrice as long as head and prothorax combined, with shallow irregular depressions, trisinuate at base, a narrow distinct costa on each elytron continuous from shoulder to apex. Apical abdominal segment narrowly margined. Length $2\frac{1}{4}$-3, width $1\frac{1}{4}$-$1\frac{1}{2}$ mm.

Hab.—Dalmorton.

Differs from *T. australis*, Macl., (which it otherwise closely resembles) in being larger and broader, darker and less hairy. I obtained numerous specimens on a vine (the leaves of which were perfectly riddled by them) in thick scrub on the banks of the Little River (a tributary of the Clarence).

EUCNEMIDÆ.

DROMŒOLUS NIGRICOLLIS, n.sp.

Elongate, subparallel, subopaque. Head, prothorax and undersurface black, prothorax narrowly margined with obscure red; scutellum either reddish-brown or black; elytra either dark or testaceous-red, becoming piceous towards apex; antennæ, tibiæ and tarsi dark red, mandibles and femora reddish-piceous; apical segment of abdomen obscurely marked with red. Head and prothorax with sparse, obscurely coloured pubescence, elytra with rather dense and very short yellowish pubescence, beneath the pubescence is longest and somewhat paler. Head (including 1st joint of antennæ) and prothorax covered with dense punctures, which under the microscope appear as shallow, minutely punctate, rounded pits, from the middle of each of which a small hair rises; scutellum densely punctate; elytra punctate-striate, interstices densely and shallowly punctate; beneath sharply, the abdominal segments shallowly punctate.

Head with a narrow, shining carina, commencing at the base, and ending in a shallow depression between the eyes; antennæ slightly passing intermediate coxæ, 1st joint bent as long as 2nd-4th combined, 2nd short, more than half the length of 3rd, 3rd not as long as 4th-5th combined, these very short, transverse, the joints after the 5th gradually increasing in length and thickness, 11th not one and a half times as long as 10th. Prothorax longer than wide, slightly the widest near apex, apex rounded, base bisinuate, posterior angles produced and somewhat acute, median line distinct at base, becoming obliterated towards apex, base depressed and obscurely margined, the sides margined beneath, these with the prosternal margins appear as a right-angled triangle on each side, the right-angle of which almost touches the anterior coxæ. Scutellum large, subquadrate, apex rounded. Elytra slightly narrower than prothorax at its widest, and not much more than twice as long, shoulders rounded. Metasternum with an impressed line almost its entire length. Abdominal segments straight, their apices at the side visible from above, causing the elytra to appear somewhat serrate; apical segment obtusely carinate at its extremity. Length $3\frac{3}{4}$-$7\frac{1}{2}$, width 1-$1\frac{4}{5}$ mm.

Hab.—Galston (A. M. Lea), Lane Cove (Macleay Museum).

This is a very variable species as regards size, scarcely two specimens being exactly the same; the colour of the scutellum and elytra is also subject to variation. I obtained numerous specimens at an old burnt log in rather thick scrub; the females were boring into the charcoal, and the males actively running about.

Dromœolus thoracicus, n.sp.

Elongate, subparallel, the derm shining. Reddish-brown, somewhat darker beneath; antennæ and legs slightly paler; muzzle and prosternal keel inclining to piceous. Covered all over with short testaceous pubescence, thinnest on prosternum. Head and prothorax densely punctate; elytra densely, minutely and shallowly punctate, and shallowly striate, the striæ feeblest about suture, all running close to the apex before they unite; beneath densely, minutely and rather sharply punctate; punctures rather strong on prosternum, becoming feebler towards apex; femora very minutely punctate.

Head with a very shallow depression between the eyes: antennæ reaching intermediate coxæ, 1st joint somewhat curved, as long as 2nd-4th combined, 2nd, 4th and 5th very short, 3rd slightly longer than 4th-5th combined, the joints from the 4th gradually increasing in size, 11th not one and a half times as long as 10th. Prothorax longer than and nearly as deep as wide, apex rounded, base bisinuate, posterior angles produced and acute, flattened above, the sides appearing feebly concave; median line distinct at base, becoming feebler (in some specimens obliterated) towards apex; in most specimens a feeble depression on each side of the middle of the disk. Scutellum subquadrate, apex slightly the narrowest and appearing in some lights feebly emarginate. Elytra slightly narrower than prothorax at its widest, and nearly thrice as long, very gradually narrowing towards apex. Metasternum with an indistinct line down its middle. Length 8-10, width $1\frac{4}{5}$-$2\frac{1}{3}$ mm.

Hab.—Galston (A. M. Lea); Lane Cove, Merimbula (Macleay Museum).

My nine specimens I obtained one sultry night during last December; one specimen is very small, measuring only 5 mm., and is rather narrower in proportion.

Lycaon (?) concolor, n.sp.

Elongate, slightly narrowing at both ends, subconvex, opaque above, feebly shining beneath. Brownish-red, legs somewhat paler; eyes black; mandibles piceous. Sparingly and very minutely setose all over (densest on the legs). Rugosely and very densely punctate all over; on the upper surface the punctures are smallest on the elytra (which are also punctate-striate, the striæ shallow, nine on each elytron); on the lower surface the punctures are strongest on prosternum, densest on apical abdominal segment.

Head flattened, with a very small carina in the middle; antennæ with 1st joint scarcely as long as 2nd-4th combined, 2nd short, about as long but not as thick as 4th, 3rd almost as long as 4th-5th combined, the joints from the 4th gradually increasing in length, increasing in thickness to the 7th, then gradually diminishing. Prothorax widest behind, the width there greater than the length; base polished and trisinuate, the middle one the smallest, receiving base of scutellum; median line invisible at base, margined laterally, the margin feebly punctured; posterior angles produced, acute. Scutellum subquadrate, feebly carinate down the middle. Elytra nearly thrice as long as prothorax, not quite covering sides of abdomen; shoulders rounded. Metasternum with a feeble line down its middle. Length 10, width 3 (vix) mm.

Hab.—New South Wales.

My single specimen I probably captured about Sydney. The apical joint of each of its antennæ is missing; those left slightly pass the base of the prothorax.

L. NOVUS, Bonv. Mast. Cat. Sp. No. 3050.

Hab.—Sydney, Galston.

DYSCOLOCERUS BASALIS, n.sp.

Short, thick, hardly shining. Head, prothorax, scutellum and beneath black: basal half of elytra, tibiæ, tarsi, palpi and the first eight joints of antennæ red; apical half of elytra piceous; three apical joints of antennæ reddish-brown; femora brownish-black. Head in front and prothorax at base with a few short silky hairs; elytra with very short pubescence; undersurface densely clothed with a minute silky pubescence.

Head densely and minutely punctate; eyes small, shining; antennæ inserted considerably in front of the eyes, the joints as in *D. heros*, Blbn. Prothorax transverse, punctured like the head; median line faintly traceable, bisinuate and narrowly depressed at base, with the posterior angles produced and acute. Scutellum long, truncate at base and apex; the apex slightly the narrower. Elytra as wide as prothorax, almost parallel-sided to near the apex, minutely punctate all over, suture flat, ten moderately feeble striæ, the 1st and 3rd uniting at one-third from the apex, 3rd and 6th closer to the apex, the others lateral and very feebly marked. Undersurface very minutely punctate. Length $4\frac{1}{2}$, width $1\frac{1}{4}$ mm.

Hab.—Galston.

Possibly this is a small male of *D. heros*, Blackb.

DASCILLIDÆ.

SCLEROCYPHON STRIATUS, n.sp.

♂. Oblong-oval, subconvex, the derm shining. Above obscure brownish-red, with irregular piceous markings; beneath piceous-brown; middle of the pro- and mesosternum, middle of base and apex of metasternum, base and apex of abdominal segments, apex of femora, tibiæ and palpi dark red, tarsi obscure testaceous. Covered all over (but densest on head, scutellum and lower surface) with very short ashen pubescence, longest above. Densely and extremely minutely punctate all over (including legs), the elytra transversely strigose.

Head short; antennæ slender, slightly passing intermediate legs, 1st joint pale, almost as long as 2nd-4th combined, 2nd very short, 3rd and 4th each twice as long as 2nd, the others gradually decreasing in length except 11th, which is almost as long as 9th-10th combined. Prothorax broadly transverse, widely emarginate in front, base feebly bisinuate, median line faintly traceable, prosternal process carinate. Scutellum large, in the centre of a shallow depression. Elytra with seven striæ obliterated at base and apex. Second and third abdominal segments feebly carinate in the middle.

The female differs from the male in being larger, even more obscurely coloured, without abdominal carinæ, and with very short spurs to posterior tibiæ, the elytral striæ less distinct. Length: ♂ $3\frac{1}{2}$-$4\frac{1}{2}$, width 2-$2\frac{1}{2}$; ♀ $5\frac{1}{2}$ and $2\frac{3}{4}$ mm.

Hab.—Tamworth.

The above species differs from *S. maculatus*, Blackb., in being much more elongate, less convex, coloured in a different style, the elytral striæ more distinct, &c.

Sclerocyphon serratus, n.sp.

(♀?) Short, subconvex, the derm shining. Above obscure brownish-red, with piceous markings on the head, apex and middle of prothorax and scutellum; meso- and metasternum piceous, femora dark reddish-piceous, tibiæ and tarsi dark red, abdominal segments reddish-testaceous, basal joints of antennæ red. Clothed with short ashen pubescence, much shorter and denser beneath. Above densely and extremely minutely punctate, on the elytra the punctures are almost obsolete, pronotum with a faint lateral row, prosternum, coxæ and femora minutely but distinctly punctate.

Head short; antennæ scarcely passing prothorax; 1st joint as long as 2nd-4th combined, 2nd more than half as long as 3rd, 11th about one and a half times as long as 10th. Prothorax broadly transverse, semicircularly emarginate in front, feebly bisinuate at base, median line feebly traceable towards apex, prosternal process carinate. Scutellum large, triangular, slightly elevated. Elytra narrowly margined, broadest at about the middle, suture feebly raised, shoulders tuberculate, without trace of striæ. Apex of penultimate abdominal segment minutely but distinctly serrate along its entire outer edge. Length $3\frac{3}{4}$, width $2\frac{3}{4}$ mm.

Hab.—Tamworth.

At once distinguished from *S. maculatus* and the preceding species by the total absence of elytral striation; in shape it is intermediate between the two; from the following species (also without striation) it is distinguished by its larger size, less convex form, sparser puncturation, different colour, &c.

Sclerocyphon basicollis, n.sp.

Shaped very much as *S. maculatus*, but smaller and less convex. The derm shining. Piceous-black, narrowly margined with dull red; basal joints of antennæ, coxæ, apex of femora and abdominal segments testaceous-red; tibiæ and tarsi clouded with piceous. Above with short ashen pubescence, densest on head and prothorax, rather dense towards apex and sides of elytra; beneath densely pubescent, anterior femora almost glabrous; on the prothorax at the base there are six short longitudinal lines of denser pubescence. Densely and very minutely punctate all over, the punctures largest on prosternum.

Head short; antennæ reaching base of intermediate femora; 1st joint slightly longer than 2nd-3rd combined, 2nd about one-third the length of 3rd. Prothorax broadly transverse, widely and shallowly emarginate in front, base feebly bisinuate, without trace of median line, prosternal process carinate. Scutellum large, triangular, the surface around it very feebly depressed. Elytra widest about the middle and without trace of striæ; feebly transversely strigose along the suture. Apex of penultimate abdominal segment minutely but distinctly serrate along its entire outer edge. Length $2\frac{1}{3}$-$3\frac{1}{2}$, width 2-$2\frac{3}{4}$ mm.

Hab.—Tamworth.

I have two specimens, one of which is certainly a male, but in neither are any of the abdominal segments carinate; one specimen has an obscure reddish mark on each side of the prothorax at base.

Sclerocyphon maculatus, Blackb.

P.L.S.N.S.W. (2), vi., 1891, p. 523.

I have this species from Sydney and Galston; at the latter place I obtained three specimens on a low-growing bush at the side of a creek, in company with a scale; when captured they exuded a yellowish fluid from their joints.

MALACODERMIDÆ.

TRICHALUS RAYMONDI, n.sp.

♂. Black, elytra red. Prothorax, scutellum and lower surface shining.

Head with the median line distinct; antennæ not reaching to the middle of the elytra, 1st joint half as long as 2nd, 2nd-9th broad, gradually decreasing in length, 10th slightly longer than 9th; rostrum short, tinged with red at apex. Prothorax transverse, slightly emarginate in front, trisinuate at base, the anterior angles scarcely rounded, the posterior produced and somewhat acute, the sides reflexed, a lanceolate impression on the disk joined to the apex by a carina; minutely granulate at the apex. Scutellum large, broader behind than in front, depressed in the middle, emarginate at base and apex, the posterior angles thickened. Elytra gradually widening to about a third from the apex, with large quadrate punctures; the suture, lateral margin, 2nd, 4th and 6th interstices raised and thickened, the 1st dividing into three at a third from the base, the central one raised and thickened. Beneath minutely punctate; the abdominal segments depressed at the sides, the penultimate deeply incised. Length 10, width $3\frac{1}{2}$ mm.

Hab.—Mt. Kosciusko (Mr. W. E. Raymond).

TRICHALUS AURITUS, n.sp.

♂. Black, sides of the prothorax and elytra red; elytra on the disk more or less tinged with black. Head, basal joint of antennæ, disk of prothorax, scutellum, and lower surface shining.

Head minutely punctate, 2nd-10th joints subequal in length and very slightly diminishing in width, the 1st thick and giving the head the appearance of having ears. Prothorax transverse, slightly produced in the middle anteriorly, the base trisinuate, posterior angles produced; the sides reflexed, highest behind the middle; a deep lanceolate impression on the disk joined to the apex by a short carina, and to the sides by a low ridge; the apex irregularly punctate. Scutellum depressed in the middle, the sides minutely punctate and parallel, the base rounded and apex emarginate. Elytra slightly widening behind, punctures large, quadrate, shallow; suture, lateral margin, 2nd, 4th, and 6th interstices raised and thickened; the first interstice divided into three near the base, the middle one only distinct and uniting with the second interstice at the base. Beneath minutely punctate; the abdominal segments irregularly depressed at the sides, the penultimate deeply incised.

♀. Without the incision of the penultimate segment, the posterior angles of the scutellum not so produced, and the antennæ narrower. Length 10-11, width 3 mm.

Hab.—Sydney.

TRICHALUS INSIGNIS, n.sp.

♀. Black; labrum, sides of the prothorax, suture and sides of the elytra red. Head, disk of prothorax, scutellum and lower surface shining.

Head distinctly impressed along the median line; the rostrum very short; antennæ with the joints broad, flat and, with the exception of the last, produced at the apex, not reaching the middle of the elytra; 1st joint short, about half as long as 2nd, 2nd one and a third times longer than 3rd, 3rd-7th gradually decreasing, 8th slightly longer than 7th, 9th shorter, 10th as long as 8th. Prothorax transverse, trisinuate at base, the sides reflexed and when viewed sideways slightly wavy; the middle of the apex produced; the disk with two areolets, the largest at the base, the smallest joined to the apex by a carina, between them and the lateral margins the surface is irregularly depressed, but not divided into areolets; the reflexed margins coarsely punctate, thickened just before the middle. Scutellum large, depressed in the middle, rounded at the base and emarginate at apex. Elytra slightly dilated to about a third from the apex, with large, quadrate punctures; the suture, lateral margin, 2nd, 4th and 6th interstices raised; the 1st divided into three near the base.

Beneath shining and minutely punctate; abdominal segments irregularly depressed at the sides, the penultimate not incised. Length 13, width 5 mm.

Hab.—Armidale (Mr. D. McDonald).

This species seems to me to come closer to *Trichalus* than *Metorhynchus*, having the first elytral costa divided into three.

Trichalus distinctus, n.sp.

♂. Black; reflexed margins of prothorax and elytra red, the elytra close to the scutellum, and the disk posteriorly tinged with black. Head, disk, prothorax, scutellum, and lower surface shining.

Rostrum short; antennæ reaching to beyond the middle of the elytra, 2nd-9th joints subequal in length, their bases gradually diminishing in width, 10th one and a half times as long as 9th. Prothorax barely transverse, trisinuate at base, the posterior angles produced; a deep lanceolate impression in the middle, joined to the apex by a short carina; irregularly punctate at sides and apex. Scutellum depressed in the middle, the apex very slightly emarginate, with the angles rounded. Elytra very slightly widened posteriorly; punctures large, transversely oblong; suture and lateral margins thickened; 2nd, 4th and 6th interstices very slightly different from the others, the first divided into three, the middle one not much more prominent than the others, being slightly thickened at the base, it and the outer one continuous to base of the elytra, the inner one continuous to the scutellum. Beneath minutely punctate; metasternum sulcate along the middle; abdominal segments irregularly depressed at the sides, the penultimate sharply, but not deeply, incised. Length 14, width $4\frac{1}{2}$ mm.

Hab.—Galston.

I have described the foregoing species as having ten-jointed antennæ, not mentioning the true second joint, but in this species it is very noticeable, not being entirely overlapped by the first, and having the apex red.

LYMEXYLONIDÆ.

HYLECŒTUS LINEARIS, n.sp.

Elongate, parallel-sided, punctate and pubescent. Eyes black, head and prothorax brownish-red, elytra and legs darker. Head and prothorax, except towards the apex, covered with a short silky yellowish pubescence; elytra more densely clothed with a shorter and lighter pubescence, underside and legs minutely pubescent.

Head separated from the prothorax by a thick neck, closely and deeply punctate, the neck more closely and shallowly; eyes large, coarsely faceted 5 approximating in front. Prothorax densely punctate, the punctures largest beneath; about one and a half times as long as wide, elevated at apex, bisinuate at base, the median line deep and wide on the basal half, the sides and front sharply keeled. Scutellum punctate, longer than wide, rounded at the apex. Elytra five or six times as long as wide; densely and minutely punctate, three scarcely elevated but distinct costæ on each elytron, continuous from base to near the apex, and a fourth not so distinct, commencing at the base and running obliquely to the suture. Underside minutely punctate. Length 9, width $1\frac{1}{2}$ mm.

Hab.—Tamworth.

Obtained with some other very rare beetles at light, one sultry night in Dec., 1892.

TENEBRIONIDÆ.

PARAPHANES DUMBRELLI, n.sp.

Short, very convex, smooth and shining. Dark bluish or bronzy-black. Head (and sides of prothorax to a lesser extent) with a coppery reflection, tibiæ dark brownish-red, tarsi black.

Head densely and minutely punctate; eyes large, transverse, median line hardly traceable; clypeus transverse, its suture almost straight, slightly, if at all, rounded in front and recurved on the sides, where it is produced a little over the eyes, the point being sharp and bluish; labrum short, transverse, impunctate; antennæ reaching to just beyond the prothorax. Prothorax broadly transverse, emarginate in front, and lobed behind, the anterior angles not quite passing the eyes; minutely punctate on the disk, the sides more densely and roughly, without trace of median line; the sides rounded, margined and flattened posteriorly; the posterior angles acute, but scarcely produced; the prosternal keel is sharper and rougher than in *P. nitidus*, and pointed at the apex. Scutellum curvilinearly triangular, impunctate. Elytra as wide as the prothorax at the base and more than three times its length, very convex, not twice as long as wide; minutely punctate all over, but not in rows, except one hardly traceable along the suture; a depression at the base near the humeral angles, and a smaller one between it and the suture; the sides margined and punctate, the elytral epipleuræ somewhat concave and irregularly punctate. Pro-, meso-, and metasternum minutely punctate. Abdominal segments punctate at base and apex, corrugated and depressed at the sides. Legs stout, minutely punctate, last joint of tarsi as long, or nearly as long, as the others combined. Length 8, width 4 mm.

Hab.—Galston (Mr. D. Dumbrell); Lane Cove (Macleay Museum).

Easily distinguished from *P. nitidus* by its more convex and shorter form; in that species the puncturation on the head and disk of the prothorax is very similar; in this, it is much denser on the head.

I have a single specimen given me by Mr. D. Dumbrell, from whom I have received many choice insects from various parts of the Colony.

P. SUBNITIDUS, Macl., P.L.S.N.S.W. (2), ii. 1887, p. 309.

Hab.—Tweed River; collected by myself.

PYTHIDÆ.

RHINOSIMUS PALLIDIPENNIS, n.sp.

Elongate, somewhat depressed, shining. Head bronze-black; with the muzzle, palpi and antennæ reddish; last three joints of antennæ darker; prothorax bronze-black; elytra testaceous, with, in some specimens, a bronzy tinge; underside lighter than prothorax, the apical abdominal segment with a reddish tinge; legs testaceous, tarsi brown. Tibiæ and tarsi slightly pubescent.

Head slightly raised in the middle; strongly and closely punctured above and below, rostrum thin, less strongly punctured; antennæ with the apical joints large, the apical obovate. Prothorax truncate at base and apex, punctured as the head, slightly longer than wide, narrower than the elytra, narrowed in front and behind, the median line distinct, two contiguous tubercles on each side at the base, the sides with three indistinct projections, the posterior angles not produced. Elytra rather strongly convex, truncate at base, widest at about the middle, finely and somewhat closely punctured. Mesosternum strongly, metasternum and abdominal segments feebly punctate. Length (rost. incl.) $4\frac{1}{2}$, width $1\frac{1}{4}$ mm.

Hab.—Richmond River (Lea); Illawarra (Macleay Museum).

R. CORTICALIS, Oll., P.L.S.N.S.W. (2), iii. 1888, p. 1512.

Hab.—Richmond River. There are also specimens from Wide Bay in the Macleay Museum.

NEOSALPINGUS CORTICALIS, Blackb., Trans. Roy. Soc. S.A., 1891, p. 292.

Hab.—Inverell, N.S.W.; under rotting leaves.

TRICHOSALPINGUS BRUNNEUS, Blackb. l.c. p. 333.

Hab.—Sydney; under rotting leaves.

MELANDRYIDÆ.

ORCHESIA ELONGATA, Macl.

As this species is very briefly described, and I have seen a number of species which Sir William's description would fit, I would add to it:—

Antennæ slender, reaching to about midway on the elytra; 1st joint long, 2nd very short, 3rd-11th equal, or very gradually decreasing, and becoming more slender towards the apex. Prothorax transverse, with a very shallow depression on each side at the base. Scutellum quadrate. Tibiæ depressed-serrate externally; spurs to the posterior slender, equal, about two-thirds as long as the 1st tarsal joint, the intermediate and anterior spurs unequal in each, the longest about two-thirds the length of the 1st tarsal joint, the other about a third; tarsi slender, 1st joint as long as 2nd and 3rd combined. Males much smaller than females. Length $4\frac{1}{2}$-$7\frac{1}{2}$, width 1-2 mm.

This is the common species; I have obtained it in numerous places in N.S.W., but nearly always at night-time, when it is very active, running in and out of crevices in bark.

ORCHESIA MACLEAYI, n.sp.

Elongate, brownish-red; with the head, pro-, meso-, and metasternum darker. Densely and minutely punctate all over, and covered with a silky yellowish pubescence, densest on the elytra, legs and abdominal segments.

Antennæ scarcely reaching beyond prothorax; after the 2nd the joints gradually increasing in length and thickness; 11th as long as the two preceding combined, but not as thick. Prothorax broadly transverse. Scutellum short and broad. Posterior tibiæ with spurs as long as themselves; 1st joint of tarsi much longer than tibiæ, and longer than following joints united; intermediate tibiæ about as long as the tarsi, the longest spur about half the length of the 1st tarsal joint, the shortest about a fifth. Length $5\frac{1}{2}$, width 2 mm.

Hab.—Dalmorton (Lea), Kiama (Macleay Museum).

The present species differs also from *O. elongata* in being lighter in colour, shorter and broader; the pubescence is longer, punctures deeper, the depressions at the base of the prothorax more conspicuous, the tibiæ not serrate; neither does there appear to be so great a disparity in the size of the sexes as in that species.

I obtained several specimens of this species from a rotten log and bred out a number of others from some pieces of it I carried away.

LAGRIIDÆ.

LAGRIA FORMICICOLA, n.sp.

Brownish-red; antennæ, excepting the base of the first four joints, tibiæ and tarsi brown, apical half of femora and base of apical abdominal segment black. Densely covered above, and on the antennæ and legs with long semi-erect hairs, beneath less densely clothed with shorter and decumbent hairs; the antennæ, in addition to the long hairs, are covered with a short blackish pubescence, especially towards the apex. Densely and rugosely punctate above.

Prothorax almost cylindrical, slightly longer than wide, median line faintly traceable; prosternum fringed at the apex with yellowish hairs. Elytra broadest and smoothest near the apex, much wider than prothorax; two costæ on each elytron, visible to the naked eye, but much confused when looked at with a glass. Abdominal segments with broad, shallow depressions at the sides. Legs punctate. Length 11-13, width 4-5 mm.

Hab.—Cootamundra, Queanbeyan (Lea), Monaro (Macleay Museum).

The first specimen of this species I took, I obtained at Cootamundra in Feb., 1889, under a log, in a nest of soldier-ants; subsequently at Queanbeyan, I obtained six under stones, in the nests of a short, thick, black and yellow ant, two each in two nests and one each in two others.

ANTHICIDÆ.

MECYNOTARSUS APICIPENNIS, n.sp.

Elongate-ovate, subconvex, the derm subshining. Above the derm is reddish-brown, eyes black, beneath reddish; legs, antennæ and palpi reddish-testaceous. Densely pubescent all over, above ashen, the sides, lower surface and legs silvery; the apical third of elytra is partly denuded of pubescence except at the suture, where it is densest, and with a faint golden tinge (in one specimen there is a round spot on each side not touching the suture, and also two transverse rows of four brownish spots (caused by the partial absence of pubescence), one in the middle, the other near the base). Prothorax very densely and extremely minutely punctate; elytra densely and not very minutely punctate, the punctures only visible on both when the pubescence has been scraped away.

Head (except eyes) concealed by prothoracic horn, longer than wide, antennæ reaching basal third of elytra. Prothorax (excluding horn) transverse; the horn is large and half as long as entire prothorax; the outer row of tubercles varies in number from eleven to fifteen, lower surface impubescent, highly polished and very minutely punctate. Elytra somewhat flattened above, about one and a half times as long and wide as the prothorax, truncate at base, the sides gradually widening to beyond the middle. Legs slender, tibiæ straight; posterior tarsi longest, 1st joint slightly longer than 2nd-3rd combined, and about one and a half times as long as 4th; the intermediate with 1st joint as long as 2nd-3rd combined, 2nd-4th decreasing in length, 5th twice as long as 4th; anterior shortest, joints 1st and 4th as long as 2nd-3rd combined, 5th as long as 2nd-4th combined. Length $3\frac{1}{4}$-$3\frac{1}{2}$, width $1\frac{1}{3}$-$1\frac{1}{2}$ mm.

Hab.—Tamworth; in débris from a flood in the Peel River.

MECYNOTARSUS AMABILIS, n.sp.

♂. Elongate-ovate, subconvex, derm shining. Derm above and below reddish-testaceous, meso- and metasternum darker, prothoracic horn and muzzle red, legs and antennæ pale reddish-testaceous, eyes black. Above and below the derm is completely concealed by whitish glistening scales, which are distinct on prothorax and extremely minute on elytra; the elytra have scattered brownish setæ with chestnut markings as follows—an indistinct irregular fascia at base, in the middle of each elytron an irregular macula, broad near the suture, narrowing and then bluntly bifurcate, a small irregular spot near apex, apex itself and suture with a faint golden lustre, continued and brighter on the prothorax. Elytra with sparse, shallow punctures, only visible when the pubescence has been scraped away.

Head (except eyes) completely concealed by prothoracic horn; eyes large, round, prominent; antennæ reaching basal third of elytra. Prothorax (excluding horn) scarcely transverse, widest in front; base truncate, in its middle a short longitudinal excision; horn half the length of the prothorax, outer row of tubercles thirteen in number, lower surface highly polished. Elytra about one and a half times as long as entire prothorax, very gradually widening to beyond the middle. Legs slender, posterior tibiæ feebly bent.

A specimen (which I take to be a female) has the prothorax more transverse, the outer row of tubercles on the horn eleven in number, the elytral markings larger but more obscure and the entire upper surface duller. Length $2\frac{3}{4}$, width $1\frac{1}{4}$ mm.

Hab.—Windsor; three specimens in flood débris on the Hawkesbury River.

The above is an extremely pretty species; it may be distinguished from *M. ziczac* by its larger size, median maculæ (which in that species resemble an irregular W); *M. ziczac* has also a faint longitudinal deepening of colour on each side of the middle of the prothorax, and in all the specimens I have seen (many hundreds) without the peculiar lustre of *M. amabilis.*

M. Kreusleri, King; Masters' Cat. Sp. No. 4265.

Hab.—Tamworth.

M. ziczac, King; Masters' Cat. Sp. No. 4267.

Hab.—New South Wales; common and widely distributed.

Formicomus posticalis, n.sp.

Elongate, subdepressed, hardly shining. Piceous-black; antennæ (especially apical joint), tarsi and prothorax paler, claw joints of tarsi testaceous, elytra with a straight white fascia at the base, and a smaller one composed of whitish hairs near the apex. Densely and very minutely punctate and pubescent all over.

Head narrowed in front and rounded behind, as long as and wider than prothorax, about the width of elytra at base. Prothorax transversely globose in front, constricted towards the base; median canal rather shallow and not continuous to apex, at the base with a small tubercle on each side. Elytra ovate, scarcely as long as head and prothorax combined, feebly depressed near the base. Femora thick, especially anterior. Length $2\frac{1}{2}$, width $\frac{2}{3}$ mm.

Hab.—Tamworth; in Peel River flood débris.

Several specimens have the prothorax and base of femora much paler than the general colour.

The above species may be distinguished from *F. australis* by its broader elytra, more elongate head and prothorax, eyes less prominent, the pale fascia at apex of elytra may be rubbed off, and the basal fascia which in all my six specimens is complete.

Formicomus villosipennis, n.sp.

♂. Narrow, elongate, convex, shining. Black; prothorax with the base reddish-testaceous, increasing to piceous-brown at apex; antennæ with the first three or four joints and apex of the 11th red, base of femora, tibiæ and tarsi reddish-testaceous, palpi piceous-black. Elytra rather densely clothed with long straggling whitish hairs; head and prothorax sparsely, abdominal segments minutely, pubescent. Above with scattered minute punctures, densest and strongest towards base of elytra; beneath minutely, apex of mesosternum distinctly punctate.

Head longer than wide, strongly rounded behind, antennæ reaching intermediate legs, 1st joint one and a half times as long as 2nd, and as long as the 11th. Prothorax very slightly narrower and longer than head, longer than wide, globose in front, the extreme apex margined; base above feebly margined, at the sides appearing as if cut. Elytra at base as wide as prothorax in front, and considerably wider than at the base, about one and a quarter times as long as head and prothorax combined, shoulders rounded, sides feebly widening to beyond the middle, near the base transversely depressed, the depression connected with base along suture,

suture near apex feebly depressed. Femora (especially anterior) thick; tibiæ straight, longer than tarsi, a minute spine at their apices.

The female differs in being much narrower across the shoulders than the male, being there no wider than the prothorax at base; elytra shorter, less parallel-sided, more feebly depressed at the base and less hairy. Length $2\frac{3}{4}$, width $\frac{2}{3}$ mm.

The above species differs from *F. Clarki*, King, in being smaller and narrower, much hairier, less strongly punctured, with a differently shaped prothorax, &c.

Hab.—Sydney; obtained by sweeping long grass.

FORMICOMUS AGILIS, King; Masters' Cat. Sp. No. 4248.

I have carefully compared the types of *F. humeralis*, Macl., with the above species and find them identical; the colour of the prothorax ranges from red to black; the elytral maculæ are apparently never united; the size is constant. I have it from a number of places in New South Wales, but it is not very common. There are also specimens from N.W. Australia in the Macleay Museum.

F. CLARKI, King; Masters' Cat. Sp. No. 4250.

It appears to me that *A. charon*, King, is the male of this species, the sexes of which differ as *F. villosipennis* (?). They are certainly congeneric, and if distinct are very closely allied species.

TOMODERUS BREVICORNIS, n.sp.

Elongate, parallel-sided, depressed, shining. With the exception of the eyes (which are black) testaceous, legs paler. Clothed above and below with rather dense pale pubescence (densest on the elytra). Head at the sides sparsely punctate, glabrous in the middle; prothorax minutely punctate at sides and base; elytra strongly punctate on basal half, more feebly towards apex, the punctures in rows; lower surface minutely punctate.

Head rounded, slightly transverse; eyes small, prominent, coarsely faceted; antennæ thickening towards apex, reaching intermediate legs, 1st joint thick, as long as 2nd-3rd combined, 3rd thinnest, 2nd and 4th-6th somewhat globular, 7th-10th transverse, 11th as long as 9th-10th combined, and slightly the widest. Prothorax slightly if at all transverse, towards the apex as wide as head across eyes and base of prothorax, at the base as wide as base of head; widely globose in front, with the sides obtusely toothed, at a third from the base deeply constricted; median canal extending from base to apex, distinct but not deep or wide. Scutellum small, wide, curvilinearly triangular. Elytra not twice as long as head and prothorax combined, shoulders feebly rounded, sides parallel to near the apex. Metasternum narrowly sulcate. Legs slender; posterior tarsi longer than tibiæ, basal joint as long as the rest; intermediate not as long as the tibiæ, joints thick, 1st as long as 2nd-4th; anterior thick, about two-thirds as long as tibiæ; all the femora equal in thickness, the anterior shortest. Length $1\frac{2}{3}$, width $\frac{3}{5}$ mm.

Hab.—Tamworth (Lea); South Australia (Macleay Museum).

Judging from the description, the above species appears to differ from *T. denticollis*, Champion, in being paler, in having the antennæ shorter and concolorous with elytra, prothoracic teeth less distinct, the posterior one not noticeably the longest, median canal different, somewhat different puncturation, &c. From *T. vinctus*, Erichs., it is very distinct.

ANTHICUS POLITULUS, n.sp.

Scarcely elongate, highly polished. Black; prothorax varying from dark red to black; antennæ dark red, apical joints and palpi darker, base of femora reddish (in a few testaceous), tarsi testaceous-brown; elytra with a scarcely oblique pale testaceous macula on each shoulder (sometimes united). Above and beneath sparsely pubescent. Head, meso- and metasternum minutely punctate, elytra impunctate.

Head subquadrate, as wide as elytra at base, and wider than and scarcely as long as prothorax; eyes prominent; antennæ slender, reaching or slightly passing intermediate legs. Prothorax transversely globose in front, strongly constricted behind; median canal marked only on the basal half, where it is shallow, punctate, and terminates in two obtuse tubercles. Elytra subovate, scarcely longer than head and prothorax combined, hardly depressed at base. Legs slender, femora (except anterior) moderately thickened, anterior shorter and about twice as thick as the others. Length 2-2$\frac{2}{5}$, width $\frac{3}{5}$-$\frac{2}{3}$ mm.

Hab.—Tamworth; in Peel River flood débris.

ANTHICUS DEMISSUS, n.sp.

Narrow, elongate, depressed, shining. Head, meso- and metasternum dark red, prothorax and antennæ paler; elytra obscure brownish-testaceous, darker about scutellum; abdominal segments piceous at apex and sides, paler in the middle, legs and palpi testaceous, eyes black. Elytra clothed with short yellowish, the sides of abdominal segments with whitish very short pubescence; the rest of the body sparsely pubescent. Densely and not very minutely punctate (except on apical portion of elytra and abdominal segments where they are very minute), the punctures largest beneath.

Head large, subquadrate, truncate at base, wider and longer than prothorax, and as wide as elytra; eyes small, scarcely projecting beyond the sides; antennæ slender, reaching base of prothorax, 1st joint slightly thickened, not as long as 2nd-3rd combined, 3rd slightly longer than 2nd, 3rd-10th subcylindrical, subequal, 11th one and a half times as long as 10th, none of the joints transverse. Prothorax longer than wide, strongly rounded in front, truncate at base, near the apex one and a half times as wide as the base, the sides straight, without trace of median line. Elytra but little longer than head and prothorax combined, about twice as long as wide, shoulders feebly rounded, parallel-sided to near the apex, feebly depressed on each side of the suture at the base. Femora thickened towards apex, anterior the shortest; tibiæ straight, thin; posterior tarsi longer than tibiæ, the basal slightly longer than apical joint; intermediate tarsi scarcely longer than tibiæ, apical joint longest; anterior tarsi much shorter than tibiæ, apical joint (seen from beneath) almost as long as the others combined. Length $2\frac{1}{2}$, width $\frac{1}{2}$ mm.

Hab.—Whitton (Lea); Tarcutta (Macleay Museum).

ANTHICUS LATUS, n.sp.

Short, thick, subdepressed, shining. Head and prothorax red and highly polished; elytra reddish-testaceous, apical third piceous, lower surface and legs reddish-testaceous, apex and sides of abdomen inclining to piceous, antennæ reddish-testaceous, apical joints darker; eyes black. Elytra covered with straggling, upright, brown, and shorter, semi-upright, whitish hairs; head and prothorax with a few scattered hairs, meso-, metasternum and abdominal segments with rather short pubescence. Above, and head at the sides beneath sparsely and shallowly punctate.

Head transverse, eyes large; antennæ inserted a short distance in front of the eyes, extending a short distance beyond prothorax. Prothorax transversely subcordate, rounded anteriorly, contracted posteriorly; longer and slightly wider than head; the disk in front with two small foveæ, connected at their base. Elytra about one and a half times as long as head and prothorax combined, and about one and a half times as long as wide; shoulders slightly rounded, sides gradually widening to beyond the middle, the suture at the base depressed. Legs rather short, posterior and intermediate tibiæ in the male with several short spines at their apices. Length 3, width $1\frac{1}{3}$ mm.

Hab.—Galston.

The above species may be distinguished from *A. brevicollis*, King, (a very common and variable species) by its broader form, larger and red head (always black in *brevicollis*), different ground colour, sparser puncturation and pubescence, concolorous legs, posterior tibiæ more slender and less bent, &c.; that species also is always dark beneath (♀ piceous, ♂ black).

ANTHICUS SIMILIS, n.sp.

Elongate, subdepressed, shining. Head piceous-black; prothorax, lower surface, legs and antennæ dark red; abdominal segments piceous-red, basal joint paler; elytra piceous-black, the base and a fascia immediately behind the middle testaceous-red, the extreme base with a brownish tinge. Above sparsely clothed with pale erect pubescence, densest on elytra, beneath scarcely pubescent. Head and prothorax densely and minutely punctate; elytra not so densely, the punctures largest towards the base, almost obsolete at apex; beneath very minutely punctate.

Head large, subquadrate, slightly longer than the width across the eyes (where it is slightly wider than prothorax), base feebly rounded; antennæ slender, inserted some distance in front of the eyes, scarcely reaching base of prothorax, 1st joint slightly thickened, about one and a half times as long as 2nd, 2nd-4th somewhat cylindrical, each nearly twice as long as wide, 5th-10th globular, 9th-10th transverse, 11th about one and a half times as long as 10th. Prothorax longer than wide, apex rounded, base truncate and feebly margined, near the apex about one and a quarter times as wide as the base, sides straight. Elytra about one and a quarter times as long as head and prothorax combined, and about twice as long as wide, slightly wider than the head, the sides subparallel to near the apex, feebly depressed near the base. Legs rather short, anterior femora very thick, all the tibiæ straight, intermediate tarsi slightly longer than tibiæ, the others not quite as long, 1st joint of posterior as long as 2nd-4th, 1st and 5th joints of intermediate each as long as 2nd-4th, of the anterior 1st and 5th slightly longer than 2nd-3rd, the cleft portion of 4th half as long. Length $3\frac{1}{3}$, width $1\frac{1}{5}$ mm.

Hab.—Queanbeyan.

The above species may be distinguished from *A. hesperi* by its larger and more coarsely punctured head.

ANTHICUS CONFERTUS, n.sp.

Subconvex, shining. Head, prothorax and lower surface black; elytra dark red, with a broad median fascia and the apex black (the red space between the apex and fascia sometimes appearing as spots); antennæ red, becoming darker towards apex, apical joint of palpi brown; legs with the posterior apical half of intermediate and apical third of anterior femora piceous-black, the rest reddish. Elytra, apical portion of prothorax, and legs with short silky suberect pubescence; abdominal segments minutely pubescent. Head above, and prothorax sparsely and minutely punctate, head beneath more strongly and densely punctate; basal two-thirds of elytra, meso-, and metasternum coarsely and densely punctate; abdominal segments extremely minutely punctate, except base of the first where the punctures are stronger.

Head longer than wide, subrounded, widest across the eyes (which are slightly in front of the middle and prominent, but not coarsely faceted), with a shallow punctate impression in the middle of the extreme base; antennæ slender, scarcely passing prothorax, basal joint as long as the two following united. Prothorax longer than wide, the width of the head (excluding eyes) scarcely longer; transversely globose in front, narrowest near the base. Elytra broad, nearly twice the width of prothorax at base, about one and a quarter times as long as head and prothorax combined, and about twice as long as wide; shoulders scarcely rounded, sides parallel to about one-third from the apex, towards apex slightly depressed on each side of the suture, the base without depressions. Legs with the femora equal in thickness, all the tibiæ straight. Length $2\frac{3}{4}$, width 1 mm.

Hab.—Tamworth.

The above species comes closest to *A. Kingi*, Macl.

Anthicus exiguus, n.sp.

Depressed, shining. Head dark or brownish-red, eyes black; prothorax clear reddish-testaceous; elytra testaceous, feebly tinged with brown, two rather narrow brown maculæ (not quite touching suture) immediately behind the middle, base tinged with brown; beneath reddish-testaceous (slightly darker than prothorax), legs paler; antennæ red, darkening towards apex. Elytra and apex of head sparsely pubescent, prothorax and lower surface almost glabrous. Head (except at the sides) and prothorax highly polished, almost impunctate; elytra minutely and not very densely punctate, the punctures largest towards the base; meso- and metasternum not quite as strongly, but more densely punctate than base of elytra.

Head large, subquadrate, longer than wide; eyes rather small, prominent; antennæ slightly passing prothorax, gradually thickening towards apex, basal joint not as long as the two following combined, apical about as long as the two preceding combined, and wider. Prothorax slightly longer than and not as wide as the head, slightly longer than wide, transversely globose in front, abruptly constricted at about the middle, the sides behind it almost parallel, base feebly margined. Elytra scarcely one and a quarter times as long as head and prothorax combined, considerably wider than prothorax, shoulder feebly rounded, sides gradually widening to near the apex, feebly depressed about scutellum. Femora scarcely thickened, the anterior not much more noticeably than the others, tibiæ straight, intermediate tarsi slightly longer than tibiæ, the others about as long. Length $1\frac{2}{3}$, width $\frac{1}{2}$ (vix) mm.

Hab.—Tamworth.

ANTHICUS GLABRICEPS, n.sp.

Subconvex, shining. Black; antennæ piceous, basal joints reddish, each elytron with two rather large testaceous maculæ (not touching sides or suture), the first suboblong, oblique, its end about one-third from the base, the other about one-third from the apex, sublunulate in shape; beneath piceous (in the Windsor specimen brownish-red), legs brownish-testaceous, tarsi testaceous. Above rather densely clothed with brownish pubescence, beneath the pubescence is shorter and paler, posterior coxæ and apex of mesosternum fringed with yellowish setæ. Head minutely punctate, base highly polished; prothorax densely and minutely punctate; elytra densely and at the base rather coarsely punctate; apex of mesosternum sparsely punctate; abdominal segments extremely minutely punctate.

Head subquadrate, slightly transverse, base feebly rounded; eyes prominent; antennæ slender, slightly thickening towards apex, reaching base of prothorax, basal joint not as long as the two following combined, apical joint about one and a half times as long and slightly wider than preceding. Prothorax slightly longer than wide, apex rounded, base margined and truncate, constricted in the middle, giving it a bilobed appearance, of which the posterior is slightly the narrower. Elytra more than one and a half times as long as head and prothorax combined, not twice as long as wide, shoulders very feebly rounded, sides parallel to near the apex, base feebly raised, narrowly depressed on each side of the suture from base to apex. Legs slender, femora scarcely thickened, tibiæ straight; anterior tarsi shorter, the others longer than tibiæ. Length 3, width $\frac{3}{4}$ mm.

Hab.—Tamworth and Windsor, N.S.W.

ANTHICUS PALLIPES, n.sp.

Elongate, subdepressed, shining. Black; antennæ pale reddish-testaceous; each elytron with two testaceous maculæ, one near the base, large, transverse, almost touching the side and suture, the other near the apex, smaller, narrower, not so close to the suture, and still further from the side; beneath piceous-black, middle of the metasternum slightly paler; legs pale testaceous, tibiæ at their base stained with brown. Above sparsely clothed with rather long brownish pubescence, densest on elytra; beneath sparingly pubescent. Head densely and very minutely punctate in front, highly polished behind, prothorax densely and minutely punctate, punctures largest at the base, the anterior angles almost impunctate, elytra rather sparsely and not very minutely punctate (except towards apex, where the punctures are almost obsolete), sides of meso- and metasternum, and apices of abdominal segments minutely punctate.

Head rounded, slightly longer than wide; eyes placed in the exact middle, prominent; antennæ slender, reaching intermediate legs, 1st joint slightly longer than 2nd-3rd combined, 2nd-7th equal in length and thickness, 8th-10th slightly wider and feebly transverse, 11th about one and a half times as long as 10th. Prothorax narrower than head and about one and a half times as long, longer than wide, transversely globose in front, much narrower behind, margined at base and apex. Elytra a little more than one and a half times as long as head and prothorax combined, twice as long as wide, shoulders feebly rounded, almost parallel-sided to near the apex, base (except at suture) distinctly raised, feebly depressed behind the base, very feebly depressed on each side of the suture. Legs slender, femora scarcely thickened, the tibiæ very feebly bent inwardly; all the tarsi shorter than the tibiæ, basal joint of the posterior as long as the following combined; in the others it is little more than half as long. Length $2\frac{2}{3}$, width $\frac{2}{3}$ mm.

Hab.—Tweed River; two specimens.

A specimen from the Clarence River differs in being narrower, with the head longer, both it and the prothorax slightly paler (reddish-piceous) and with the legs longer and thinner, but in the same proportions. I do not think it is more than a variety.

The above species differs from the preceding (which it closely resembles) in being narrower; the antennæ and legs paler; elytral maculæ paler, the basal larger; head smaller and less quadrate; prothorax more densely punctate, longer, less distinctly bilobed, the anterior lobe appearing almost angled; elytra with the base more distinctly raised, not so depressed on each side of the suture, as well as longer and sparser pubescence.

Anthicus pulchrior, n.sp.

Subconvex, shining. Head and lower surface dark red, prothorax paler, eyes black; antennæ red, increasing to brown at apex; elytra testaceous-red, suture darker, the base narrowly, a broad median fascia black, apical third stained with brown. Head feebly punctate, highly polished; prothorax densely and minutely punctate; elytra coarsely punctate on basal half, towards apex the punctures almost obsolete; beneath apparently impunctate, above sparsely clothed with short pale sub-erect pubescence, beneath very minutely pubescent.

Head and prothorax as in *A. glabriceps.* Elytra about one and a half times as long as head and prothorax combined, more than twice as long as wide, shoulders feebly rounded, sides feebly widening to beyond the middle, narrowly depressed on each side of the suture from base to apex, deepest near the apex. Legs slender, femora slightly thickened, intermediate tibiæ feebly bent; all the tarsi shorter than tibiæ, the anterior very short, basal joint of posterior longer, in the intermediate not as long as the following combined. Length $2\frac{1}{3}$-3, width $\frac{2}{3}$-$\frac{4}{5}$ mm.

Hab.—Tweed River.

This is a somewhat variable species, none of my five specimens being exactly alike; some specimens are much lighter in colour than others; one has the head and prothorax concolorous, another has the median fascia incomplete.

The above species in shape closely resembles *A. glabriceps,* from which its much paler colour, more convex form, weaker prothoracic and stronger elytral punctures will serve to distinguish it.

ANTHICUS ABERRANS, Macl.; Mast. Cat. Sp. No. 4268.

This species is congeneric with *Macratria australis,* King.

ANTHICUS MASTERSI, Macl.; Mast. Cat. Sp. No. 4295.

This is a plentiful, widely distributed, and very variable species. I have specimens in which the elytral maculæ are very large and pale; others in which they are very small and dark (as in the types); and some with the maculæ entirely absent, and close intermediate stages. The prothorax ranges in colour from pale reddish-testaceous to almost black; the size also is somewhat variable.

ANTHICUS MONILIS, King; Mast. Cat. Sp. No. 4296.

If I am right in my identification of this species (and I think I am), it is widely distributed and very variable. Many specimens have the head dark red; others have the elytra black, with a fascia near the base, and two oblique maculæ behind the middle (not quite reaching suture) reddish-testaceous; many have the median fascia incomplete (as in the types) and appearing as claw-shaped, triangular or circular, piceous or brown maculæ; some specimens have a dark triangle about the scutellum; some have the legs concolorous; in others the tibiæ are brownish; the colour of the abdominal segments is also subject to variation.

ANTHICUS RARUS, King; Mast. Cat. Sp. No. 4303.

A. propinquus, Macl.; Mast. Cat. Sp. No. 4301.

Hab.—Windsor, Sydney, Tamworth.

A. COMPTUS, Laf.; Mast. Cat. Sp. No. 4275. *Hab.*—Sydney.

A. DENISONI, King; Mast. Cat. Sp. No. 4280. *Hab.*—Galston, Sydney.

A. DUBIUS, King; Mast. Cat. Sp. No. 4281. *Hab.*—Tamworth.

A. GAWLERI, King; Mast. Cat. Sp. No. 4283. *Hab.*—Tamworth. There is also a specimen in the Macleay Museum from N.W. Australia.

A. GLABER, King; Mast. Cat. Sp. No. 4284. *Hab.*—Tamworth.

A. GLABRICOLLIS, King; Mast. Cat. Sp. No. 4285. *Hab.*—Inverell.

A. KREUSLERI, King; Mast. Cat. Sp. No. 4291. *Hab.*—Sydney.

A. MYRTEUS, King; Mast. Cat. Sp. No. 4297. *Hab.*—Tamworth, Sydney, and Whitton.

A. PALLIDUS, Macl.; Mast. Cat. Sp. No. 4300. *Hab.*—Windsor.

A. WOLLASTONI, King; Mast. Cat. Sp. No. 4307. *Hab.*—Whitton.

SYZETON BLACKBURNI, n.sp.

Elongate-ovate, shining. Reddish-testaceous; head black, two oblique maculæ in the centre of the elytra (almost touching the suture) piceous, palpi pale testaceous; antennæ red, from the 7th joint darkening, the apical piceous, but with its extreme point lighter; in one specimen the posterior thighs are darkened. Above with decumbent whitish pubescence; beneath more sparingly clothed. Above densely and minutely punctate, the punctures largest at the base of the elytra, smallest on the head.

Head wider than the prothorax. Prothorax slightly transverse, rounded at apex, truncate, or very slightly bisinuate at base; the sides scarcely arcuate; there are two very irregular transverse impressions, the apical very shallow, the posterior being formed by shallow irregular foveæ. Elytra much wider than prothorax, and wider than head, the shoulders rounded, sides parallel to near the apex, emarginate at base, about twice as long as head and prothorax combined, an oblique impression behind the shoulders. Legs long, intermediate tibiæ and posterior femora arcuate, tarsi as in *S. lætus*, Blkb.

The ♀ differs from the ♂ in having the oblique maculæ smaller and paler, the legs not so graceful, in the antennæ which ♂ and ♀ are as in *S. lætus*. Length $2\frac{1}{3}$, width $\frac{3}{4}$ mm.

Hab.—Armidale (D. McDonald); Sydney (Lea).

I have a female from Galston which differs in being smaller and narrower ($1\frac{1}{2} \times \frac{1}{2}$ mm.), with the antennæ darker and with a piceous tinge in the middle of the prothorax. I do not think, however, that it is another species.

Syzeton immaculatus, n.sp.

♀. Oblong-oval, shining. Piceous-black; base of femora, tarsi, antennæ and palpi brownish-testaceous. Sparingly clothed above with soft decumbent ashen pubescence; beneath and on the tibiæ the pubescence is shorter and slightly denser. Above densely and minutely punctate, the punctures largest and densest about the base of the elytra, smallest on the head, beneath very minutely punctate.

Head slightly wider than prothorax at its middle, the eyes very large. Prothorax scarcely if at all transverse, strongly rounded anteriorly, the base truncate, sides arcuate; at the base there is a short longitudinal excision, and a feebly marked median transverse depression. Elytra wider than prothorax, about one and a half times as long as head and prothorax combined, its base almost straight; humeral angles slightly rounded, behind them the sides are parallel to near the apex, an oblique impression behind each shoulder. Legs long, femora thick; intermediate tibiæ bent at base, its tarsi with the 1st joint slightly longer than the rest combined; the posterior tarsi with the 1st joint twice as long as the others combined. Length $2\frac{1}{4}$, width $\frac{3}{4}$ mm.

Hab.—Galston.

My specimen is somewhat damaged, having lost two joints from each antennæ; the joints that are left correspond with those of *S. lætus*, ♀., except that the basal joint is equal in length to the two following, the 2nd not noticeably shorter than the 3rd.

Syzetoninus 4-foveatus, n.sp.

♂. Oblong-oval, scarcely shining. Head and scutellum black; prothorax, elytra, lower surface and apical joints of antennæ brownish-black; legs and palpi piceous-brown, coxæ and tarsi paler; antennæ with basal joints not much paler than the others. Above very minutely and not densely pubescent, more densely beneath. Head and prothorax very densely and minutely punctate, elytra not so densely but more strongly, the punctures strongest towards the base; meso- and metasternum densely and minutely punctate, densest at the sides, but strongest in the middle; abdominal segments (basal most noticeably) minutely punctate.

Head as long as the width at the base; eyes prominent, across them the width is greater than that of the prothorax; antennæ rather thick, reaching basal third of elytra, the joints from the third gradually widening; 1st-3rd joints cylindrical, 1st as long as 2nd-3rd, 2nd not much longer than 3rd, 3rd shortest, 4th-10th shortly obconic, 11th one and a half times as long as 10th. Prothorax feebly transverse, rounded in front, truncate at base, widest in front of the middle; at the base with a row of four shallow irregular foveæ; without an impression across the middle. Elytra scarcely wider than head, two and a half times as long as prothorax, about twice as long as wide, shoulders rounded, sides subparallel to near the apex, a shallow depression behind the base. Legs slender, all the tibiæ straight, posterior femora very slightly thicker than intermediate, basal joint of posterior tarsi twice as long as the following united, the basal joint of intermediate about as long as the remainder. Length $1\frac{2}{3}$-$1\frac{3}{4}$, width $\frac{3}{5}$-$\frac{2}{3}$ mm.

Hab.—Galston and Gosford.

From the male of *S. inconspicuus*, which it closely resembles (and of which I have both sexes), the above species may be distinguished by its being more densely punctate, the eyes less conspicuous, the femora not so thick, the tibiæ straight, the thicker and almost concolorous antennæ, and in the impressions at the base of the prothorax.

Syzetoninus impressicollis, n.sp.

♂. Subovate, shining. Above and below black; the elytra dark brownish-black, legs piceous-red, coxæ, tibiæ, and tarsi paler; antennæ reddish, the apical joint brown; palpi testaceous. Above sparingly and minutely, beneath not much more densely pubescent. Above densely and towards the base of elytra not very minutely punctate; meso- and metasternum punctate, the punctures densest at the sides and almost invisible in the middle.

Head longer than the width at the base; eyes large, prominent, the width across them a little more than that of the prothorax; antennæ slender, inserted immediately in front of the eyes, not quite reaching posterior coxæ; 1st and 4th joints each as long as 2nd-3rd combined, 3rd shortest, 4th-10th obconic, very gradually decreasing in length, 11th not much wider than the others and one and a half times as long as 10th. Prothorax transverse, rounded in front, the sides behind almost parallel, truncate at base; on each side of the middle of the base there is a large shallow elliptical oblique impression or fovea; an impression on each side stopped in the middle by a dumb-bell-shaped, almost impunctate elevation. Elytra much wider than prothorax, shoulders slightly rounded, sides almost parallel to near the apex, a shallow arcuate impression behind the base. Posterior femora hardly thicker than the others; tibiæ feebly curved, the posterior compressed, dilated towards and emarginate at apex; posterior tarsi with basal joint thrice as long as the others combined; intermediate with basal joint scarcely longer than the 5th. Length $1\frac{2}{3}$, width $\frac{3}{4}$ mm.

Hab.—Galston.

Syzetoninus (?) variegatus, n.sp.

♂. Head black; prothorax and underside reddish-brown; posterior legs reddish, the tibiæ stained with brown, the tarsi testaceous, posterior femora (except apex) black; base and apex of antennæ reddish, the intermediate joints reddish-brown; elytra reddish-brown, the shoulders red, the apex reddish-testaceous, behind it a wavy reddish-brown fascia, and behind that a wavy fascia the colour of the apex (perhaps better described as apical third reddish-testaceous, an irregular fascia in the middle); about the middle of the elytra an irregular obscure fascia of pale hairs. Upper and lower surfaces and legs clothed with a very short pubescence. Above densely and minutely punctate, punctures most visible on the head, and only visible on the apical portion of the elytra when pubescence has been scraped away, beneath very minutely punctate.

Head twice as broad as long, the eyes very large, prominent and coarsely faceted, the width across them nearly equal to the base of the elytra, much wider than the apex of the prothorax (above they occupy about $\frac{3}{5}$ and beneath more than $\frac{2}{3}$ of the surface). Antennæ thick, reaching the middle of the elytra, 1st-3rd joints narrower than 4th-11th, these of equal width except 11th, which at its middle is slightly the widest, but pointed at apex; 1st, 4th and 11th joints about equal in length, 2nd short, 3rd very short, appearing as a minute tubercle at the base of 4th, 5th-10th obconic, equal, none of the joints transverse. Prothorax slightly longer than wide, narrowest and rounded in front, very slightly trisinuate at base; a shallow transverse depression towards the base appearing in the middle like shallow foveæ (but not visible in all lights). Elytra with the derm shining, not one and a half times as long as head and prothorax combined, shoulders prominent, a shallow oblique impression behind them; sides slightly rounded, widest at a little beyond the middle, about one and a half times as long as broad. Posterior femora thick, the basal joint of the tarsi more than twice as long as the others combined, the basal joint of the intermediate not as long as the others combined, all the tibiæ straight. Length $1\frac{3}{4}$, width $\frac{2}{3}$ mm.

Hab.—Tamworth.

This is a very pretty little species; the reddish humeral angles are very prominent and almost as if with a small tubercle.

Syzetoninus (?) crassicornis, n.sp.

♀. Ovate, shining. Head and prothorax black, elytra dark brownish-black, antennæ red, femora brownish-red; palpi, tibiæ and tarsi testaceous. Minutely pubescent above and below. Densely and not very minutely punctate above, the punctures largest on the elytra and especially towards the base; meso- and metasternum rather strongly punctured.

Head not quite as long as wide; eyes large, prominent, not quite reaching the base of the head; antennæ thick, inserted considerably in front of the eyes, reaching a short distance beyond the prothorax; 1st joint as long as 11th, 2nd shorter, 3rd-4th shortest, 3rd-10th transverse, 8th-10th widely so, 11th shortly obovate, not quite as long as 9th-10th, the joints from the 4th gradually thickening. Prothorax transverse; widest at the base, where it is not much narrower than the head, strongly rounded in front; a row of large shallow irregular foveæ at base; with a very shallow, indistinct impression in the middle of the apex. Elytra convex, at the base slightly wider than head across the eyes, about one and a half times as long as head and prothorax combined, not one and a half times as long as wide, widest behind the middle, shoulders feebly rounded, no oblique impressions behind them. Length $1\frac{1}{4}$ (vix), width $\frac{1}{2}$ mm.

Hab.—Galston.

I cannot make out the legs very satisfactorily, but the posterior femora appear to be thickened towards the apex and all the tibiæ straight. The antennæ are the shortest and thickest (even for a ♀) that I have seen in any species of the three allied genera.

Syzetonellus sordidus, n.sp.

♂. Oblong-oval, subshining. Head deep black; prothorax brownish-black; elytra brownish, the base reddish-testaceous, the apex feebly tinged with testaceous; beneath piceous-brown, legs pale testaceous, posterior femora brownish, coxæ and in front of them reddish; antennæ reddish-testaceous, the three apical joints brown. Elytra covered with minute pubescence, beneath the pubescence is very minute. Above densely and minutely punctate, the punctures largest at base and smallest on the apical half of elytra (where they are only visible when the pubescence has been scraped away); meso- and metasternum with minute but distinct punctures.

Head about as long as the width at the base, between the eyes as wide as the base of elytra, at the base not wider than prothorax. Eyes prominent, coarsely faceted; antennæ inserted immediately in front of the eyes, reaching the basal third of elytra, the joints after the 4th gradually increasing in width to apex, 1st joint about twice as long as 2nd, 2nd somewhat globular, 3rd very short, 3rd-5th cylindrical, 6th-8th shortly obconic, 9th-10th transverse, 11th conical, as long as 9th-10th combined. Prothorax transverse, base and apex rounded, sides arcuate, an irregular transverse impression in the middle; on each side of the middle of the base an oblique impression. Elytra not twice as long as head and prothorax combined, about one and a half times as long as wide, at its widest a little beyond the middle, a shallow depression near the base not reaching the sides. Posterior legs with the femora very slightly thicker than the others, tibiæ dilated towards and emarginate at apex; basal joint of intermediate tarsi as long as the others combined, the claw joint as long as the two preceding it, all the tibiæ straight. Length $1\frac{3}{4}$, width $\frac{3}{5}$ mm.

Hab.—Galston.

The posterior tarsi in my specimen are entangled with the protruding genital organs, and I cannot see them very clearly.

SYZETONELLUS HUMERALIS, n.sp.

♂. Oblong-oval, shining. Head, prothorax, basal joints of antennæ and shoulders red; apical joints of antennæ brown; elytra and lower surface piceous; legs, prosternum, and palpi testaceous; eyes black. Above very minutely pubescent, densely and minutely punctate, the punctures largest towards the base of the elytra; beneath minutely pubescent, meso- and metasternum rather strongly punctate.

Head as long as the width at the base, but not the width across the eyes, these very prominent; a shallow, very indistinct impression in the middle of the base; antennæ reaching to about the middle of the elytra; 2nd-5th joints cylindric, 6th-10th obconic, 3rd shortest, 11th longest, not quite as long as 9th-10th combined; 1st-3rd narrowest, 11th widest, the others equal in length and width, none of the joints transverse. Prothorax scarcely if at all longer than wide, at its apex the width of the base of the head, at its base scarcely as wide as the width across the eyes; the apex and sides rounded, the base minutely trisinuate; on each side of the middle of the base a broad shallow fovea causing a Y-shaped elevation to appear; a transverse shallow impression in the middle not visible when viewed from above or behind. Elytra twice as long as head and prothorax combined, and about twice as long as wide, at its widest about the middle; shoulders slightly rounded, an arcuate impression behind the base. Posterior femora not much thicker than the others; all the tibiæ straight, the posterior are widened towards and emarginate at apex, the first joint of its tarsi about twice as long as the others combined, the first of the intermediate is about equal or slightly less than the others combined. Length $1\frac{1}{2}$, width $\frac{2}{3}$ mm.

Hab.—Galston.

CURCULIONIDÆ.

METHYPORA PARALLELA, n.sp.

Narrow, parallel-sided, as deep as wide. The derm dark reddish-brown, of the elytra dark red. Densely covered all over with small round scales; on the rostrum, anterior portion of head, three longitudinal lines on prothorax, an irregular fascia near the base, the apex and sides of elytra, lower surface, and the legs they are of a beautiful shining golden colour, with an occasional greenish tinge; the rest of the scales are dirty brown, except on the scutellum, where they are white. Forehead, apex of rostrum, apex (and disk sparsely) of elytra and tibiæ with short recurved setæ. Head and rostrum densely and minutely punctate;

prothorax and elytra densely and very coarsely punctate (or foveate) in rows, punctures partially concealed by the scales.

Rostrum shallowly sulcate, as long as the rest of the head and not much narrower; antennæ as in *M. postica.* Prothorax scarcely as long as entire head and very slightly wider, cylindrical, truncate at base and apex; scutellum small, narrow. Elytra emarginate at base, towards the apex declivous, each minutely produced at apex. Legs rather short, femora scarcely thickened, anterior tibiæ curved, spurred at apex. Length (rost. excl.) 4, width $\frac{2}{3}$ mm.

Hab.—Gosford.

I have another specimen which differs in being much more soberly coloured, the scales above being of a dirty ashen colour, except on scutellum (where they are white), and before posterior declivity (where they are pale silvery green); beneath the scales are of an obscure pale green.

I think I am right in referring this species to *Methypora*, though its narrow, parallel outline gives it a very different appearance from *M. postica.* The derm (and punctures to a certain extent) cannot be seen till the scales have been scraped away, and I am afraid to touch either of my specimens beneath.

Rhamphus acaciæ, n.sp.

Short, shining, subdepressed, broadest near apex of elytra. Black; tarsi somewhat paler, antennæ pale testaceous, club piceous (its apex sometimes reddish), apex of rostrum tinged with red. Antennæ minutely pubescent, legs and abdominal segments with sparse whitish hairs. Head densely and strongly punctate, the rostrum with a few elongate punctures, prothorax densely and minutely punctate, and with large round punctures; scutellum round, minutely punctate; elytra striate-punctate, punctures strong, striæ very shallow, interstices feebly wrinkled; metasternum coarsely punctured; femora punctate above, strigose beneath, posterior very thick; posterior tibiæ with a number of obtuse spurs at apex. Length 1-1$\frac{1}{4}$ (vix), width $\frac{1}{3}$-$\frac{2}{5}$ mm.

Hab.—Galston (Lea); Armidale (Mr. D. McDonald).

The males are somewhat narrower than females. Notwithstanding their small size I have seen specimens of this species leap 7 or 8 inches; when beaten into an umbrella on a sunny day they are very difficult to capture. I have obtained them only from the flowers of *Acacia decurrens*. The size of this species will at once distinguish it from *R. australis* and *R. distinguendus*.

Protopalus insignicornis, n.sp.

♂. Black, subopaque. The eyes, antennæ, sides of the elytra, and a few small patches on the disk shining. Densely and extremely minutely punctate all over.

Head sparsely covered with small oval testaceous scales; a deep elongate fovea between the eyes. Rostrum with scales like the head, but at the sides and beneath paler and more elongate; narrowing from about the middle, then dilated at the muzzle, which is moderately strongly but shallowly punctate, and with an elongate depression down its middle; scrobes shallow; lower surface with three minutely tuberculate ridges, the inner one continuous from apex to near the base, the two outer about half-way, with irregular depressions between them. Antennæ sparsely covered with short yellowish hairs or setæ; the scape about one-third longer than the head and rostrum, and not quite the length of the funiculus, slender but swollen at the apex; funiculus with the 1st joint slender, slightly swollen at apex, 2nd longer, much swollen at the apex, the two combined not quite as long as the scape, the other joints thick, the 3rd not quite as long as the swollen portion of the 2nd, 4th-7th short, transverse, pubescent; the 5th, 6th, and especially the 7th throw out long grey hairs beneath which reach back to the 2nd joint, club irregularly conical, pubescent, its joints feebly marked. Prothorax sparsely covered with short oval testaceous scales; along and on each side of the median line at the base with a number of whitish elongate scales; rostral groove with a few pale scales; transverse, broadest behind, with small rounded setose tubercles all over, the tubercles smallest at the sides, beneath and in front; a sharp ridge rising in the centre and continuous to the apex, beside it there are no tubercles, but a few punctures. Scutellum small, quadrate, transversely depressed at the base. Elytra triangular in form, deeper than wide, bisinuate at base, humeral angles prominent, a strong tubercle on each elytron equidistant from suture and base; striate-punctate, the punctures large and round, largest and rather square at the sides, smallest at the apex; the suture near the base and till about one-third from the apex strongly humped and tuberculate, and with long black hairs rising from it, at front and back with shorter whitish hairs; on each side of it on the second interstice a bundle of long whitish hairs forming with the posterior one of the hump a small triangle, in all of them a few white scales beneath, also some small patches of whitish scales apically; on the second interstice at a little more than one-third from the base a number of stout setæ; the whole surface is sparsely covered with small oval scales, ranging in colour from testaceous to sooty-black; the sides (which are precipitous) less densely than on the disk and apex. On lower surface, at the sides sparsely covered with testaceous scales, much smaller and darker in the middle; the excavation in the mesosternum fringed with long whitish scales. Legs long, sparsely covered with short setæ; the anterior femora about as long as the rostrum, the others shorter, all of them beneath with a low but sharply terminating ridge; tibiæ with two minute spurs at the inward apex; tarsi setose, the claw-joint with a few small hairs, the 3rd densely spongiose, 2nd and 1st curled over at their apices so as to leave a funnel between them. Length from eyes to apex of elytra 18, rostrum 10, scape 15, first joint of funiculus $5\frac{1}{2}$, second $6\frac{1}{2}$ mm. Width across humeral angles 8, muzzle 2 mm. Depth beneath hump 9 mm.

♀. Differs from ♂ in having the rostrum shorter, not so suddenly or strongly dilated at the apex, and with stronger punctures; the scape is not so long, the funiculus with the 1st joint much shorter than the 2nd; the club only densely pubescent, without the bunches of hairs on the 5th to 7th joints. The elytra are not so triangular, the sutural hump is less prominent, without the long hairs, the triangle of white hairs feebly marked, &c., &c. Length 15, rostrum $5\frac{1}{2}$, scape $2\frac{1}{2}$, first joint of funiculus $\frac{1}{3}$, second 1 mm. Width $7\frac{3}{4}$, muzzle 1 mm. Depth $7\frac{1}{2}$ mm.

I have a pair (obtained *in copula*) of this marvellous beetle, which I found on a fallen log on the Tweed River; it also occurs in Southern Queensland.

The extraordinary antennæ of the male will at once distinguish it from its congeners; it comes closest to *P. cristatus*, Pasc.

CHRYSOMELIDÆ.

POLYOPTILUS IRREGULARIS, n.sp.

Elongate, convex, shining. Brownish-red; legs and antennæ paler, lower surface and coxæ darker, eyes black. Lower surface, antennæ (except basal joint) and legs with very minute pubescence.

Head trigonal from in front of the eyes, cylindrical behind; densely punctate above, beneath less densely and deeply; antennæ slender, reaching to apical third of elytra; 1st joint thick, as long as 2nd-3rd, 3rd one and a half times as long as 2nd, 4th-11th cylindrical, very gradually increasing in length and decreasing in width, 11th not one and a half times as long as 4th. Prothorax longer than wide, truncate at base and apex (where it is darkest), at its widest near the apex, about as long as the head and a little wider than across the eyes; less densely and more irregularly punctate than the head, several shallow depressions near the base. Scutellum triangular, punctate, depressed in the middle. Elytra about twice as wide and about thrice as long as prothorax, striate-punctate, both striæ and punctures very irregular, especially so towards apex; interstices sparsely and irregularly punctate; sides parallel to near the apex; shoulders slightly rounded, prominent, depressed and irregularly punctate at their sides inwardly. Beneath very densely and extremely minutely punctate, the punctures largest about the coxæ and apex of mesosternum; metasternum deeply sulcate. Legs subequal in length, the intermediate shortest; femora (especially posterior) stout, the posterior ridged beneath and near the apex with a short and very sharp spur concealed by the tibiæ when folded; tibiæ widening to apex, curved; tarsi spongiose beneath. Length 9, width $3\frac{1}{2}$ mm.

Hab.—Galston (Mr. S. Dumbrell).

GALLERUCELLA MCDONALDI, n.sp.

Head above, apex of femora, tibiæ and tarsi black; pronotum and elytra testaceous-brown, lower surface and base of femora dark red; above clothed with a short soft yellowish pubescence, beneath more sparsely clothed; antennæ, base of femora, tibiæ and tarsi with a short whitish pubescence; 3rd tarsal joint densely covered beneath with yellowish setæ.

Head coarsely and deeply punctured, except beneath; median line very distinct, a transverse line between the eyes; antennæ inserted close to the median line and level with the front of the eyes, not quite extending to the middle of the elytra, 2nd joint half as long as 1st and 3rd, 3rd-7th gradually increasing, 8th-11th gradually decreasing in length. Prothorax broadly transverse, truncate at base and apex, widest in front of the middle, the anterior angles slightly produced, the posterior produced obliquely forward and pointed; coarsely and densely punctate, except at the apex, largely depressed in the middle, the front and sides from about the middle being raised and marking the depression. Scutellum minutely punctate, about as long as its width at the base, narrower at the apex where it is truncate. Elytra densely punctate, but not coarsely as the prothorax, the sides gradually increasing in width to beyond the middle; seen from above with the naked eye apparently covered with a series of minute tubercles. Beneath scarcely punctate; a broad, shallow depression on each side of the abdominal segments, the penultimate segment in the male slightly incised in the middle. Length 6-8, width 3-4 mm.

Hab.—Armidale.

This species may be readily distinguished from *G. australis* and *semipullata* (if these are to be recognised as distinct) by its smaller size, different coloration, denser and coarser puncturation, differently shaped scutellum, prothorax, &c.

I first received a specimen of this pretty little species from Mr. Duncan McDonald, from whom I have obtained many interesting specimens; subsequently I obtained larvæ, as well as imagines, feeding on the Eucalyptus Mistletoe (*Loranthus* sp.); the larva is smoother, more elongate and less hairy than that of *G. australis.*

A PRELIMINARY COMMUNICATION UPON THE CEREBRAL COMMISSURES OF THE MAMMALIA,

WITH

SPECIAL REFERENCE TO THE MONOTREMATA AND MARSUPIALIA.

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(Plate xliv.)

> "The subject requires careful re-investigation, but if the currently received statements are correct, the appearance of the 'corpus collosum' in the placental mammals is the greatest and most sudden modification exhibited by the brain in the whole series of vertebrated animals—it is the greatest leap anywhere made by Nature in her brainwork."—*Huxley*, "Man's Place in Nature."

The cerebral commissures of the non-placental mammal present a simplicity of arrangement, which may be readily understood, so that a study of their distribution is likely to throw a considerable amount of light upon the more complicated systems of connecting fibres in the brain of the placental mammal. The knowledge of the arrangement of the commissures of the Proto- and Metatherian cerebrum, moreover, must have an important bearing upon the proper understanding of the morphology of the brain of all sub-mammalian Vertebrates, since the Monotremata and Marsupialia form the connecting links between the latter and the higher mammals. This tracing of the homologies with the Eutheria is all the more important because the common descriptive terms have mostly been originally applied to parts of the higher mammalian brain, especially that of the Primates.

During the present year, acting upon the suggestion of Professor Wilson, to whom I am deeply indebted for much valuable advice, I have examined a considerable number (about thirty) brains of the Monotreme and Marsupial orders, more especially those of *Ornithorhynchus* and *Perameles nasuta*. A knowledge of the gross anatomy having been obtained by dissections of fresh brains, the minute anatomy was worked out in serial sections of the whole brain cut in coronal, sagittal and horizontal planes. The Weigert-Pal and Golgi staining methods were used for most of the work, supplemented by occasional use of anilin blue black. In addition to the above, the cerebrum has been examined in the Phalanger, *Macropus*, Koala, Kangaroo-rat, *Dasyurus* and *Echidna*, and compared with those of the rabbit, pig, cat, dog, guinea-pig and mole. From a series of fœtal specimens of *Phalangista* of various ages, I was enabled to make out many points in the cerebral development. Through the kindness of Professor Wilson and Mr. J. P. Hill, I was enabled to examine some beautifully stained series of sections of fœtal Kangaroos and Bandicoots, as well as a very valuable series of sections of a fœtal Platypus, whose external appearance is described in this number of the Society's Proceedings. For the abundant supply of material with which this research was conducted, I am deeply indebted to Dr. C. J. Martin, Mr. J. P. Hill and Dr. Meredith, of Raymond Terrace. To Mr. Robert Grant I am under a deep obligation for much valuable assistance in the histological work.

In the Marsupial and Monotreme brain the greatest interest centres in the unique arrangement of the cerebral commissures, the uniformity of whose general plan throughout these orders indicates the close relationship between the Proto- and Metatheria, and separates them as a distinct and well defined group from all the Eutherian orders.

This paper is merely intended as a synopsis of that part of the subject which relates to the commissures. The complete results of the work on the non-placental cerebrum I hope to present to the Society in a short time.

At an early stage in the development of the non-placental mammal, the mesial wall of the prosencephalic vesicle becomes indented to produce two parallel furrows, in exactly the same way as occurs among the Eutheria. The lower of these two furrows, which extends forwards as far as the foramen of Monro and backwards as far as the posterior extremity of the lateral ventricle, is the *fissura choroidea*. The upper corresponds to what has been called the *fissura arcuata (Bogenfurche* of Arnold) in the placental mammal and is coextensive with the lateral ventricle. Included between these two fissures is a strip of cortex, which is known as the *arcus marginalis (Randbogen)*, which (owing to the deficiency of the cortex lining the fissura choroidea) becomes the edge of the cortex cerebri. The fissura arcuata of the Monotreme and Marsupial brain differs from the corresponding structure in the placental mammal, in that it persists into adult life as the fissura hippocampi in the whole extent of the ventricle, thereby meriting the name of "*Ammonsfurche*" given to the corresponding structure in the Eutherian brain by Mihalkovics. In the non-placental mammal, then, the hippocampal fissure forms a projection —the hippocampus—into the lateral ventricle in its whole extent. The fissure, and consequently the hippocampus, corresponds in shape with the contour of the ventricle. So that in Platypus, where the lateral ventricle has only a small descending horn (so small that it was quite overlooked by Hill, "On the Cerebrum of Ornithorhynchus," (Philosophical Transactions B. 1893), the hippocampus and hippocampal fissure present a slight hook-like bend downwards at their posterior extremity. This is shown in a somewhat exaggerated manner in fig. 2 *hf.* In all Marsupials the fissura hippocampi (fig. 1 *hf.*) presents a well marked curve downwards at the posterior extremity corresponding to the downward curve of the lateral ventricle to form its descending horn. From the arcus marginalis is formed the fascia dentata and from the projection into the ventricle the cornu Ammonis, whose histological structure closely resembles that of the corresponding regions of the Eutherian brain, as described by Ramon y Cajal.*

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* "Neue Darstellung vom histolog. Bau des Central-nervensystems," Archiv für Anat. p. 377, 1893.

The ventricular aspect of the hippocampus is covered in its whole extent by the alveus, a layer of fine medullated nerves, which arise as axis-cylinder processes of the large pyramidal cells of the hippocampus (especially those near the fimbria) and from the polymorphous cells, which form the nucleus fasciæ dentatæ. "Collaterals" derived from the same sources also pass into the fimbria to become "commissural" fibres. All these fibres converge towards the thickened lamina terminalis, which is the homologue of the *septum lucidum* of higher Mammals. In order to reach this point, above the foramen of Monro, the fibres coming from the anterior extremity of the hippocampus are directed backwards and inwards, and those coming from the posterior part of the hippocampus are directed forwards and inwards with varying degrees of obliquity. Since the greater part of the entire hippocampal formation is placed behind the foramen of Monro, including the whole of the descending horn, which alone is present in Eutheria, there is, consequently, a large mass of fibres coursing forwards and increasing as it goes, from fresh accessions of alveus fibres. This mass of fibres becomes collected to form a distinct ridge which constitutes the *fimbria*, which is mainly derived from the descending horn. The fimbria, therefore, will vary in size with the length and degree of development of the hippocampus behind the foramen of Monro, more especially with the size and extent of the descending limb of the hippocampus. In Platypus, and to a less marked degree in *Echidna*, the descending part of the the hippocampus is short, and in neither is the layer of alveus fibres thick in this region. As a consequence neither Monotreme has a well-formed fimbria. In all Marsupials, however, there is an extensive part of the hippocampus lying posterior to the foramen of Monro and a well developed descending limb, so that the cut fimbria projects as a prominent spur in transverse section. Since the hippocampus extends forwards beyond the foramen of Monro, no part of the fimbria ever becomes free from the hippocampus to form posterior pillars or body of the fornix as in placental mammals. The fimbria, or its representative, lies in the whole of its extent along the margin of the cortex, where that is formed by the fascia dentata. The latter structure in Platypus throughout forms the upper border of the choroid fissure, but in *Perameles* and others, where the ventricle turns downwards, and the descending cornu thus formed bends forwards, the fascia dentata and fimbria come, of course, to occupy a position at the *lower* margin of the choroid fissure in its descending limb, and the fimbria lies *above* the fascia dentata in this region. The destination of the alveus fibres, after they have arrived at the region of the foramen of Monro, varies.

(*a*) The great majority of the fibres cross the middle line to enter the hippocampal region of the opposite side, so that they effect an exchange of fibres between the two hippocampi. In the alveus of the opposite hippocampus they give off numerous collaterals which enter the white matter and come into relationship with the pyramidal cells. These fibres constitute therefore the *hippocampal commissure* proper of Owen and Symington—the *corpus callosum* of Flower, Sander, Osborn and almost all recent writers—the *hippocampal decussation* (in Platypus) of Hill. Its origin from cells of the hippocampus (including the subiculum and fascia dentata) indicates without the slightest possibility of doubt its homology with the psalterium of Eutheria.

(*b*) A large bundle of fibres dips downwards behind the anterior commissure to enter the optic thalamus. This is the *anterior pillar of the fornix.*

(*c*) A third smaller and more scattered bundle arches forwards in the mesial wall of the hemisphere in front of the anterior commissure—the *precommissural fibres of Huxley.*

(*d*) A considerable number of alveus fibres pass into other regions of the same hippocampus from which they arise. These may be called *hippocampal association fibres.*

The present paper will only deal with the first of these sets of fibres—the hippocampal commissure—and will only refer to the others in so far as they are related to the commissural fibres. It may be remarked, however, in passing, that Hill's statement* that "all such fornix as exists in *Ornithorhynchus* crosses in the middle line" and that the descending fornix fibres come from the hippocampal commissure is absolutely erroneous, since the great majority of such fibres come directly from the alveus and never cross the middle line. His further description of their destination and of the formation of the taenia thalami is equally inaccurate.

On separating the cerebral hemispheres of any Marsupial or Monotreme from above, a large white transverse band will be noticed passing between the two hemispheres and hiding from view the anterior extremity of the third ventricle and the foramina of Monro. The question of the homology of this band has been the subject of much controversy.

A full account of the earlier discussion of this question will be found in the paper of Flower,† and the more recent bibliography will be found in the papers of Symington‡ and Hill.§ Ever since Meckel's monograph|| there have been supporters of his view that the superior commissure was corpus callosum. Thus Flower in *Echidna* and a series of Marsupials,¶ Pappenheim in *Didelphis*,** Sander in *Macropus* and *Didelphis*,†† Osborn in fœtal *Macropus*,‡‡ Zuckerkandl in Platypus,§§ and Herrick in *Didelphis*,|||| as well as in numerous papers elsewhere, have, among others, supported

* *Loc. cit.*

† "On the Commissures of the Cerebral Hemispheres of the Marsupialia and Monotremata," Phil. Trans. 1865, p. 633.

‡ "The Cerebral Commissures in the Mammalia and Monotremata," Journ. of Anat. Vol. xxvii. p. 69.

§ "Cerebrum of Ornithorhynchus," Phil. Trans. B. 1893.

|| Descr. Anat. Ornithor. parodoxi, 1827.

¶ *Loc. cit.*

** Compt. Rendus, Vol. xxiv. p. 186, 1847.

†† "Ueber das Quercommissurensystem des Gehirns bei den Beutelthieren," Arch. f. Anat. 1868.

‡‡ "The Origin of the Corpus Callosum," Morph. Jahrbuch, Vol. xii.

§§ "Ueber des Riechcentrum," 1887.

|||| "Callosum and Hippocampus in Marsupial and lower brains," Journ. of Comp. Neurology, Vol. iii. p. 179.

the view of Meckel that a corpus callosum is present. Haeckel as recently as 1893 has made use of the following terms in describing the essential features of the Marsupial and Monotreme brains. Among the "Hereditiv-charactere der Monotremen" he places "die primitive reptilienähnliche Bildung des Gehirns, insbesondere der Mangel eines ausgebildeten Corpus Callosum," and referring to the Marsupialia, "die geringe quantitative und qualitative Entwickelung des Gehirns, namentlich des Corpus Callosum."* Beevor, who, after an examination of the cerebrum of *Macropus*, expressed the opinion that the superior commissure was corpus callosum (Brain, 1887), elsewhere denies the presence of any hippocampal commissure in certain Primates.† Apart from the evidence of the presence of such a commissure which the non-placental mammal affords, there is the valuable corroborative evidence of its presence in the placental mammal by Honegger.* The opinion of Owen that the corpus callosum is absent in the Non-placentalia is supported by Eydoux and Laurent,† by Robert Garner in Platypus and several Marsupials,‡ by Symington in the clearest and best account of the subject which has yet appeared,§ and Hill;|| and Edinger in the fourth revised editions of his lectures¶ says that all Marsupials so far examined lack a corpus callosum.

In spite of this the generally accepted opinion among recent writers [of which, for instance, the works of Foster and Balfour, as well as the more recent work of Minot on Embryology and the

* "Zur Phylogenie der Australischen Fauna," Jena.

† "On the Course of the Fibres of the Cingulum, &c., in the Marmoset Monkey," Phil. Trans. 1891.

* "Vergleichend-anatomische Untersuchungen über den Fornix, &c.," Recueil de Zoologie Suisse, Tom. v. Nos. 2 and 3.

† "Sur l' Encephale de l'Echidna comparé à celui de l'Ornithorhynque," Voyage de la "Favorite."

‡ "Anatomy of the Brain of some small Quadrupeds," British Assocn. Reports, 1858, p. 123.

§ *Loc. cit.*

|| *Loc. cit.*

¶ "Vorlesungen über den Bau der Nervösen Centralorgane," Leipsig, 1893.

comparative papers of Sir William Turner,* may be quoted as examples] is that all mammals possess a corpus callosum. This opinion is still actively upheld by Herrick in his numerous papers, although in a different (but equally mistaken) sense to all other writers. So that to-day there is still considerable uncertainty upon this question, in spite of the short but clear and convincing paper of Symington.†

So far no attempt has been made to explain either the arrangement of the fibres in this commissure or the difference in shape which it presents in different animals, and which so deceived Flower. This paper aims at offering an explanation of these appearances.

If a sagittal section be made through the mesial wall of the cerebral hemisphere of *Perameles*, *i.e.*, a short distance from the mesial plane of the brain, the section stained by Pal's method presents an appearance which is represented in a purely schematic manner in fig. 1. In the middle of the figure is seen the section of the commissure (*ps.*), which has given rise to so much discussion, and radiating from it the fibres (*f.*) of the alveus are schematically represented proceeding to all parts of the hippocampus, whose contour is represented by the hippocampal fissure (*hf.*) From the concavity of the hook formed by the commissure are to be seen issuing the fibres of the anterior pillars of the fornix (*af.*) and the precommissural fibres of Huxley (*s.*) separated by the anterior commissure (*ac.*).

In fig. 2 the corresponding structures in *Ornithorhynchus* are represented in a similarly schematic manner. The psalterium or superior commissure here presents only a slight hook at its posterior extremity corresponding to the rudimentary posterior descending cornu of the hippocampus. Consequently the commissure is not folded in bilaminar form as it is in *Perameles*. In fig. 3 the condition found in the placental mammal is diagrammatically represented.

* "The Convolutions of the Brain," Journ. of Anat. Vol. xxv. 1890; "The Cerebrum of *Ornithorhynchus*," Journ. of Anat. Vol. xxvi.

† *Loc. cit.*

In *Perameles* the sagittal section of the commissure is thin in front, where it is composed of scattered bundles coming from the anterior part of the hippocampus. But as it is traced back it becomes thicker and more compact from the crowding together of fibres from the middle portion of the hippocampus. Posteriorly the commissure takes a sudden bend downwards and forwards, and at the bend a large number of fibres are aggregated to form a structure which resembles the *splenium corporis callosi* of placental mammals, and was actually believed by Flower to be the splenium. Since it is produced in the same manner as the splenium, it may not be inappropriate to call it the "*splenium of the hippocampal commissure.*" From this splenium the ventral limb of the commissure extends downwards and forwards like the psalterium of the placental mammal, and as in the latter it is formed mainly by the fimbria. In the higher Marsupials the angle formed at the splenium by the two layers of the commissure becomes more acute, and in the highest Metatherians like the Kangaroo the two layers form two parallel bands united behind at the splenium. After this description of the arrangement in *Perameles*, the appearance of the commissure met with in Platypus will be readily understood. As the descending horn of the ventricle is rudimentary there is a very small descending limb of the hippocampus. There is consequently no ventral layer of the commissure, but only a slight hook-like "splenium" at the posterior extremity of the commissure. In the Eutheria (fig. 3) where that portion of the hippocampus lying above the velum interpositum does not develop, there is consequently no *dorsal* layer of the hippocampal commissure; but, corresponding to the ventral part of the hippocampus, which alone persists, the ventral layer of the hippocampal commissure forms the psalterium, as we usually understand that term—*the place of the dorsal layer of the commissure being occupied by the corpus callosum.* The corpus callosum of higher mammals is continuous with the psalterium at the callosal splenium, and the exact point of union of the two is not usually evident. Although in the highest mammals the splenium is formed wholly of callosal fibres, yet in some of the lowlier Eutheria, *e.g.*, *Mole* (Ganser*) it is formed of psalterial fibres, and is not therefore strictly a splenium *corporis callosi*, but corresponds rather with the "splenium" of the marsupial commissure. Ganser, from such considerations, and recently Paul Martin† from a study of the development of the corpus callosum in the cat, have come to the conclusion that the separation of the psalterium from the corpus callosum is purely artificial and serves no useful purpose, since both commissures connect parts of the cortex cerebri. These writers therefore include both structures under the term corpus callosum, and divide it into dorsal and ventral layers. But as I have already pointed out, the superior commissure of Proto- and Metatheria is formed solely of fibres derived from cells lying in the hippocampal region. This in Eutheria is the only distinguishing feature of the psalterium, that it is formed of fibres whose "Ursprungzellen" lie in the hippocampus, as distinct from callosal fibres, which consist solely of axis-cylinders and collaterals of cells lying in the mantle proper. The whole superior commissure of the non-placental mammal is strictly homologous then with the *ventral* layer of the great cerebral commissure of the placental mammal, while the *dorsal* layer of the latter is a pallial commissure superadded to the ventral, and superseding the dorsal, layer of the hippocampal commissure present in the Marsupials and Monotremes. If then it be permissible to consider the ventral layer of the Eutherian commissure as truly corpus callosum, we must, of course, admit that the Proto- and Metatheria have a corresponding structure, constituting, however, a corpus callosum, none of whose fibres arise in the mantle proper and which is, therefore, not strictly comparable to the great white band seen on divaricating the hemispheres of a higher mammal. This relationship of the superior limb of the hippocampal commissure in the Metatheria was not appreciated by Flower, who, from the resemblance of the whole commissure in sagittal section to the combined corpus callosum and psalterium

* "Vergleichend-anatom. Studien ü. d. Gehirn des Maulwurfs," Morph. Jahrb. Bd. vii. 1882.

† "Zur Entwick. des Gehirnbalkens bei der Katze," Anat. Anzeiger, 1894.

of Eutheria, regarded the dorsal layer of the marsupial hippocampal commissure as a true corpus callosum.

In the descriptions given above, I have described the appearance seen on section through the mesial wall rather than through the middle line, because in the latter plane the fibres have become collected into a more compact mass, and the simplicity of the arrangement is correspondingly obscured. It may be pointed out in this connection that the marked difference in the appearance presented on mesial section of, *e.g.*, such brains as those of *Echidna* and *Macropus*, are more apparent than real.

The mass of grey matter, which is situated on the ventral aspect of the hippocampal commissure in *Ornithorhynchus* and which fills up the concavity of the hook formed by the commissure in *Perameles*, is the homologue of the septum lucidum of Placentalia, being formed, like the latter, from the thickened lamina terminalis. The septum lucidum, therefore, in Marsupials (fig. 1) fills up the concavity of the "psalterial" hook, lying *ventral* to the dorsal limb or cornu of the hippocampal commissure, which alone is present in Platypus (fig. 2), *dorsal* to the ventral limb or cornu, which alone is present in Eutheria, while, as already stated, it lies in the Marsupial between the ventral and dorsal limbs of the commissures, which are both present. The septum lucidum, therefore, presents the same topographical relation to the corpus callosum of placental mammals as it does to the dorsal limb of the hippocampal commissure of non-placental mammals, so that Flower's* main argument for the existence of a corpus callosum—that it lies dorsal to the septum lucidum—loses all its cogency.

In this connection it is important to emphasize the fact that the "septum" lies entirely upon the ventral aspect of the hippocampal formation in Platypus and ventral to its anterior part in Marsupials. It lies, therefore, entirely *ventral* to the Randbogen, below which it is carried backwards with the superior commissure as the latter develops. Now the corpus callosum occupies the same position in relation to the septum pellucidum as the dorsal

* *Loc. cit.*

limb of the hippocampal commissure does in Marsupials, and develops in the lamina terminalis just as the corpus callosum does (Marchand, Paul Martin, Minot). Moreover the latter is continuous posteriorly with the psalterium. The corpus callosum from comparative reasons, therefore, as well as from the purely ontogenetic evidence in human brain by Marchand,* and Paul Martin in the cat,† lies entirely *ventral* to the Randbogen. Hill's statement‡ that "the corpus callosum in its backward extension breaks through a convolution, which lies outside the ring from which the fascia dentata, fimbria and fornix are developed," as well as the opinion of Fish "that in its dorso-caudal growth the callosum ploughs its way . . . through the arcuate gyre"§ are as equally opposed to the facts of comparative anatomy as they are quite unsupported by the brilliant results of Marchand's developmental researches.

Before a corpus callosum (using the term in the restricted sense in which anatomists generally regard it, *i.e.*, as distinct from the psalterium) can develop, either the hippocampus must disappear in the region in which the supraventricular callosal mantle-commissure is to develop, or the callosal fibres must traverse the hippocampal region. Of these alternatives the former is that which is found to take place. Accordingly in the ontogeny of the cerebrum of the placental mammal the anterior portion of the fissura arcuata (the "vordere Bogenfurche" of His), and consequently the hippocampal projection into the anterior horn and body of the lateral ventricle, disappears preparatory to the development of the corpus callosum, the "hintere Bogenfurche" alone persisting to become the hippocampal fissure, which forms a projection limited to the descending horn of the ventricle. This is quite in accordance with the belief of Professor D. J. Cunningham, who, as the result of his study of the development of the

* "Ueber d. Entwick. d. Balkens im Menschlichen Gehirns," Arch. f. Mikr. Anatomie, Bd. xxxvii. 1891.

† *Loc. cit.*

‡ "The Hippocampus," Phil. Trans. B. 1893.

§ "The Indusium of the Callosum," Journ. of Comp. Neurology, Vol. iii. 1893, p. 61.

human cerebrum, says*:—"I believe that it [vordere Bogenfurche] is transitory and that it is gradually obliterated during the time that the corpus callosum assumes shape." In Proto- and Metatheria the anterior commissure is the cerebral commissure *par excellence*, being the sole connection between all parts of the hemispheres, excluding the hippocampi only. It is of interest to note in this connection that the anterior commissure persists in Eutheria in just that part of the mantle related to the descending horn of the ventricle in which the hippocampus remains, while in the region from which the hippocampus has disappeared the anterior commissure is supplanted by the fibres of the proper corpus callosum. In the temporal lobe of Placentalia the alveus fibres (the root fibres of the hippocampal commissure) present the same relationship to the terminal fibres of the anterior commissure as they do to the same commissure in the whole range of the extensive hippocampal region of Non-placentalia. And, as the hippocampal region in the latter is co-extensive with the lateral ventricle, so the anterior commissure is co-extensive with the lateral ventricle, *i.e.*, supplies, in these forms, the whole of the cortex, excluding the hippocampus only.

The important question, "What is the significance of the corpus callosum?" must now be considered. Is it a new commissure to connect cortical areas hitherto unconnected or not present in lower mammals; or, on the other hand, is it merely a new path for fibres which possess representatives in the brains of the Meta- and Prototheria? From a consideration of the facts before us, it seems possible that the corpus callosum appears in response to the demand for a shorter connecting route between the rapidly developing dorsal portions of the cortex cerebri. That such factors are at work, the Marsupials themselves seem to afford evidence. In *Perameles* the anterior commissure passes around the corpus striatum as an external capsule to reach the various regions of the mantle. In *Phalangista*, a bundle of anterior commissure fibres proceeds to the cortex *viâ* the internal capsule,

* Cunningham Memoirs of Roy. Irish Acad. No. vii. 1892, p. 5.

in addition to the external capsule. In *Macropus*, in order, apparently, to meet the demands of the greatly increased mantle, almost half of the anterior commissure fibres pass through the internal capsule to reach the dorsal part of the mantle. It seems as if this principle became extended in the placental mammal, and to provide for the enormous mantle development of the higher Mammalia, a shorter supraventricular route was established in place of the circuitous path, which the fibres of the anterior commissure would otherwise have had to take to reach such a region, for instance, as the callosal convolution in man.

Although from these considerations it seems as if the callosal fibres were serially homologous with the fibres of the anterior commissure, *i.e.*, fibres separated from the anterior commissure to meet the exigencies of a huge mantle-development, it must not be forgotten that the parts of the cerebrum which the corpus callosum connects, only develop late in the phylogenetic and ontogenetic history of the individual. Thus Sir Wm. Turner* states that the relative proportion of mantle to rhinencephalon decreases as we descend the Mammalian series until in the lowest mammals the pallium is almost as small as the rhinencephalon. In *Perameles* this reduction of pallium goes still further, as, instead of being as large as the rhinencephalon, the pallium forms merely a small cap placed upon the rhinencephalon. In the Eutheria a considerable portion of the mantle, viz., the temporal lobe, is connected by the anterior commissure. If, then, from the small cap of mantle found in *Perameles* we subtract the portion corresponding to the temporal mantle of higher forms, there will be little, if any, mantle left to be connected by a corpus callosum. In such higher Metatherians as the Wallaby the demand for a corpus callosum becomes greater, and is met to some extent by added fibres of the anterior commissure passing through the internal capsule. If in such a highly developed brain as that of the Wallaby, where the demand for a true corpus callosum is evident, such a structure is wanting, it seems *a priori* highly

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* Journ. of Anat. Vol. xxv.

improbable that in the Sauropsida and Amphibia such a commissure should exist, as so many writers assert.

Although *a priori* statements are of little value as scientific argument, still with such presumptive evidence of the absence of a corpus callosum in Submammalia, one is naturally chary of accepting any opinion as to its presence, unless supported by definite and convincing evidence. Such evidence moreover is not yet forthcoming, and the arguments which have hitherto been adduced in support of the hypothesis, are of the flimsiest kind. Herrick states* "the callosum is practically absent [in *Didelphys*] . . . a rudiment of what may be called corpus callosum [is present], although we are unwilling to definitely homologise it with that body . . . it soon loses itself in the median walls of the hemisphere, corresponding to the septum pellucidum. Being a tract of cortex, this band has as great claim to be homologised with the corpus callosum as the relatively larger commissure of the alligator." The area which Herrick here calls "septum pellucidum" and elsewhere "intraventricular lobe" is an area of the mesial surface of the cortex, which is directly continuous posteriorly with the tract which has already been described as the septum lucidum and which develops from the lamina terminalis. The corresponding grey mass in Reptiles has been called "septum pellucidum" and "Fornix leiste" by Edinger† and Meyer,‡ although the latter would not definitely homologise it with the "septum" of Eutheria. Flower§ called it "septal area." All these terms are very misleading, because the area in question is not homologous with the septum lucidum, which is merely the thickened lamina terminalis.‖ This tract, moreover, develops from the "posterior olfactory lobule" of His, and can be readily

* "Cerebrum and Olfactories of the Opossum, &c.," Bull. Sci. Laboratories, Denison University, Vol. vi Part ii. p. 75.

† "Vergleichend-entwick. und anat. Studien im Bereiche der Hirnanatomie. 3. Riechapparat und Ammonshorn," Anat. Anzeiger viii. 10, 11.

‡ "Ueber das Vorderhirn einiger Reptilien," Zeit. f. wiss. Zool. lv. Bd. Nov. 1892.

§ *Loc. cit.*

‖ Minot "Human Embyrology."

traced in the Mammalian series as the *gyrus subcallosus* of Zuckerkandl* or the "peduncle of the corpus callosum." Neither of these terms is applicable to the nonplacental mammal since there is no corpus callosum. The area in question may be distinguished as "*the precommissural area*," a purely descriptive term equally applicable to all vertebrates possessing a cortex. The "precommissural area" from its connections and ontogeny is part of the rhinencephalon. Now the only two commissures which are known to have any connection with the rhinencephalon are the anterior and hippocampal commissures—the corpus callosum never. To distinguish some fibres of the hippocampal commissure by the name of "corpus callosum"—as Herrick does—simply because they go to the precommissural area is therefore entirely unwarranted, and opposed to all the accepted criteria of a corpus callosum. Since the corpus callosum of certain reptiles is confined to the homologous area, it is only natural to conclude that a corpus callosum is absent in them as it is in *Didelphys*.

Moreover, Osborn† in Amphibia speaks of a bundle of fibres as "a commissure of the dorsal portion of the mantle and homologous, on this ground, with the corpus callosum," quite oblivious of the fact that, by his own showing, the dorsal commissure in Marsupials is anterior commissure. Besides, Edinger‡ shows that the mesial and dorsal portions of the cortex of reptiles is homologous with the Ammon's horn, and therefore its connecting fibres must be hippocampal commissure. When it is upon such flimsy and unscientific evidence that many writers base their belief in the presence of a corpus callosum in Submammalia, one is fully justified in doubting their conclusions, especially when there is so much discordance as to what actually is the corpus callosum. Thus many writers (*e.g.*, Osborn, Gage, &c.) describe as corpus callosum a structure which is undoubtedly hippocampal commissure. Evidence is accumulating, which will go far to prove that the corpus

* *Loc. cit.*

† *Loc. cit.*

‡ *Loc. cit.*

callosum of most writers on Submammalia, is nothing else than a hippocampal commissure—a view, which a comparison with the arrangement of the commissures in Platypus would lead one to expect. The great source of confusion to investigators not only upon the Marsupial but also upon the Sauropsidan cerebrum, in attempting to compare the latter with the placental mammal, is the altered position of the hippocampal commissure—firstly, by the bending of the hemisphere accompanied by a corresponding bend in the commissure, and secondly, the disappearance of just that part of the hippocampus and its commissure, which clearly maintains its true morphological position as the *upper* margin of the choroidal fissure, *dorsal* to the septum pellucidum. In the Platypus we have the key to unlock the whole question.

The following summary presents a hypothetical explanation of the presence and order of appearance of the three commissural bands met with in the region under consideration.

In the lowest stage of cerebral development the anterior commissure is the great commissural system of the cerebrum. Included in the anterior commissure are numerous strands of varied significance, which may in lowly forms be quite distinct from one another as they lie in the lamina terminalis, *e.g.*, in Teleostei, where this anterior commissure system is known as the "*commissura interlobularis*" (Göttsche). Early in development the upper border of the choroidal fissure becomes differentiated as a hippocampus, which, before the ventricle becomes bent, lies entirely dorsal to the fissure, as in Platypus and the Sauropsida. This is the portion of the cortex furthest removed from the situation of the anterior commissure, and hence this—the hippocampus—is the region which first demands a shorter route for its connecting fibres. Hence the hippocampal commissure appears as the second distinct commissural band, and we have the Monotreme and Marsupial condition.

In the ontogeny of the Eutherian brain this order of development of the commissures is also observed, the anterior commissure being the first to appear, and later the combined calloso-hippocampal commissure. Of the latter commissure, the commissural fibres of the fornix are the first to develop,* so that in the early Eutherian brain there is a stage which closely resembles the adult condition in Metatheria with "anterior" and hippocampal commissures and a complete absence of corpus callosum proper. Combined with this absence of the corpus callosum there is a persistence of the Bogenfurche, which completes the picture of the Marsupial brain, constituting a veritable "*Metatherian stage*" in the development of the Eutherian brain. These interesting facts in the development of the higher mammalian brain, which the recent work of Marchand and Martin have elucidated, fully bear out the statement of the late Sir Richard Owen that the hippocampal commissure in the Marsupials "represents the first stage of the corpus callosum as it appears in the development of the placental mammal"—a statement which has been repeatedly misunderstood by Owen's critics. The work of Owen, which was performed almost fifty years ago with the crude methods of investigation of that time, will stand the test of the latest methods of investigation which the last few years have yielded. In the light of our advanced knowledge of to-day, with all the delicate and selective staining agents and improved methods of research, the results of his labours on the brain of the nonplacental mammal stand out as a lasting memorial to his close observation and insight. The opposition which has been brought to bear against his investigations by so many prominent biologists, some of whom, from a less clear comprehension of the subject, attempt to depreciate the value and question the accuracy of his work, can have no other result than to expose their own ignorance. Even as late as last year, an English writer well known in neurological literature, in a disparaging attempt to find fault with Owen's work on Platypus, simply laid himself open to the accusations with which he ineffectually attempted to stamp the work of the great *savant*. The result of the present research on the cerebrum of a large series of Monotremes and Marsupials, with the methods of Golgi and Weigert, is to completely vindicate Owen from the

* Martin, *loc. cit.*

charges of inaccuracy which have been ignorantly levelled against him. I am well aware that the writer of the paper in question had very bad material with which to work, but that is all the more reason why he should have been more cautious in his attack upon others' work. The hypercritical tone of the paper in question reaches its acme in the following passages:—"On what ground, too, does Owen maintain, that the essential function of the fornix as a commissure . . . is maintained, when, as will be shown presently, *all such fornix as exists in Ornithorhynchus decussates in the middle line, is not united with the olfactory bulb and may be, for all one can tell to the contrary, not a longitudinal commissure at all, but a series of tracts uniting together corresponding parts of the two sides?* . . . "*He saw the difficulty, but not the way out of it.*"*

The closing phrase in this quotation accurately describes the position of its writer, who, by ignoring the close and intimate connection of the hippocampus with the olfactory lobe (the internal root, the *Riechbundel* of Zuckerkandl, and "the *olfactory bundle of the fascia dentata*" of the present writer), and having elsewhere stated that the external olfactory root cannot be traced to the hippocampus, completely excludes the hippocampus from any connection with the olfactory region, in spite of the fact that he correctly located the fascia dentata as the olfactory centre. But for the statement of Owen that the "association" between the olfactory and hippocampus is maintained to a greater extent (as compared with the commissural connection) than in higher animals, his statements may be taken as strictly accurate, a very close and intimate association existing between the anterior extremity of the hippocampus and the olfactory lobe, by means of fibres passing through the precommissural area, and which are probably homologous with some of the "precommissural fibres of Huxley" and the striæ Lancisii of the Eutherian cerebrum. The latter homology is rendered all the more probable by the statements of Blumenau† that the striæ Lancisii, which are continued pos-

* The italics are mine.

† *Loc. cit.*

teriorly into the fascia dentata, are connected anteriorly with the olfactory lobe, in much the same way as I have elsewhere shown my "*olfactory bundle of the fascia dentata*" to be connected in Platypus.

After the appearance of the hippocampal commissure the increased development of the mantle next demands a shorter course for its connecting fibres, which is provided by the corpus callosum. If these conjectures are right, the three cerebral commissures must be regarded as serially homologous, the anterior commissure, or at least its pars olfactoria,* appearing first, the hippocampal commissure next, and the corpus callosum last. That some of the fibres, which in Placentalia pass in the latter, cross the middle line with the anterior commissure in Non-Placentalia seems certain, so that part of the anterior commissure is really the homologue of the corpus callosum in the Proto- and Metatheria, the hippocampal commissure being merely a part of the anterior commissure, which has become separated off earlier in phylogeny. The appearance of a corpus callosum can hardly be considered then, therefore, such a sudden event as would appear at first sight and such as Professor Huxley's remark *(supra)* seems to imply, but is merely an example of the adaptive element in development, which recent research has recognised as the important modifying factor of phylogenetic tendencies in ontogeny.

What becomes of the anterior extremity of the hippocampus in the placental mammal? Comparison with the non-placental mammal supports the view, which is forced upon one by the important researches of Marchand† and Blumenau,‡ that the *gyrus supracallosus* of Zuckerkandl§ (the *indusium* or *striæ Lancisii)* is the representative of the anterior part of the hippocampus.

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* The "pallial" part of the anterior commissure probably does not appear until after the hippocampal commissure.

† *Loc. cit.*

‡ "Zur Entwickl. v. feineren Anatomie des Hirnbalkens," Archiv f. Mikr. Anatomie, Bd. xxxvii. 1891.

§ *Loc. cit.*

In man and microsmatic mammals the temporal part of the hippocampus retains its primitive contour, the fascia dentata ending just behind the splenium of the corpus callosum. Hill,* not recognising the association between the disappearance of part of the hippocampus and the appearance of the corpus callosum, attributes this fact to "accident." But what happens in the macrosmatic mammal? For, in order to prepare for the advent of a corpus callosum, the whole of the upper and anterior part of the hippocampus has disappeared, and only the small temporal segment is left to carry on the functions of the whole. To compensate for this restriction, the hippocampus, as it grows, becomes bent upon itself in an S-shaped manner (fig. 6) and becomes accommodated *under* the corpus callosum, in which situation it may extend forwards almost as far as the foramen of Monro. This bending can be readily seen in the brain of the rabbit or fœtal pig. Hill, in discussing the question "whether the fascia dentata is continuous with the nervus Lancisii?" comes to the conclusion that there is no continuity between the two structures, and that the fascia dentata is essentially a *subcallosal* structure. His principal argument is that in the ox "he fails to see any indication of the return of the fascia dentata to the under-surface of the splenium in order that it may round the splenium and sweep forward in the nervus Lancisii in the manner required by the theory" [of Honegger and Zuckerkandl†]. This view, that the fascia dentata is essentially *subcallosal*, is not only directly opposed to the facts of its development as described and figured by Mihalkovics, Blumenau and Marchand, but also to the facts elicited by a comparison with the Marsupial. The corpus callosum occupies the same relative position to the Randbogen that the superior limb of the hippocampal commissure does in Metatheria, and hence the fascia dentata is essentially *supracallosal*.

If the suggestions concerning the striæ Lancisii advanced in this paper are correct—and the whole weight of comparative

* "The Hippocampus," *loc. cit.*

† *Loc. cit.*

and developmental facts, as well as the histological structure as described by Ramon y Cajal, seems to favour the view—then the cleft between the mesial stria and the callosal gyrus would be the anterior extremity of the Bogenfurche. So that for practical purposes the opinion of Schwalbe (which is essentially identical with those of Hertwig, Schmidt and Mihalkovics) that "the Bogenfurche in its upper part becomes the upper boundary of the corpus callosum" is for all practical purposes correct. Strictly speaking, however, the callosal fissure must be regarded as a new formation, because with the degenerate condition of the hippocampus is associated the practical absence of the "Ammonsfurche," the callosal fissure being formed by the growth of the cortex above the corpus callosum, causing it to bulge over the latter. So that Professor Cunningham's statement* must be regarded as strictly correct "that the Bogenfurche is transitory and is gradually obliterated during the time the corpus callosum assumes shape."

The facts brought forward in this paper afford a perfectly rational explanation of the circuitous course taken by the fornix fibres in the higher mammalia, without resorting to any such theory of the rotation of the brain as that advanced by Hill†—a pure speculation utterly opposed to all the facts of development. From an examination of the brain of a higher mammal, there is no apparent reason why the hippocampi should not be connected like the rest of the temporal lobe by the anterior commissure fibres. But just as by a comparison with the condition met with in the Prototheria, the reason for this is apparent, so also is the meaning for the course of the anterior pillars of the fornix above the foramen of Monro to reach the optic thalamus self-evident.

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* "The Surface Anatomy of the Primate Cerebrum" Cunningham Memoirs, Roy. Irish Acad. No. vii. 1892.

† Plan of the Central Nervous System, 1885.

EXPLANATION OF FIGURES.

Fig. 1.—Scheme of a sagittal section through the mesial wall of the cerebrum of *Perameles nasuta*. The alveus fibres represented in a purely diagrammatic manner.

Fig. 2.—Ditto. Platypus.

Fig. 3.—Ditto. Placental mammal.

Fig. 4.—Scheme of the hippocampus as seen in transverse section through the region of its commissures. The cells, axis-cylinders and collaterals shown as they are stained by Golgi's method.

Fig. 5.—Mesial view of "hippocampal region" in pig (fœtal) to show the S-shaped bend of the hippocampus; only the posterior part of the corpus callosum represented.

References to figures.

ac., anterior commissure; *af.*, anterior pillar of fornix; *alv.*, alveus; *c.*, "collateral" of an alveus fibre, ending in the *stratum radiatum; cc.*, corpus callosum; *d.*, molecular layer of the fascia dentata; *df.*, descending alveus fibres (to form the anterior pillar of fornix and the precommissural fibres); *ext. olf.*, external olfactory root; *f.*, fibres of alveus, represented schematically; FD., Fascia dentata; *fi.*, fimbria; *g.*, pyramidal cells of the hippocampus; *hf.*, hippocampal fissure; *hip.*, hippocampus; *int. caps.*, internal capsule lying in the corpus striatum; *l.*, bundle of collaterals (so-called superficial medullary lamina) derived from the pyramidal cells of the hippocampus, also transverse sections of bundles of longitudinally running fibres; M., foramen of Monro; *p.*, Purkinje-like cell of the fascia dentata; ps^1., dorsal limb of the hippocampal commissure; ps^2., ventral limb of the hippocampal commissure (the psalterium of placental mammals); *pyr.*, pyramidal cell of the subiculum cornu Ammonis; *rf.*, rhinal fissure; *s.*, precommissural fibres of the fornix-system; *sept.*, "septum pellucidum"; *s. hip.*, subiculum cornu Ammonis; *spl.*, splenium corporis callosi; spl^1., "*splenium of the hippocampal commissure*."

DESCRIPTION OF A NEW *ISOPOGON* FROM NEW SOUTH WALES.

By R. T. Baker.

(Plate xlv.)

Isopogon Dawsoni, sp.nov.

An erect shrub of 6 to 9 feet, so far as seen, the branches and young shoots hoary-tomentose. Leaves linear, 8 to 9 inches long, from very narrow at the base to about 2 lines broad near the apex, on long petioles; pinnate or deeply divided into 5-7 narrow segments, rarely entire, rigid, terminating in an almost pungent point, midrib slightly prominent on both sides, margins somewhat recurved. Cones terminal, sessile, solitary, globular, 6 lines in diameter after flowering. Outer bracts not numerous, hoary pubescent, prominent, subulate, the inner ones broader and shorter. Cone scales very numerous, acuminate, with narrow points prominent after flowering, obovate, closely imbricate, densely silky-hairy on the convex side, the exserted portion not so hairy, the tips or points pubescent.

Perianth yellow (?), probably purple (not yellow when collected), very silky villous, about 9 lines long, lobes of the corolla about half the length of the tube; stamens inserted in the corolla lobes; anthers sessile, the connective tipped with a small appendage; filaments flat, much shorter than the anthers. Style-end clavate, minutely papillose pubescent, the thickened part 4-angled, separated by a constriction from the bulbous base of the stigmatic termination. Receptacle under 6 lines.

Nearest affinity is *I. longifolius* of South-Western Australia.

Loc.—Murrumbo Ranges, Goulburn River, near Widden, New South Wales.

This species is dedicated to Mr. Licensed Surveyor Dawson, of Henbury, Rylstone, who was instrumental in discovering this and other species, and has further aided botanical research by bringing to light varieties and species new for New South Wales.

I have to acknowledge my indebtedness to Mr. J. H. Maiden for his assistance in working out this description.

EXPLANATION OF PLATE.

Fig. 1.—Flower (slightly enlarged).
Fig. 2.—Corolla lobe (enlarged), showing stamens.
Fig. 3.—Cone scale, front view.
Fig. 4.—Cone scale, back view.
Fig. 5.—Cone scale, profile.
Fig. 6.—Outer bract.
Fig. 7.—Seed.

(Figs. 3-7 enlarged.)

FURTHER OBSERVATIONS UPON THE ANATOMY OF THE INTEGUMENTARY STRUCTURES IN THE MUZZLE OF *ORNITHORHYNCHUS.*

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(Plates xlvi.-xlviii.)

In a recent paper in the Quarterly Journal of Microscopical Science,* Professor E. B. Poulton has recurred to the subject of the tactile and glandular structures in the skin of the snout of the *Ornithorhynchus*, and has given in addition an interesting account of the structure, and in part of the development, of the hairs in the same animal, with which account he has incorporated a discussion of the homologies and origin of mammalian hair in general.

It is with the earlier part of the paper, dealing with the structures in the skin of the snout, that the present writers are more particularly concerned. Mr. Poulton has done us the honour of making frequent reference to our previously published observations† upon the rod-like tactile organs (push-rods), of whose existence and general structural characters he was the first to give a description.‡

We are interested to note that part of Mr. Poulton's later work on the peculiar structures in question had been carried on contemporaneously with our own—viz., in the (English) summer of 1892. The abstract of our long-delayed paper in the Macleay Memorial Volume appeared in the published "Abstract of Proceedings of the Linnean Society of N.S.W.," August 31st, 1892,

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* Vol. xxxvi. p. 143.

† Macleay Memorial Vol. Sydney, 1892, p. 190.

‡ Proc. Physiol. Soc. pp. xv. and xvi.; Journ. of Physiol. 1884.

although the title alone occurred in the "Proceedings" of the Society for that year.

In our paper in the Macleay Memorial Volume we expressed our regret at having been unable to utilise Ehrlich's methyl blue reaction upon the living tissues of the platypus snout, and ever since we have been anxious to extend our observations by means of this and also more especially by the use of Golgi's silver method. But even in Australia it is not so easy to procure living specimens of *Ornithorhynchus* and especially to have them sent on alive to Sydney, and it is only quite recently that our efforts towards again obtaining the animal alive have been rewarded with success.

Professor Poulton incidentally states his regret that we had omitted any allusion to the sweat-ducts "and their associated hair-like and nervous structures." We may state that it was the peculiarities of these structures which first of all engaged our attention and upon which in fact we wrote our first draft of a communication. On putting together our observations, however, it appeared to us that certain points remained, for the elucidation of which a further supply of fresh material was eminently desirable. Accordingly we avoided, of set purpose, all reference to the gland-ducts, and restricted ourselves to the attempt to set forth the structure of the push-rods, which appeared to be made sufficiently plain by the aid of the methods which we had up to that time been able to use.

In the introductory portion of his paper Mr. Poulton has given utterance to some rather severe strictures upon the character of the photo-micrographic illustrations which accompanied our paper in the Macleay Volume. We may at once admit the justice of much of Mr. Poulton's criticism in this regard. It is true that, as he charitably suggests, the negatives and even the proofs were very much better than the final impressions would lead one to suppose. The sections were, in point of fact, satisfactory in the highest degree; the negatives were, as we believe, very good indeed, *as photo-micrographs*, ——; while the proofs seemed at least tolerable reproductions. The ultimate results were undoubtedly the reverse of satisfactory. Nevertheless, while grateful for Mr. Poulton's expressed sympathy, we cannot but feel that his critical instincts have led him to castigate with undue severity our well meant attempt after perfect fidelity of illustration. We feel that he has applied to photomicrographic illustrations criteria of clearness and definition only applicable to the product of the draughtsman's art. He must surely be aware that, at least in a high-power photograph of a histological subject (as distinct from the test-object of the professed photomicrographist), it is inevitable that while a few points may be rendered definite, much is necessarily out of focus and "smudgy." And even in view of his criticism we must maintain that there *are* important points brought out definitely and unmistakably in at least some of the "smudges" which inspire Mr. Poulton with horror. We would instance the lenticular bodies in fig. 10, the Pacinian-like bodies and their relations in figs. 8 and 9, the abrupt ending of the medullary sheaths of the nerve fibres in the base of the rod shown in fig. 11, the peripheral and axial groups of filaments seen in transverse section in fig. 13 (to which Mr. Poulton himself appeals further on for our discomfiture), and very specially the isolated filaments of the rod-organ shown in fig. 12. The latter figure is "smudgy" enough in all conscience, and yet the positive evidence, free from all shadow of doubt or deception, which such a photograph affords of the independence and even of structural features of the fibrils in question is perhaps sufficiently valuable to justify the exhibition of even that highly inartistic and blotchy reproduction.

Certain of the figures we are willing enough to consign to oblivion, but even did the series stand alone in all the ugliness of their imperfect reproduction, it would in our opinion be grossly unfair to pass upon them Mr. Poulton's sentence of wholesale condemnation. But it is to be noted that the photomicrographs do not, and were never meant to, stand alone, but in connection with drawings, both from nature and semidiagrammatic, which had the express purpose of elucidating and interpreting the obscurity of the photographs. With these drawings, we still believe that to the unbiassed mind the unfortunate photomicrographs may serve to convey an idea of certain of the appearances we have described, and, so far as they go, to carry conviction of the realty of the things represented. And after all it may well enough be doubted whether a blurred uncertainty of pictorial representation is so very greatly inferior to that fatal illusory clearness of delineation so often met with, which is due to the influence of inadequate visual hypothesis upon the draughtsman. Such clearness may indeed be advantageous where no possible doubt exists as to the nature and characters of the structures to be represented, since these may in this way be made perfectly clear to the student; but on the other hand it is only too common to find erroneous hypotheses as to the nature of obscure structural details backed up by misleading drawings of the "clearest" possible description. And this observation is not made here simply as of general application. If the reader will refer to Mr. Poulton's own figures (especially his fig. 12 of Pl. XIV.) showing the structure of the "ganglion" in relation to a sweat-duct in the skin of the platypus snout, he will there see represented a collection of bodies described as "ganglion-cells," each of which is figured as duly equipped with a definite nucleus. As a matter of fact, as we shall show later on, these are not ganglion cells at all, but knob-like endings of medullated nerves,—*and they do not possess nuclei.* The appearance in a few of these bodies of a spot (to be further referred to) more or less suggestive of a nucleus, (and in some few cases, perhaps, the actual presence of a nucleus belonging to the sheath of the somewhat cell-like mass) has evidently been misinterpreted by Mr. Poulton as witnessing to the existence of nuclei in the bodies themselves. Nuclei have accordingly been clearly delineated so as to convey a quite inaccurate idea of the real nature of the "ganglion" in connection with the sweat-duct.

We are, it is needless to say, quite disposed to take for granted that Mr. Poulton's material was not of the best description, and did not afford a fair opportunity for correctly interpreting the details of these nerve structures. But what we complain of is that he has given to his drawings an utterly misleading character of clearness and definiteness by representing structural features which we cannot but regard as almost entirely hypothetical since they are certainly absent from the (presumably) better preserved specimens in our possession.

The simplicity and clearness of semidiagrammatic delineation characterise other of Mr. Poulton's drawings than those which are by him entitled "semidiagrammatic." This is of little importance so long as the structural features are correctly given. But in his important figure 1 (really semidiagrammatic) upon which he largely relies for illustration of the general features of the push-rod, it is plain, both from his own descriptions and from his figure 4 (see also our fig. 4*), that he has omitted, in each of the three rods shown, *an entire layer of cells* (second layer of imbricated cells). If, in our attempt by photomicrography to avoid as far as possible errors such as these—arising no doubt from a laudable desire for clearness and definiteness,—we have incurred the reproach of making public, obscure and comparatively uninstructive photomicrographic illustrations, we may at least plead that these latter could not easily convey any erroneous structural hypotheses.

We shall now proceed to state the results of our continued investigations into the structure both of the push-rods and of the sweat-ducts.

I. The Push-rods.

With the fresh material recently secured we have in part devoted ourselves to the obtaining of satisfactory silver impregnations of the nervous elements of the skin of the muzzle by the use of the rapid Golgi method and to obtaining the methyl-blue reaction with the same structures by a modification of Ehrlich's method. With both methods of procedure we have achieved a fair measure of success. In order also to compare with our former highly successful gold preparations by Freud's method with bichromate tissue, we have followed Ranvier's formic-gold method for fresh tissue and have again procured very good results.

The further investigations we have thus been enabled to make into the anatomy of the push-rods in view of Poulton's late

* Macleay Mem. Vol. *loc. cit.*

criticism of some of our former statements may entitle us again to be heard in reply.

We have further completed our study of the sweat-glands and ducts and their associated structures, and we propose by means of it to supplement Professor Poulton's account of these interesting objects.

Upon the whole, as Mr. Poulton points out, our views upon the structure of the push-rods coincide with his own. The only really important subject of dispute concerns the essential nature of the fibrils or filaments which traverse the shaft of the push-rod. Poulton strongly opposes our view that these filaments are nervous in character. He appears to have interpreted our remark that he "failed to recognise the nervous character and connections of the filaments" as reproaching him with imperfect observation. It was certainly not so intended but merely as a statement of a fact, and as such, indeed, Mr. Poulton with some emphasis expresses his entire agreement with it.

We are very well aware that our opportunities for satisfactory investigation of the tissues of Ornithorhynchus are, in the nature of the case, vastly superior to those usually possessed by investigators in Europe. In view of this very fact, however, is not Mr. Poulton's dogmatic assertion that the "nervous character" of the filaments "does not exist" just a little hasty? In regard to the question of their nervous *connection* we unfortunately did not gather from Mr. Poulton's brief communication that he had "inferred" an actual continuity between nerve-fibres and the filaments in question such as we claimed to demonstrate. In the note itself there does not appear the slightest suggestion of such an inference. The title, "On the tactile terminal organs," &c., to which he appeals as sole evidence of his inference can hardly be taken as giving explicit information upon this particular point. It used to be held for example that auditory nerve fibres ended by continuity with auditory hair-cells. It has been shown pretty conclusively by Retzius, van Gehuchten and others* that these

* *Cf.* Retzius in Biolog. Untersuchungen, Neue Folge, iii. & iv.; Verhandl. d. Anat. Gesellsch. 1892, p. 63; Anatomischer Anzeiger, vi. p. 82; Van Gehuchten in La Cellule, viii. 1892.

cells are not actually connected by continuity with nerve fibres, and yet we fancy that no one would deny to the hair-cells the name of "terminal organs" of the auditory sense-apparatus.

If, however, it be admitted, as seems to be the case, that the filaments of the push-rod are, as we have described and figured them, structurally continuous, without break or interruption, with the axis-cylinders which terminate in them, then it is difficult for us to follow Mr. Poulton in his emphatic objection to regarding the former as nervous in character. He says they must be looked upon as "a new and interesting form of nerve terminal organ probably epithelial in character," but where, we ask, is there the slightest evidence for their (non-nervous) epithelial character apart from their situation in the epidermis? and of course this alone is no proof whatever that they are non-nervous. They are utterly unlike any other epithelial structure of which we are aware, and their nervous continuity is really very strong evidence against their being modified epithelial cells, for all recent investigations by Kölliker, Ramon y Cajal, v. Lenhossék and others* have shown that nowhere do sensory axis-cylinders end by actual continuity with non-nervous epithelial structures, but on the contrary by fine fibrillar often varicose end branchings in close proximity to, and contact with, epithelial cells which may or may not be specially modified. Later on we hope to give convincing proof that the fibrils under dispute are neither more nor less than just such intra-epidermic end-branchings of axis-cylinders.

Careful perusal of Mr. Poulton's statements in this connection will show that his single argument in support of his very positive opinion against the nervous character of the fibrils is the appearance they present in sections, as clear and somewhat highly refracting elements. He quotes Professor Schäfer as an authority for the view that this appearance is opposed to the theory that they are terminal nerve-fibrils. To support this argument from appearance Mr. Poulton has recourse to two

* *Cf.* Kölliker, in Verhandl. d. Anat. Gesellsch.; Ramon y Cajal, trans. in Arch. f. Anat. u. Physiol.

of our own photomicrographs. "If," he says, "they establish nothing else, they certainly prove that this conclusion as to the nature of the filaments [that they are nervous in character] is erroneous; neither naked axis-cylinders nor nerve fibrils could have caused the appearances seen in transverse section in Pl. xxv. fig. 13, and in longitudinal section in fig. 8." And why not? Apparently merely because we have clear and unstained dots and lines in two (bi-chromate) preparations stained respectively with anilin blue-black and haematoxylin, reagents which in tissues hardened with chromic salts are not to be depended upon as axis-cylinder stains. What, we must ask, are the histological criteria of nerve-fibrils and axis-cylinders? The absolute test of the nervous character is of course the histogenetic one. If these filaments are, morphologically, outgrowths or prolongations of axis-cylinders (which in turn are simply the processes of nerve-cells), then we presume that no slight histological modification of the ultimate ramifications of such a process would prevent us from assigning to them a distinctly nervous character. This we premise because we believe that these terminations of axis-cylinders (as we confidently regard them) have undergone some very slight histological or chemical modification. But it is of the utmost importance to note that whatever change may have occurred has been far too slight to affect those fundamental micro-chemical reactions to certain stains which, in the absence of the histogenetic test, constitute our ultimate criterion of their nervous character.

It was upon the strength of the argument derived from the reaction to gold salts that in our former paper we confidently pronounced these filaments to be nervous, nor should we now see any valid reason for rejecting that conclusion even if no further facts were before us.

It seems appropriate here to notice a curious little mistake Professor Poulton appears to make in reference to the gold reaction upon the fibrils. After admitting the conclusiveness of our gold-stained preparations as to the continuity of the fibrils with the axis-cylinders at the base of the rods, he goes on to say:

"It is noteworthy too that although the filaments are represented in Pl. XXVI. fig. 22 as black varicose threads, the authors accurately state in the description (p. 200) that 'the fibrils are not black but only highly refractory.'" Can it have escaped Mr. Poulton that this figure and description are those of a haematoxylin specimen and not of a gold-stained one? (Our fig. 12 gives the actual photomicrograph itself.)

In our gold preparations to which Mr. Poulton had just been referring before making this quotation, the fibrils are, of course, stained black,—or at least the darkest violet,—and stand out in most striking contrast to everything except the nerve-fibres with which they are directly continuous, as shown in our figs. 19 and 21, for whose perfect accuracy we can vouch.

It is, however, with some gratification that we are now able to present a camera lucida drawing of a push-rod (fig. 1) from a specimen impregnated by Golgi's silver method, which in the fullest and most convincing manner corroborates our former observations. Little in the way of further description seems requisite as the figure speaks for itself in a quite unmistakable fashion. From the leash of nerve fibres at the base of the rod, stained axis-cylinders are seen to ascend and to enter the base or basal part of the shaft of the rod, and then to be continued along the shaft as members both of the more peripheral circlet and of the axial group of fibres in the core of the organ. Such perfect examples as that represented were indeed far from common. We did not find that the tissue reacted at all freely towards this highly selective but rather capricious stain. All the more welcome were the few more favourable patches in which the impregnation had turned out successfully. But everywhere, almost, one could get at least partial reductions of silver showing varying lengths of axis-cylinders and terminal fibrils blackened in a precise and selective manner.

No one, we imagine, viewing the present figure, and not absolutely mistrustful of the *bona fides* of the observers and the draughtsman, can now refuse his consent to our previously expressed dictum as to the "nervous character" of the fibrils traversing the shaft of the push-rod.

One or two minor details suggested by the figure deserve notice. The fibrils are shown as non-varicose. The apparent varicosity of the fibrils especially in our gold-stained preparations turns out to be due partly to minute sinuosities in the course of the fibrils* and partly to the presence of intercellular cement substance between the cells of the successive rows through which the filaments pass towards the surface, and which has caused reduction of the gold salts. One or two minor details suggested by the same figure seem to deserve remark.

The fibrils do not in it, nor in other of our Golgi specimens appear to be varicose as we formerly represented them in our semidiagrammatic illustrations and as they actually do appear in the haematoxylin preparation of the isolated fibrils already referred to as the subject of one of our photomicrographs† and as they also appear very distinctly in our gold-stained preparations. We have little doubt that the Golgi preparations indicate the true features of the filaments themselves and prove them to be quite smooth and sinuous, and that the varicosity as shown in specimens prepared by other methods is due to the adhesion of extraneous particles probably of intercellular cement. The regularity of the arrangement of these particles upon the filaments is doubtless due to their corresponding to the intervals between the successive rows of cells traversed by the fibrils in their course towards the surface. This view is borne out by the fact that in some parts of gold-stained preparations where the reduction was cruder and less precise than in others, the parallel series of filaments were occasionally seen to be joined by a series of dark, transverse lines, corresponding doubtless to the intervals between the successive cell elements of the core, uniting the apparently varicose points of adjacent fibrils and so giving rise to

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* These sinuosities can indeed occasionally be recognised as such when haematoxylin preparations are carefully examined.

† Macleay Mem. Vol. *loc. cit.* fig. 12.

a somewhat ladder-like appearance of lines whose blurred outlines testified to the indefinite and less highly selective character of the reduction in such patches. This appearance is never to be seen in silver-impregnated nor indeed in any other kind of specimen, but it assists us in interpreting the seeming varicosity of the nerve-fibrils.

We have satisfied ourselves by careful re-examination of our haematoxylin preparation of the isolated fibrils that the beaded contour indicated in the photomicrograph is not merely an out-of-focus representation of the minutely sinuous outline seen in the Golgi, and we may add also in good haematoxylin sections (vertical) of the push-rods, and we are therefore convinced that we have given above the correct interpretation of the somewhat moniliform contour of the fibrils exhibited in some kinds of preparations.

Another point to which we may here refer is the absence from the preparation represented in fig. 1 of any evidence of branching of the axis-cylinders in the base of the rod. But that such branchings do occur our gold-preparations testify, so that there are a greater number of fibrils in the rod than there are nerve-fibres entering it. As we formerly stated the subdivision of the axis-cylinder occurs in the basal part of the rod just at the point where the medullated sheath is lost.

The figure further illustrates the connection of axis-cylinders with the Pacinian-like corpuscles, and shows in addition that other bundles of fibres extend up into the dermal papillæ. After giving off some fibres to the rod as shown in the figure these terminate in the papillæ giving off end branches, of which some at least enter the neighbouring epidermis.

We were unsuccessful in demonstrating the "nervous character and connections" of the lenticular bodies formerly described by us as lying in the base of the push-rod.

Gold-preparations, however, give indubitable testimony in support of our former statements in regard to them, and the examination of fresh preparations impregnated with methyl blue by Apathy's modification of Ehrlich's process* has fully confirmed our conclusions. Striking views of the intermediate disc or plate between the two clear vesicular cells of the body were obtained, its nervous character being indicated by its colour reaction with the methyl blue. It bore a distinct resemblance, though on a smaller scale, to the nervè disc stained with methyl blue figured by Dogiel† in the Grandry's corpuscles, with which structures we formerly compared the lenticular bodies.

The methyl blue reaction was also exhibited by the other nervous structures in connection with the rods, viz., the nerve-fibres, the cores of the Pacinian-like corpuscles and also by the fibrils in the rod itself. Thus we have the most ample histological confirmation of the nervous character of these structures. We therefore believe that we are entitled to state definitely that these interesting filaments, in spite of their fairly definite and regular arrangement, are nothing but the end branchings of axis-cylinders of sensory nerve fibres, which have acquired a slightly specialised character from their definite relation to certain specially differentiated epidermal cells arranged so as to constitute the rod-organ.

Possibly such an example of differentiated and correlated nervous and epithelial structures may be regarded as standing midway between the ordinary intra-epidermic end-branchings of cutaneous nerves and such specialised epithelial and nervous arrangements as are found for example in the tastebuds, where also we have axis-cylinders ending freely by terminal filaments in intimate relation with far more highly specialised epithelial cells.

II.—The Sweat-ducts and their Associated Structures.

The general characters and position of these glands were described by Poulton in 1884‡ and again in the present year.§

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* Zeitsch. f. wiss. Mikr. ix. 1, 1892, p. 15.

† Arch. f. Anat. u. Physiol. 1891, p. 182.

‡ Journ. of Physiology, Vol. v. pp. 15-16.

§ Quart. Journ. of Micros Science. June, 1894.

In his recent paper Poulton has entered more fully into their histological structure, but from the unsatisfactory nature of the material at his disposal, there remain some points which he was unable to elucidate, and others which we are convinced he has erroneously interpreted

As stated by Poulton, the gland consists of :—

(1) A terminal coiled secretory portion, which is wider than the rest of the tube.

(2) A coiled duct leading from this to the base of an epithelial downgrowth of the general epidermis.

(3) An intra-epidermal portion, pursuing a winding and irregular course through the core of the epithelial downgrowth, to open on the surface.

Poulton describes the secretory portion of the tubule as being "lined with short columnar cells surrounded by a longitudinal layer of smooth muscle-cells," and in his fig. 8, Plate XIV., outlines these latter with great distinctness. We do not think that the words "short columnar cells" well express the appearances seen by us in a large number of specimens from different animals. The cells lining this part of the duct are rather large and granular, with nuclei which stain well with ordinary nuclear stains, but the protoplasm very slightly or not at all. These cells surround a wide lumen and rest upon a basement membrane, between which and the secretory epithelium small triangular strongly staining cells are intercalated at intervals. The whole is surrounded by a sheath of fibrous tissue, but nowhere have we been able to find any trace of fusiform or muscle cells (fig. 3).

The character and arrangement of the epithelial cells in this secretory end of the duct somewhat suggest the appearance of a transverse section of the alveoli of a mucous salivary gland in mammals.

The duct leading from the secretory portion of the tube to the epidermal downgrowth consists of two layers of cells. An outer circle of short columnar cells, which exhibit a faint striation, and whose nuclei and protoplasm stain well with haematoxylin and carmine, surrounds a cuticular layer with flattened nuclei, as described by Poulton. The whole is surrounded by a fibrous-tissue sheath (fig. 4). The duct is frequently accompanied by a leash of medullated nerves whose destination is the base of the epidermic downgrowth, which the duct enters.

The appearance and minute structure of the epidermal downgrowth with the duct traversing it are shown in fig. 2, which represents a vertical section of the organ. As to the general structure and probable significance of this downgrowth, we are in entire agreement with Poulton, who considers that it represents a modified hair follicle, through which the duct of the gland courses to the surface. The further structural particulars which we have been able to make out, tend only to strengthen Poulton's ingenious hypothesis.

The upper part of this epidermic cylinder is mostly composed of plate-like epithelial cells placed vertically to the surface. Poulton describes them as fusiform, but as they appear fusiform both in longitudinal and transverse sections of the organ, (*vide* our figs. 2, 5 and 6, or Poulton's figs. 8, 9, 10 in Quart. Journ. Micros. Science) they must in reality be flattened plates. These layers of flattened imbricated cells are arranged around the duct as a centre, but are separated from its lumen by a nucleated cuticular layer, the cells of which are irregular but generally flattened in the same direction as the plates (figs. 2, 5, 6, *c*). The individual outlines of the cells of this layer are difficult to make out, and indeed in some cases (fig. 2, *c*) the cells appear fused.

Outside the preceding layers of cells which form the core of the epithelial cylinder, but not separated from them by any sharp line of demarcation, are the investing layers of cells formed by a downgrowth from the general epidermis, the layers of which turn sharply downwards to form the peripheral part of the cylinder. These investing layers in the upper part of the cylinder consist merely of epithelial plates continuous with the more superficial parts of the general epidermis, (fig. 2, *b*) while below this there is superadded a peripheral layer of more or less cubical cells formed by the reflection of the Malpighian layer of the epidermis. It will be observed, on reference to fig. 2, that the flattened epithelial squames of which the upper part of the core of the cylinder (probable hair shaft) is composed project vertically at the surface, and, the constituent cells becoming more or less separated from each other, form a brush-like arrangement which usually projects slightly above the general surface of the epidermis. According to our observations upon perfectly prepared material (Flemming's fluid, alcohol, and Müller's fluid), this mass of cells never constitutes a solid plug, as Poulton has figured it, but exhibits the loose and brush-like arrangement represented in fig. 2, the duct passing through it to reach the surface.

Towards the base of the cylinder, where it enlarges to form a bulb, the arrangement of cells does indeed, as Poulton points out, very strikingly suggest the bulb of a hair. This resemblance is perhaps best seen in transverse sections (fig. 6). In this situation the squames and cuticular cells surrounding the duct, which in the upper portion of the cylinder form its core, both become continuous with a mass of polyhedral cells (figs. 2 and 5, *p*). Amongst these polyhedral cells the duct of the gland passes in an irregular manner (fig. 2, *d*). The cells lining the lumen are not differentiated from the others, and their edges are ragged both here and upwards throughout the course of the duct.

Previous to entering the bulbous base of the cylinder the duct is composed of two regular layers of cubical cells (fig. 2, *d*,). At the point of entry the external layer becomes continuous with the outermost layer of cells forming the follicle, and the internal although differentiated from the polyhedral cells for a short distance, by taking the stain a little more deeply, soon becomes absolutely continuous with them.

In describing this epithelial cylinder Mr. Poulton says:—"The general epidermis is continued over it as a sheath, which strongly suggests the outer root-sheath of a hair, and between it and the cylinder itself a line of separation tends to appear." He also figures such a separation of the core from its sheath in his fig. 8. We have also noticed the same tendency of the core to shrink away from its investing layers of cells in this position in some few specimens, but the follicle figured by us does not illustrate this. Poulton then continues—"Below, this sheath forms the outer part of the bulb, and is separated from the inner part by a space containing small branched cells, the nature of which could not be determined in my material." These branched cells are figured by Poulton in his fig. 8 *sp*. We have never seen in any of our specimens an appearance approaching that described by Poulton; the sheath of the follicle formed from the general epidermis being, as we have above described, always in contact with the polyhedral cells (figs. 2 and 6, *p*).

We now come to a part of Poulton's paper with which our observations are entirely at variance, but it is only just to state that Mr. Poulton is himself of opinion that his material was not adequate and that "the whole structure of these hair-like epidermic cylinders, and the nervous tissues evidently associated with them, is so remarkable and complex that the fresh tissues are required for their satisfactory elucidation and for the discovery of the nerve terminations which we must believe to exist in connection with the apparatus."

Poulton is quite right in describing the bulb as being invariably associated with numerous medullated nerve fibres, but we have never seen any appearances that would justify one in considering the terminations of these fibres as ganglion cells as he does. They do indeed terminate in bulbous expansions of the axis-cylinders, but not in ganglion cells. No doubt, too, Poulton's specimens did not enable him to see that large numbers of these expansions of the axis-cylinder are situated within the outer sheath of the cylinder and amongst the epithelial cells forming the outermost layer of the root sheath (figs. 2, 5, 7).

Accompanying the duct on its course to the base of the epithelial cylinder more or less closely a large bundle of medullated fibres can be seen. As they approach the base of the cylinder some of the fibres, whilst still in the dermis close to the bulb, terminate in enlarged extremities which are similar to those we are about to describe. Others pass on to the cylinder itself and penetrate the outer fibrous sheath, entering amongst the epithelial cells forming the follicle, where their axis-cylinders suddenly expand into vesicle-like swellings, as seen in specimens stained with logwood and carmine (figs. 2, 5). The swelling of the axis-cylinder, as seen in such specimens, is faintly granular and exhibits a knotted appearance. This is seen in specimens stained by Kultschitzki's method* to be surrounded by a thin expansion of the medullated sheath, outside which again is a sharply defined nucleated capsule, continuous with the primitive sheath of the nerve fibre (figs. 2, 5, *n*).

Fresh tissue impregnated with gold chloride by Ranvier's method, or bichromate-hardened tissue stained by Freud's gold method give ample demonstration of the connections of these swellings with the axis-cylinders of the nerves (fig. 7).

We thought it possible that Golgi's silver impregnation method might show the existence of further ramifications, such as we had found to occur among the epithelial cells of the rod organs, but though by this method the end-swellings stained and their connection with the axis-cylinders was well shown, no trace of any further prolongation was to be seen. This negative result seems fairly conclusive, as the intra-epithelial ramifications of axis-cylinder branches were well impregnated in neighbouring push-rods. By no method of staining is there shown the slightest indication of nucleus in the end-swellings, although the nucleus of the capsule surrounding it, when viewed from the surface, might in some instances be mistaken for one.

Poulton's figs. 8 and 12 showing these bodies as definite nucleated ganglion cells are, therefore, quite erroneous and misleading.†

In addition to the nerve-terminations described above, Golgi preparations show leashes of fibres running upwards towards the

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† Occasionally the optical transverse section of the axis cylinder before it swells out into the enlarged knob, gives rise to an appearance somewhat simulating a nucleus.

* Anat. Anzeiger, 1889, p. 223, and Zeitschr. f. wiss. Mikros. vi. 2, 1889, p. 196.

surface in the intervals between the follicle and the neighbouring epidermis. These fibres lose their medullated sheaths and terminate in branchings of naked axis-cylinders, which together with similar branchings from other sides of the follicle form a ring-like plexus around the neck of the follicle, most of the individual fibres of which have a vertical direction.

We were unable to satisfy ourselves that the terminations of these fibres entered the epidermis of the follicle. The appearance closely resembles that described by Burckhardt* and Bonnet† as occurring around the neck of the hair follicles of sensitive hairs in some mammals, and by the latter author also in the base of the epidermal downgrowths in the snout of the pig.

The further structural details we have been able to ascertain, together with the whole arrangement and termination of the nerves to the follicle, support in the strongest manner Poulton's suggestion, that the epidermal downgrowth through which the duct of the gland passes, represents a modified hair. Moreover we are of opinion that it not only structurally represents some form of modified hair, but that it is so far functionally a sensitive hair. The core of the follicle (fig. 2, *a*) does not end flush with the surface of the skin, but projects appreciably beyond. In the specimen from which fig. 2 was drawn is a fair example of this. From the relation of the cells of the core to the surrounding epithelium, one would imagine that as the epithelial cells of the follicle proliferate, the core must be pushed upwards so as to project from the surface, just as occurs with a perfectly formed hair. In this case, however, the projecting end of the core must constantly be worn away, or more probably disintegrated, leaving the appearance shown in fig. 2. Why the excretory duct of the gland should possess such a peculiar relation to it, we are at a loss to understand. The fact that, as far as we can judge, about one half of the fibres of the enormous fifth nerve in this region are associated with these supposed hairs, speaks strongly for their

* Burckhardt, "Ueber die Nervendigung in den Tasthaaren der Säugethiere."

† Bonnet, *loc. cit.*

possessing present functional importance, and indicates that they are no mere vestiges of some ancestral whiskers.

The above described mode of termination of the fibres at the base of the follicle is not peculiar. Dietl* recorded and figured somewhat similar endings in the root sheath of the sensitive hairs of the ox, cat, and dog. He described the nerve fibres as penetrating the hyaline layer of the dermic sheath and ending amongst the epithelial cells of the outermost two layers of the outer root sheath in knobbed ("knopfförmig") swellings. Dietl was uncertain whether they were indeed terminal. Bonnet† confirmed Dietl's observations and extended them to the sensitive hairs of a variety of domestic animals. He described the nerves as ending in the deeper layers of the epithelium of the outer root sheath in pale, knobbed, finely granular expansions of the axis-cylinder. These are situated in a very distinct capsule formed by the primitive sheath. Bonnet considered these expansions of the axis-cylinder as identical with the "Tastzellen" described by Merkel‡ as occurring in the same situation, but, as we think justly, denies their cellular character.

If anyone will compare figs. 14 and 15 of Plate XIX., and fig. 12 of Plate XVIII., in Bonnet's paper, with those accompanying this paper, he will find it impossible to doubt that the structures are identical in character. The first of these three figures of Bonnet represents a vertical section of the root sheath of a sensitive hair from the horse stained with osmic acid, the second a similar preparation from the snout of the pig. The third is also from the snout of the pig, and represents the base of an epithelial downgrowth stained by Löwits' gold chloride process, and might indeed well enough represent a patch of one of our gold chloride preparations of the nerve endings in the bulb of the sweat-duct.

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* Untersuchungen über Tasthaare II. Sitzungsberichte der k. Akad. d. Wiss. Wien. Mat. Naturwiss. Klasse lxvi. Bd., iii. Abtheil. 1872.

† "Studien über die Innervation der Haarbälge der Hausthiere." Morph. Jahrbuch von Gegenbaur, Bd. iv. 1878.

In a recent paper‡ upon the anatomy of young specimens of *Echidna*, Professor W. Newton Parker describes shortly the developing sweat-glands in the skin of the snout of that animal, and, pointing out their resemblance to those described by Poulton in *Ornithorhynchus*, he expresses his dissent from the hypothesis advanced by the latter writer to explain their peculiar structure. Neither his description nor his figures appear to us to afford sufficient ground for rejecting a theory which, although without doubt antecedently improbable, is yet borne out by so many striking correspondences in structure indicated by Prof. Poulton and in the present paper.

The developmental stages studied by Prof. Parker were probably much too late to afford conclusive evidence as to the real manner of development of these structures. So, at least, an inspection of his special figure of the sweat-gland and duct on Plate II. would indicate. The only specific reference we note to an earlier condition, is the statement that "the lumen is not developed in the young stages."

EXPLANATION OF PLATES.

Fig. 1.—Vertical section of rod-organ, showing nervous arrangements, from a preparation impregnated with silver by Golgi's rapid method (× 320 diams.). At the base of the rod the axis-cylinders of the nerve fibres show out strongly. These fibres have two destinations (*a*) to the base of the rod where some join the small Pacinian bodies and the remainder penetrate the rod-organ to be continued up almost to the surface as the axial and peripheral groups of axis-cylinders. (*b*) To the sides of the rod-organ, where some enter the organ to take part in the formation of the peripheral circular group of axis-cylinder processes, whilst others pass up to the sides and tip of the papilla, where they enter the epidermis. The axis-cylinder processes apparently end in the superficial portion of the rod-organ, and are not demonstrated

‡ P.Z.S. 1894, Part i. pp. 3-14, Plates I.-III.

right up to the surface, but from the gradual way in which they are, by this method, shown to taper off at their extremities, it is probable that they participate in the corneous change which obtains in the epithelial cells of this region of the rod-organ, and do not therefore react in the same manner to the reagents as in the deeper region. The preparation was drawn with a Zeiss' camera lucida.

Fig. 2.—(× 320 diameters). Vertical section of sweat-duct traversing an epithelial cylinder (modified hair). The preparation from which this figure was taken was cut from a portion of the muzzle which showed remarkably little pigmentation. Accordingly the outlines of the epithelial cells were not obliterated by the perinuclear deposits of pigment and showed out with distinctness. It was fixed in absolute alcohol and stained with haematoxylin.

a, epithelial plates forming the core of the cylinder; *b*, epithelial sheath continuous with the superficial layers of the epidermis; b^1, epith. sheath continuous with the malpighian layer of the epidermis; *c*, cuticle of duct formed of fused epithelial cells; *d*, intra-epidermal portion of duct; d^1, infra-epidermal portion of duct; *e*, medullated nerves ending by enlargements of the axis-cylinder (*k*,) surrounded by a nucleated expansion of the primitive sheath *n*; *n'*, nuclei of nerve sheath; *p*, polyhedral epithelial cells in the bulbous portion of the cylinder continuous with *a* above.

Fig. 3.—(× 320 diameters). Section of the deepest (secretory) portion of the tube stained with haematoxylin.

a. secretory epithelium cells; *b*. small deeply stained cells wedged in between the secretory cells.

Fig. 4.—(× 320 diameters). Transverse section of excretory duct stained with haematoxylin.

a. outer layer of columnar striated cells; *b*, inner layer of flattened cells, the outlines of which are not seen.

Fig. 5.—(× 480 diameters). Transverse section through the bulbous portion of the epidermal cylinder stained with haematoxylin.

d, duct of sweat-gland; *c*, cuticular cells lining duct; *p*, polyhedral cells of bulb; *b*, plate-like epithelial cells continuous with the superficial layers of the epidermis (*vide* fig. 2); b^1, epithelial sheath continuous with the malpighian layer of the epidermis (*vide* fig. 2); *k*, terminal enlargements of the axis-cylinders of medullated nerves supplied to this region; *n*, nuclei in expansion of the primitive sheath forming a capsule for *k*. Drawn with camera lucida.

Fig. 6.—(× 480 diameters). Transverse section of the neck of an epidermal cylinder similar to but smaller than the one from which fig. 5 was taken. Stained with haematoxylin. This section was taken in a region where the follicle was completely surrounded by dermis, *f*.

d, duct of sweat-gland, which is wider in this region; *c*, cuticular layer of cells surrounding duct; *a*, epithelial plates (*cf.* fig. 2, *a*); b^1, epithelial cells containing perinuclear pigment continuous with b^2 at the summit of the dermal papilla; b^2, malpighian layer of epidermis containing perinuclear pigment; *e*, epidermis.

Fig. 7.—(× 320 diameters). Vertical section through bulbous base of epithelial cylinder traversed by sweat duct; showing knob-like endings of medullated nerve fibres both within and without the bulb. Stained by Freud's gold-chloride method.

DESCRIPTION (WITH FIGURES) OF A YOUNG SPECIMEN OF *ORNITHORHYNCHUS ANATINUS* FROM THE COLLECTION OF THE AUSTRALIAN MUSEUM, SYDNEY.

By J. T. Wilson, M.B., Professor of Anatomy in the University of Sydney.

(Plate xlix.)

Opportunities of studying the anatomy of young ("foetal") specimens of *Ornithorhynchus* have seldom occurred to the scientific investigator, if we may judge from the paucity of published descriptions of such specimens.

The explanation of this fact is obvious enough if we remember that the eggs of the animal are laid while the development of the embryo is yet at a very early stage (according to Caldwell* at a stage equivalent to that of a 36 hours' chick), and that the further development, both within the egg and probably for a prolonged period after hatching, goes on in the nest situated at the end of a lengthy burrow which is rather difficult of discovery and by no means easy of access.

In consequence of the absence both of pouch and of teat in the platypus, the young animal during the period of development which answers to that of the "mammary foetus" of the marsupial, is probably either wholly unattached or only very insecurely and temporarily attached to the person of the mother. Thus, even if the latter emerges at all from the burrow during the period of nurture of her offspring, as is likely enough, it is improbable that she bears her young about with her. That she should do so habitually is indeed excluded by the aquatic habits of the species. The capture of adult females in a state of lactation has been recorded, but the young naked "mammary foetus" has never been obtained save in the nest. In this respect the habit of the

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* Caldwell : Journ. & Proc. Roy. Soc. N.S.W. xviii. p. 117.

Ornithorhynchus would seem to differ from that of the kindred genus *Echidna*, in whose case there is ample evidence that the mammary foetus is borne about, either occasionally or habitually by the mother.* (The incubating egg itself seems to be carried in a temporary pouch in *Echidna*.†). Here the very imperfect marsupium or bilateral pouch-like fold of the integument, which is present during lactation, affords at least a partial support in default of a nipple, while a similar pouch appears to be lacking in the *Ornithorhynchus*.

In view, therefore, of the rarity of examples of what I have already referred to as the "mammary foetus" of the platypus, the present description of one that I believe to be slightly younger than any hitherto described may be not unwelcome to comparative anatomists.

For this very valuable acquisition I am greatly indebted to the liberality of the Trustees of the Australian Museum in Sydney, who were good enough to place it at my disposal along with a young *Echidna* to enable me to continue certain investigations into the anatomy, more particularly of the head, of the Monotremes.

It is to be hoped that ere long we shall have more abundant light thrown upon the embryology and foetal anatomy of *Ornithorhynchus* and *Echidna* from the researches of European anatomists into the developmental material which we are led to believe has been accumulated at considerable expense by both English and German naturalists.

It is perhaps permissible in the interests of British science to express a keen regret that hitherto so little has come to light as product of Mr. Caldwell's fully equipped expedition of over ten years ago. It is indeed somewhat humiliating to English-speaking zoologists that after the highly auspicious beginning and the apparently successful conclusion of that important and long-

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* Owen: "On the marsupial pouches, mammary glands, &c., of the *Echidna hystrix*." Phil. Trans. 1865, pp. 671-86.

† Haacke, W.: "On the marsupial ovum, the mammary pouch and the male milk glands of *Echidna hystrix*." Proc. Roy. Soc. xxxviii. p. 72.

desired undertaking they should be found looking forward rather to the results of the labours of Professor Semon and his colleagues now in course of publication in Jena, than to those of Mr. Caldwell which might have been expected to emanate from Cambridge.

In this short paper I propose merely to give a description of the external characters of my specimen which I had very carefully drawn by Mr. G. H. Barrow prior to any interference with it in the way of dissection.

I may premise that my examination of the external anatomy of the young animal reveals nothing really new, and in fact enables me to add little to Owen's description of a somewhat similar specimen published nearly sixty years ago. So far as I have been able to discover only three young *Ornithorhynchi* have yet been described and figured, the youngest being the specimen just referred to. This was described and figured, along with a larger one, by Sir Richard Owen in Trans. Zool. Soc. Vol i. 1835, p. 221 *et seq.*, (Pl. XXXII.-III.), and also in Todd's Cyclopædia of Anat. and Physiol. Vol. iii. "*Monotremata*," where an additional figure is given. The late Dr. George Bennett of Sydney in the same Volume of the Trans. Zool. Soc. p. 252, refers to his discovery, in a burrow, of three young *Ornithorhynchi* having a length of 1⅞ inch, but unfortunately he was unable to preserve them. It is possible or even probable that they were slightly younger than the one here dealt with, but as he does not indicate whether or not the measurement followed the contour of a curved body, it is impossible to say. My specimen is only 40 mm. in length if the distance between the extreme points of the apparently naturally curved body be taken, while it is exactly double that length if the dorsal contour line from tip to tip of snout and tail be measured. In any case Dr. Bennett gave no further description or drawing of his specimens if we except a reference to them as "only thinly covered with hair," a statement which Owen quotes,* but which is unintelligible to me, for sections recently made showing the structure of the skin of my specimen prove that the

* Todd's Cyclop. Vol. iii.

development of the hair follicles is still in the earlier stages, and that nowhere have hair-shafts as yet approached the surface of the epidermis, which was perfectly naked.

Besides Owen's two specimens the only other one known to me is one which came into the possession of the late Professor W. K. Parker and whose external characters were partly described and a figure of it given (p. 25) in his "Mammalian Descent" (Lond. 1885). More elaborate drawings (life-size) of this specimen have quite lately been published by Professor E. B. Poulton in the Quart. Journ. Microsc. Sci., Vol. xxxvi., in connection with his paper on the hairs, &c., of *Ornithorhynchus*. Mr. Poulton also gives a list of memoirs dealing with the anatomy of portions of this specimen.

From the drawings of Parker's specimen I have estimated the length of the dorsal contour line from the tip of the snout to the tip of the tail as about 250 mm. It was thus very considerably larger than mine, in which the same line is only 80 mm.

One of Owen's two specimens was also much larger, so that his smaller specimen is the only one with which one can rightly compare the subject of the present paper.

The specimen (which had been labelled as from the Patterson River) has been very satisfactorily preserved in alcohol, as microscopical sections subsequently made bear witness. Cellular structure and arrangement are well shown and karyokinetic figures are abundant, at least in the epidermis. It is perfectly intact with the exception of a small apparently accidental skin-incision on the ventral aspect of the neck (shown in figure 3), and two other very small abrasions on the skin of the back and abdomen. The general integument is quite naked and marked throughout by delicate transverse wrinkles, which are probably of post-mortem production, and are neither so numerous nor so pronounced as those figured in Owen's specimen (Trans. Zool. Soc. Vol. i. Pl. XXXII.). The long axis of the animal is markedly curved, the convexity being dorsal. The contour of the dorsal surface forms rather more than a semicircle of slightly unequal curvature throughout. (In Parker's specimen the contour formed nearly a complete circle as shown in Poulton's plate.) The dorsal contour line from tip to tip as already stated measures 80 mm., while the distance between the extreme points of the curved body (vertex to root of tail) in a straight line, is 40 mm. There is no distinct cervical constriction, a "neck" being practically absent. The distance from the tip of the snout to the anterior border of the forelimb is 15 mm.

The maximum breadth of the head is 11 mm. The snout is sharply separated from the rest of the head by the developing lappet-like fold of integument which forms so prominent a feature at the base of the adult muzzle. This has here the character of a collar-like ridge and is continuous all round the root of the muzzle, though just at or above the elevated angles of the gape which reach up to it, it is somewhat lower than elsewhere and is slightly overlapped by the somewhat projecting hinder angle of the upper lip or maxillary lobe. The length of the snout is proportionately small both to the rest of the head and to its own width. It is 4·5 mm. long from tip to basal groove in front of lappet, while it measures 6·5 mm. in width.

The gape has a sinuous outline and is a simple fissure throughout which is almost closed. No trace of the tongue can be seen from the outside nor any vestige of the integumentary folds which, according to Owen, united the upper and lower lips across the angle of the mouth in his specimen. The upper lip throughout slightly overhangs the sinuous gape, whose posterior extremities turn somewhat dorsally where they reach to the collar-like lappet.

The nostrils are situated dorsally and about 1·5 mm. behind the anterior end of the snout. Between, and just in front of the interval betwixt these, the dorsal surface of the snout is sharply elevated into a very prominent "caruncle," which also projects very slightly forward so that it almost reaches the coronal plane of the anterior margin of the snout. The tip of this caruncle is whiter than its surroundings and evidently forms the epidermal covering which was presumed by Owen to exist over the "minute fleshy eminence lodged in a slight depression" and "surrounded by a discontinuous margin of the epidermis" observed by him.

The position of the eye is not marked by wrinkles but is smooth and rounded and is indicated by the line of the closed ocular fissure which extends back for a distance of 2 mm. from a point 1·5 mm. behind the lappet at the base of the muzzle. The pigment of the eye can be seen around this faintly appearing through the continuous integument of the region.

The position of the ear is indicated by the slight integumentary depression of the external auditory meatus just behind the ocular fissure and 4·5 mm. behind the lappet.

The dorsal and ventral surfaces of the forelimbs are directed forwards and backwards respectively, the preaxial and postaxial borders being respectively mesial and lateral. The forelimbs are separated at their bases by a much wider interval than are the hind limbs, and they do not incline towards each other as do the latter whose dorsal and ventral surfaces look outwards and inwards respectively, the borders being actually as well as morphologically pre- and postaxial.

The free distal margins from which the digits spring in both hand and foot are crescentic.

The digits are well-marked and they all already possess claws, but those of the toes are much smaller than those of the fingers.

The natatory membrane of the manus is present as a free lappet-like fold of its integument at the palmar aspect of the roots of the fingers and it already reaches about as far as the nail-tips. It is this fold which really forms the distal margin of the hand, ventrad of the digits, seen in fig. 3.

In the corresponding situation in the pes there is merely a slight integumentary ridge.

The length of the free portion of the hind limb is about 7 mm. and of the forelimb perhaps a trifle less.

A trace of the calcanean spur is present in the hind limb as a very minute papilla on the ventral (internal) aspect of the limb, but it is hidden away in the flexure between the limb and the abdomen in the ordinary position of the limb.

The cloacal aperture is situated ventrally close to the root of the tail. A small papilla is visible in the aperture. It is impossible yet to determine the sex of the specimen, as the external characters are insufficient.

The tail is flat ventrally and convex dorsally. It measures 11 mm. in length and 6 mm. in its maximum breadth.

As Professor W. Newton Parker* has so recently instituted a comparison between the young mammary foetus of *Echidna* and that of *Ornithorhynchus*, it is unnecessary for me again to call attention to the interesting resemblances and comparatively slight differences in external characters between them. I cannot, however, agree with Professor Parker in his remarks concerning the horny character of the snout in either young or adult Monotremes. Thus he indicates as a point of similarity between the young of the two genera that in each case the snout is "horny and immobile," and he states that in the older of his stages of the *Echidna* the "horn" is thicker than in the younger. Upon this he observes "this is the more remarkable as in the adult the skin in this region can hardly be said to be horny at all." Most certainly it cannot. No epithet could well be further from the mark than "horny" as applied to the skin of the snout of the adult *Echidna*, which is, on the contrary, a very soft and delicate skin, wrinkly and freely movable upon the deeper parts.

But I cannot understand why the term "horny" should be applied to the general epidermis of the snout of the foetus in either genus. The snout of the foetal platypus dealt with in this paper is at all events no more "horny and immobile" than is that of the young mammary foetus of a marsupial, with this sole exception that over the very limited area of the caruncle the corneous epidermis is perhaps a little thicker and denser than elsewhere. Sections of the snout which have lately been made show that, except over the above area, there is no yellow reaction at all to a double stain of picric acid and hæmatoxylin, and the stratum corneum is relatively quite a thin layer, even over the caruncle, where, however, it does show the yellow picric stain indicating a process of cornification. Further I have in my

* P.Z.S. June, 1894.

possession two young Echidnæ in which the spines are just beginning to show and in neither of them is there any "horny" character of the snout.

In a note appended to his memoir, Professor Parker, after quoting from a paper by Dr. C. J. Martin and the writer† to the effect that the skin of the snout of the adult *Ornithorhynchus* is "no more horny than that of a dog's nose," makes the following comment :—"There is no doubt, however, that in my specimens of the young of both genera the horny layer of the epidermis covering the muzzle is so thick as to justify one in speaking of a "horny" snout, even though this is of course more flexible than the beak of a turtle or bird."

But if mere thickness of the stratum corneum of the epidermis will justify one in speaking of such a structure as composed of horn or "horny," one may with equal propriety speak of man as possessing a "horny" foot, seeing that the skin of the human heel possesses a stratum corneum vastly thicker in proportion than that of the skin of the snout of Monotremes, young or old, of either genus.

I am aware indeed that the British working-man is sometimes described—for rhetorical purposes—as a "horny-handed son of toil," but hitherto I have not taken this epithet as giving a literal and scientific description of his palmar epidermis.

On this principle of interpretation, of course, the whole superficial epidermal layer or stratum corneum is a layer of "horn"; but surely something more than this general and far from novel proposition is implied when it is stated that the *Ornithorhynchus* possesses a "horny beak." *And whatever more is implied is erroneous.*

Surely to justify the description of a structure as "horny" we must have, not merely a thick stratum corneum, but some such further chemical and physical transformation of it or of the "stratum lucidum" as that which gives rise, *e.g.*, to the nails, and which is entirely lacking in the general epidermis of the

† Macleay Memorial Vol. (Sydney, 1892).

muzzle of the *Ornithorhynchus.* As matter of fact the skin of the snout of both young and adult *Ornithorhynchi* possesses a stratum corneum which is only *moderately* thick, which is as soft and flexible as epidermis elsewhere, whose cell-outlines and nuclei remain distinct right to the surface and which is traversed by innumerable sweat-ducts and the delicate tactile rod-organs. In view of these characters and in the absence of any special physico-chemical transformation of the tissue, as distinct from what occurs in the general epidermis, *e.g.*, of a dog's nose or of the human hand or foot, I can see no purpose or meaning in retaining the old and thoroughly misleading idea of the "horny" character of the "beak" of the "duck-billed platypus."

The special histological characters of the caruncle will be treated of in a future publication.

EXPLANATION OF PLATE.

Fig. 1.—"Mammary foetus" of *Ornithorhynchus anatinus.* Life size. Ventral aspect.

Fig. 2.—The same. Life size. Lateral aspect.

Fig. 3.—The same. × 3 diams. Ventro-lateral aspect (right).

ON SOME AUSTRALIAN AND TASMANIAN MOLLUSCA, WITH THEIR SYNONYMS.

By John Brazier, F.L.S., C.M.Z.S.

In this paper I have endeavoured to correct and clear up the specific names of numerous species that have been described by the late Rev. J. E. Tenison-Woods, Mr. W. F. Petterd and myself.

A large number of Tasmanian species are identical with those found in South Australia, Victoria, and on the east coast of New South Wales.

I am under very great obligation to my friends Lieutenant C. E. Beddome and Miss Mary Lodder of Tasmania for their kindness in forwarding me their type specimens for examination and comparison with those of Australia.

1. Columbella (Atilia) attenuata, Angas.

1871. *Columbella (Mitrella) attenuata*, Angas, Proc. Zool. Soc. p. 14, Species 4, pl. 1, fig. 4.

1883. *Columbella (Atilia) attenuata*, Tryon, Manual of Conchology, Vol. v. p. 151, pl. 53, fig. 18.

1884. *Terebra Beddomei*, Petterd, Journal of Conchology, Vol. iv. No. 5, p. 142, No. 28.

1885. *Terebra Beddomei*, Tryon, Man. Conch. Vol. vii. p. 40.

Hab.—Sow and Pigs Reef, Port Jackson, 4 fathoms, Green Point, 8 fathoms, sand and shells *(J. Brazier*, 1864); Middle Harbour, in shell sand and shingle, Maroubra and Long Bays, near Sydney *(A. U. Henn)*; Brown's River, Tasmania *(C. E. Beddome and W. F. Petterd)*.

This is another variable species sometimes of a shining brown with a pale band at the sutures; others are finely mottled with network. Having Mr. Petterd's types before me from Mr. Beddome, I find that *Columbella attenuata*, Angas, is identical with Petterd's *Terebra Beddomei.*

2. NATICA BEDDOMEI, R. M. Johnston.

1877. *Natica polita*, Tenison-Woods, Proc. Royal Soc. Tasmania, "Census; with Brief Description of the Marine Shells of Tasmania," p. 32 (non *Natica polita*, 1875).

1884. *Natica Beddomei*, Johnston; Tate, Proc. Royal Soc. Tasmania, p. 208.

1884. *Natica Beddomei*, Johnston, Proc. Royal Soc. Tasmania, p. 222.

1886. *Natica Beddomei*, Johnston; Tryon in Man. Conch, Vol. viii. p. 54.

1886. *Natica effossa*, Boog Watson, Report on the Gasteropoda, Voyage of H.M.S. "Challenger," Zoology, Vol. xv. pp. 439, 704-706, Pl. XXVIII. fig. 3.

1893. *Natica Beddomei*, Tate, Proc. Royal Soc. South Australia, Vol. xvii. p. 325.

1893. *Natica Beddomei*, Adcock, "A Hand List of the Aquatic Mollusca of South Australia," p. 6, No. 168.

Hab.—Bruni Island, Tasmania *(Rev. H. D. Atkinson, W. Legrand, W. F. Petterd, C. E. Beddome)*: South Australia *(Professor Tate)*: Station 161, April 1st, 1874, lat. 38° 22′ 30″ S., long. 114° 36′ 30″ E., off the entrance to Port Phillip, Melbourne 33 fathoms, sand; Station 163 B, June 3, 1874, lat. 33° 51′ 15″ S., long. 151° 22′ 15″ E.; Port Jackson, Sydney, 30 to 35 fathoms, hard ground bottom; temperature 63° Fahr. *(H.M.S. Challenger)*: off Port Jackson Heads, 5 miles due east, 45 fathoms, June 3, 1874, found with *Typhis Cleryi*, Sowerby *(J. Brazier)*.

The first specimen that I saw of this species was sent to me by Mr. W. F. Petterd as far back as 1870, and since that I have seen numerous examples from Tasmania. The Rev. Tenison-Woods described a fossil form from Table Cape, Tasmania, in 1875 under the name of *Natica polita;* he had seen the species now known as *Natica Beddomei*, but erroneously supposed the recent form to be the same as the fossil. Both Professor Tate and Mr. Johnston agree that the recent form should be separated from the fossil; both species have a very deep suture, but in the living mature form the number of whorls is invariably $3\frac{1}{2}$ to 4. The only figure of this species is that given by Dr. Boog Watson in the "Challenger" Report, Vol. xv. Pl. xxxvii. fig. 3, under the name of *Natica effossa*. There appear to be some discrepancies in the "Challenger" Reports regarding the various depths; for instance, we find Port Jackson, Sydney, 30 to 35 fathoms; these depths are outside of Port Jackson Heads. Very few writers trouble themselves to look up the Admiralty Charts and prick off the latitude and longitude.

3. Terebra (Euryta) Harrisoni, Tension-Woods.

1863. *Euryta pulchella*, Ad. and Angas, Proc. Zool. Soc. p. 418, pl. 37, fig. 14 (non *Terebra pulchella*, Desh.).

1865. *Euryta pulchella*, Angas, Proc. Zool. Soc. "Molluscan Fauna of S.A." p. 169, No. 81.

1875. *Euryta Brazieri*, Angas, Proc. Zool. Soc. p. 390, Pl. xlv. fig. 5, 5a (non *Terebra Brazieri*, 1871).

1877. *Mangelia Harrisoni*, Tenison-Woods, Proc. Royal Soc. Victoria, p. 56.

1884. *Daphnella Harrisoni*, Tryon, Man. Conch. Vol. vi. p. 306.

1885. *Terebra (Euryta) Angasi*, Tryon, *loc. cit.* Vol. vii. p. 38, pl. 12, fig. 26.

1886. *Terebra (Euryta) Angasi*, Tryon; Tate in Southern Science Record, p. 4.

1887. *Pleurotoma (Cithara) Harrisoni*, Gatliff in Victorian Naturalist, "List of some of the Shells of the Marine Mollusca found on the Victorian Coast," Vol. iv. No. 4, p. 59.

1893. *Euryta Angasi*, Tryon; Adcock, "A Hand List of the Aquatic Mollusca of S.A." p. 5, No. 125.

Hab.—Rapid Bay, South Australia, deep water *(G. French Angas)*: South Australia *(Professor Tate and Adcock)*; off Port Jackson Heads, 25 fathoms, sand floor *(J. Brazier*, 1874): Clark Island, Victoria *(Tenison-Woods)*: Victoria *(J. H. Gatliff)*: Port Stephens, N.S.W., on the ocean beaches after heavy weather; and in beach shingle and sand at Edward's Beach, Middle Harbour.

This species was first named by Adams and Angas *Euryta pulchella*; the specific name being already in use in *Terebra* by Deshayes, Mr. Angas in 1875 redescribed it from specimens that I sent him, under the name of *E. Brazieri*, he having already in 1871 named a *Terebra Brazieri*. Tenison-Woods in 1877 called it *Mangelia Harrisoni*. Mr. Tryon in 1885 renamed it *Terebra (Euryta) Angasi*. Mr. J. H. Gatliff of Melbourne sent me specimens in 1885, to have the name confirmed; at the time I wrote him out the history of the species, but in his list of the Victorian Mollusca he places it in *Pleurotoma*: it should be placed in the subgenus *Euryta* of *Terebra*; it is named in the Melbourne Museum by Tenison-Woods *Mangelia Harrisoni*: I have compared it with specimens from New South Wales. Woods' specific name must stand for this species.

4. Triforis scitulus, A. Adams.

1851. *Triforis scitulus*, A. Ad., Proc. Zool. Soc. p. 278.

1878. *Triforis fasciata*, Tenison-Woods, Proc. Roy. Soc. Tasmania, p. 34.

1887. *Triforis fasciata*, Tryon, Man. Conch. Vol. ix. p. 190.

1887. *Triforis scitulus*, Tryon, *loc. cit.* Vol. ix. p. 191.

1893. *Triforis scitula*, Adcock, A "Hand List of the Aquatic Mollusca of S.A." p. 7, No. 241.

Hab.—Port Lincoln, South Australia *(Cuming in Brit. Museum)*: Cook's landing place, south side of Botany Bay, found under stones at low water and in shell sand *(Brazier*, 1864);

Middle Harbour, in shell sand and beach shingle *(A. U. Henn and Brazier):* North Tasmania *(Rev. H. D. Atkinson):* South Australia *(Professor Tate and D. J. Adcock).*

A white and brown species, with the middle row of nodules very prominent; though Mr. Angas had a large number of specimens from me, and duly returned some named *T. scitulus*, he never entered it in his List of Port Jackson Mollusca. The species is somewhat common on the coast of N.S.W. *T. fasciata*, Tenison-Woods, now before me from Mr. Beddome cannot be separated from the above species.

5. Rissoia (Apicularia) Strangei, Brazier.

1884. *Rissoa lineata*, Petterd, Journ. Conch. Vol. iv. No. 5, p. 137, Species 8 [January] (non *lineata*, Risso, 1826).

1894. *Rissoia (Apicularia) Strangei*, Brazier, Proc. Linn. Soc. N.S.W. Vol. ix. (Series 2nd) p. 173, Pl. xiv. fig. 11 (not 12 as quoted in the text).

Hab.—North Coast of Tasmania, on the underside of exposed rocks at low water *(W. F. Petterd):* Green Point, Watson's Bay, Port Jackson, found in an old bottle and under stones at low water spring tide *(A. U. Henn):* Edward's Beach, Middle Harbour, in shell sand and shingle *(Brazier).*

In the early part of the year I described this species under the name of *Rissoia Strangei*. Through the kindness of Mr. Beddome who sent me the greater part of his Tasmanian Mollusca to examine and compare with those of New South Wales, I found while comparing mine with Mr. Petterd's types that *R. lineata* is identical with my *R. Strangei*. The name of *R. lineata* being preoccupied by Risso in 1826, *Strangei* will be retained for the Tasmanian and Australian species.

6. Rissoia (Amphithalamus) Jacksoni, Brazier.

1886. *Rissoa (Scrobs) badia*, Watson, Report on the Gasteropoda, Voyage of H.M.S. "Challenger," Zoology, Vol. xv. p. 612, Species 47, pl. 46, fig. 3 (non *Rissoa badia*, Petterd).

Hab.—Sow and Pigs Reef, Port Jackson, 4 fathoms, sand and broken shells; Cook's landing place, south side of Botany Bay, in shell sand and beach shingle, not common *(J. Brazier*, 1864); Middle Harbour, under stones at low water; Green Point, Watson's Bay, under stones and in shell sand *(A. U. Henn).*

The name *badia* having been already in use by Mr. Petterd in 1884 for a Tasmanian species, I have changed Dr. Boog Watson's name to *Rissoia Jacksoni*, after Sir George Jackson to whom the Navigator Captain Cook named Port Jackson.

7. Rissoia (Amphithalamus) olivacea, Dunker.

1867. *Alvania olivacea*, Dunker, Novara Expedition (Mollusca), p. 11, Pl. II. fig. 14.

1875. *Diala tumida*, Tenison-Woods, Proc. Roy. Soc. Tasmania, p. 147.

1884. *Rissoa Diemenensis*, Petterd, Journ. Conch. Vol. iv. No. 5, p. 138, Species 13.

1887. *Litiopa (Diala) tumida*, Tryon, Man. Conch. Vol. ix. p. 283.

1887. *Rissoia olivacea*, Tryon, *loc. cit.* Vol. ix. p. 339, pl. 66, fig. 43.

1887. *Rissoia Diemensis*, Tryon, *loc. cit.* Vol. ix. p. 368.

1894. *Rissoia (Amphithalamus) olivacea*, Dunker; Henn, Proc. Linn. Soc. N.S.W. (2) Vol. ix. p. 174, No. 71.

Hab.—Sydney, Manly Beach and Botany Bay *(Frauenfeld):* Swansea, Tasmania, rare *(Legrand);* Table Cape and Tamar Heads, Tasmania *(W. F. Petterd):* Green Point, Watson's Bay, and Middle Harbour, Port Jackson *(A. U. Henn);* Long Bay, South of Sydney, in shell sand and alive under stones, low water.

It is very strange that Tenison-Woods should have called this a *Diala* when it is a *Rissoia;* and Mr. Petterd described it under the name of *Rissoa Diemenensis.* Having both the Tasmanian species before me I find that they are merely varieties of *Rissoia* *olivacea*, Dunker, the varieties of which are very numerous in Port Jackson and on the coast in the living state. A number of the Tasmanian species have been described from beach worn and faded specimens.

8. RISSOIA (AMPHITHALAMUS), PETTERDI, Brazier.

1884. *Rissoa pulchella*, Petterd, Journ. Conch. Vol. iv. No. 5, p. 138, Species 14 (non *Rissoa pulchella*, Risso, nec *pulchella*, Philippi, nec *pulchella*, Danilo and Sandri).

1887. *Rissoia pulchella*, Tryon, Man. Conch. Vol. ix. p. 368.

Hab.—North Coast of Tasmania and Isles in Bass's Straits *(W. F. Petterd)*: Cook's landing place, south side of Botany Bay, under stones and in shell sand among the rocks *(J. Brazier*, 1864).

A very pretty little species; when in good condition of a fine bright brown, when sea worn of a dirty pale colour.

The specific name *pulchella* is preoccupied by Philippi in 1836, by Risso in 1826 for *Rissoia auriscalpium*, Linné, and by Danilo and Sandri for *Rissoia decorata*, Philippi, 1846; I take great pleasure in renaming it after my friend, correspondent, and fellow voyager, Mr. William Frederick Petterd of Tasmania.

9. RISSOIA (SETIA) FLAMIA, Beddome.

1882. *Rissoa (Setia) flamia*, Beddome, Proc. Roy. Soc. Tasmania, p. 169, No. 16.

1883. *Rissoia (Setia) Sophiæ*, Brazier MSS.

1887. *Rissoia (Setia) flamia*, Tryon, Man. Conch. Vol. ix. p. 359.

1894. *Rissoia (Setia) Sophiæ*, Braz.; Henn, Proc. Linn. Soc. N.S.W. (2), Vol. ix. p. 174, No. 74.

Hab.—Blackman's Bay, Tasmania, 7 fathoms *(C. E. Beddome)*: Point Piper, Port Jackson, living under stones *(Brazier)*; Green Point, Watson's Bay, Port Jackson, under stones and in shell sand *(A. U. Henn)*.

A minute turbinated shell, white with red diagonal flames, and about one of the most common species that we have. A large number were sent to Mr. Angas as far back as 1876 with other species; about the time I named this in MS., I received sea-worn specimens from Mr. Petterd; having Mr. Beddome's types before me the matter is now at rest.

10. CIRSONELLA WELDI, Tenison-Woods.

1876. *Cyclostrema Weldi*, Tenison-Woods, Proc. Roy. Soc. Tasmania, p. 147, No. 43.

1876. *Cyclostrema immaculata*, Tenison-Woods, *loc. cit.* p. 148, No. 46.

1877. *Cirsonella australis*, Angas, Proc. Zool. Soc. p. 39, Pl. v. fig. 16.

1888. *Cyclostrema immaculata*, Tenison-Woods; Tryon in Man. Conch. Vol. x. p. 95.

1888. *Cyclostrema (Tubiola) Weldii*, Tryon, *loc. cit.* Vol. x. p. 95, pl. 33, fig. 11.

1888. *Teinostoma (Cirsonella) australis*, Tryon, *loc. cit.* Vol. x. p. 107, pl. 35, figs. 83, 84.

1889. *Cyclostrema australis*, Whitelegge, "List of the Marine and Fresh Water Invertebrate Fauna of Port Jackson and Neighbourhood," Journ. and Proc. Roy. Soc. New South Wales, Vol. xxiii. p. 268, No. 555.

1894. *Teinostoma (Cirsonella) australe*, Henn, Proc. Linn. Soc. N.S.W. (series 2nd) Vol. ix. p. 175, No. 88.

Hab.—Long Bay, South Tasmania, 20 fathoms *(Rev. H. D. Atkinson)*; Long Bay and Blackman's Bay, Tasmania *(W. F. Petterd)*: Botany Bay, in shell sand, Sow and Pigs Reef, Port Jackson, 4 fathoms *(J. Brazier*, 1864); Green Point, Watson's Bay, found in an old bottle *(A. U. Henn.)*.

This is another species described twice by the Rev. Tenison-Woods, as *Cyclostrema Weldi* and *immaculata;* and by Mr. Angas as *Cirsonella australis.* Some specimens when in good condition show from two to three fine spiral raised lines round the narrow umbilicus; in others they are wanting. The large number of Tasmanian specimens kindly lent to me by Mr. Beddome have cleared up many points between the Tasmanian and Australian species. Evidently Tenison-Woods had very few specimens at his disposal, for I am quite sure he would never otherwise have made two species. His name of *C. Wedi* has priority over Angas' *C. australis.*

11. PUNCTURELLA HARRISONI, Beddome.

1882. *Cemori Harrisoni*, Beddome, Proc. Roy. Soc. Tasmania, p. 168, No. 11.

1890. *Puncturella Harrisoni*, Pilsbry, in Tryon, Man. Conch. Vol. xii. p. 294.

1894. *Puncturella Henniana*, Brazier, Proc. Linn. Soc. N.S.W. Vol. ix. (2nd series) p. 177, No. 107, Pl. XIV. fig. 14.

Hab.—Off Old Station, Brown's River Road, 7 fathoms; Bruni Island, South Tasmania *(C. E. Beddome)*: Green Point, Watson's Bay, Port Jackson, two specimens found in an old bottle; Edward's Beach, Middle Harbour, in shell sand and beach shingle *(A. U. Henn)*; off Green Point in 8 fathoms, and Sow and Pigs Reef, 4 fathoms, on dead valves of *Trigonia Lamarckii*, Gray (*J. Brazier*, 1864).

Having Mr. Beddome's types before me I find them to be identical with my species, his name having priority.

12. CHORISTODON RUBIGINOSUM, A. Ad. and Angas.

1863. *Naranio rubiginosa*, A. Ad. and Angas, Proc. Zool. Soc. p. 425, pl. 37, fig. 17.

1867. *Choristodon rubiginosum*, Angas, Proc. Zool. Soc. p. 924, No. 78.

1884. *Clementia Tasmanica*, Petterd, Journ. Conch. Vol. iv. No. 5, p. 145, Species 36.

1892. *Naranio rubiginosa*, Tate, Proc. Roy. Soc. South Australia, p. 134.

1893. *Naranio rubiginosa*, Adcock, "A Hand List of the Aquatic Mollusca of S.A." p. 12, No. 66.

Hab.—Watson's Bay, Port Jackson, dredged in 4 fathoms enclosed in a nodule of clay *(G. French Angas)*: off Vaucluse Bay, Port Jackson, 12 fathoms, muddy bottom, fine living specimens found in hard clayey mud, two specimens got crushed with the dredge (*J. Brazier*, 1866): Aldinga Bay, very rare and small, in shell sand (*Professor R. Tate*); dredged in Hardwicke Bay, Spencer Gulf, S.A., from eight to ten fathoms, four perfect shells, and five single valves (*Dr. Verco*): dredged off Long Bay and Brown's River, in about 7 fathoms (*W. F. Petterd*): Frederick Henry Bay, South Tasmania (*Miss Lodder*).

The Tasmanian specimen submitted to me by Miss Lodder was described by Mr. Petterd as *Clementia Tasmanica*; it is identical with *Choristodon rubiginosum*, A. Ad. and Angas. Last year (1893) Miss Lodder sent me a bivalve to determine for her; it also was *C. rubiginosum*, Ad. and Ang. At the time I did not make a note of the locality sent with the specimen. The southern specimens do not differ from the Port Jackson ones; the colour is the same, rayed with brown and purple at the umbones. Of the four specimens I obtained in 1866, one was sent to Mr. Angas with a lot of other Mollusca, but evidently overlooked by him.

The Genus *Choristodon* was founded by Jonas, 1844; H. and A. Adams, 1857; *Naranio*, Gray, 1853, is a synonym.

NOTES OF A VISIT TO THE ISLAND OF ERROMANGA, NEW HEBRIDES, IN MAY, 1894.

By Sutherland Sinclair, Secretary of the Australian Museum.

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Erromanga was first discovered by Captain Cook in 1774. He landed at the east side of the island, but withdrew in face of a hostile demonstration by the natives, and fired on them, so their first contact with white men was unfriendly. Cook named the high land near the spot where he landed and was attacked Traitor's Head. The Missionary, Rev. H. A. Robertson, suspects, however, that they must have seen white men before Cook landed. Knowing the customs of the people well he thinks they would have acted differently if he had been actually the first white man they saw. This is only an inference ; there is no evidence, and probably never will be any to bear it out. The next contact with white men was even worse. Before 1835 the island was occupied by sandal wood traders, who cut and exported the sandal wood which grew abundantly in the forests, and was visited occasionally by trading vessels, who did not cultivate friendly relations with the natives. Every beach on Erromanga has been the scene of some tragedy, and sometimes even the sandal wood has been taken away covered with blood. It is said that 300 white people and others not natives of Erromanga lost their lives during this period. The sandal wood is gone now and the trade extinct.

The Erromangans are by no means a weak people—either physically or intellectually; many of those I have seen are men of good physique and strong character. They have the reputation of being the only people in the New Hebrides who actually killed their missionaries. Although the missionary is at present the principal personage on the island, and could if he chose control the government, he has wisely refrained from doing so. The government is, therefore, still in the hands of the chiefs. The island is unlike some others in the New Hebrides in that it is occupied by one race who speak one language, although there are local dialects. The people are divided into tribes, who formerly were hostile to one another, and frequently engaged in war. The land was divided into shires, somewhat like our counties. That in which Dillon's Bay is located is called Lo-itnatman, meaning "The Kingdom of Men." It extends for about 8 miles north and 12 miles south of Umbongkora, or Dillon's Bay, and contained the dominant tribes. The tribes on the south were generally more manly and warlike than the Northerners. The head chiefs were supreme over each tribe, and there were under chiefs, but there was no one man over all the island. The chieftainship in each case is hereditary from father to son, although sometimes some stronger man might usurp and hold the power.

This form of government still remains in its main outlines, but is now much modified in practice by the influence of the teachers, who are usually the best men on the island, often, though not always, chiefs themselves. A habit is growing up of consulting one another and of asking the missionary for advice.

Paganism, in the sense of worshipping a multitude of idols, did not exist in Erromanga; in fact they had no idols, but they worshipped their dead ancestors, whom they called "Natemas," and to whom they offered food,—which the rats ate. They had a place of the dead, but no Heaven. No one was believed to die a natural death; if he did not die in battle he was bewitched by some sacred man either at his own instance or on behalf of some one else. If the sacred man obtained possession of any article belonging to a person whom he wished to injure, he could perform certain ceremonies over it which were supposed to involve the death of the owner, and the strange part was that the doomed person hearing of this would in many cases actually die, unless the articles were recovered in time, or the sorcerer killed. One might engage a sacred man to bewitch another against whom he had a grudge, but the sacredness of the exorcist did not prevent his sometimes losing his life in consequence. An instance of this occurred not many years ago on the shores of Dillon's Bay when such a man was shot to prevent his bewitching a person from whom he had taken a piece of sugar cane.

The people also worshipped the moon, which was symbolised by "Navelah" or Sacred Stones. These were cut in the form of large rings, and jealously guarded and kept buried by the sacred men. They were produced at the periodical heathen feasts and passed on from tribe to tribe, being joint property.

These feasts are in themselves comparatively innocent. There is a great expense for food on the part of the chiefs or tribes who are hosts for the time; a tower of poles fastened to a tall tree is built like a scaffolding, and pigs, yams, &c., are hung on it, sometimes in hundreds. The people come and sing, dance and feast; and if that were all they might be ignored. But it is at these feasts that mischief is planned and often carried out, so the missionaries have necessarily set their faces against them. In heathen times cannibalism accompanied these feasts, but that is now a thing of the past. Cannibalism was not rampant on Erromanga. The chiefs and great men ate their victims, but many a man never tasted human flesh. There are still a few persons alive who were cannibals, but soon it will be entirely a thing of the far past.

The marriage customs of the Erromangans were interesting. Polygamy prevailed, and when a man died his brother inherited his wives. Marriages were not arranged by the people most concerned, but by the tribe. In heathen days the girl was sold, and she was often betrothed in her childhood. If when she grew up she refused to join her husband she could be forced to do so, and if her husband cared to venture he might come and steal her away. Her friends might kill him if he belonged to a hostile tribe, but would not pursue him. Now, when a girl is marriageable, her parents and near relations look out for a husband for her, and when they have settled the locality to which their intertribal interests require her to go, she is asked whom in that place she would like for a husband. When she has made her choice the man is asked, and then they come to the missionary to have the ceremony performed. It is very difficult to ascertain the name of a married woman. Native etiquette in such matters is strict, and no man will tell it. She is called the wife of So and So. This is after all much like our own custom of calling married women Mrs. So and So, and dropping their maiden and Christian names. But in Erromanga a man even will hardly tell you his own name; he somehow does not like to do so, but his friend will tell it.

The women in former times were dressed much better than the men. The latter wore hardly any clothing, while the women wore skirts made from the leaves of the pandanus or the bark of the the hibiscus. Girls, unmarried women and widows wore short skirts, betrothed and married women wore long skirts. The shoulders would be covered with a piece of tappa or native cloth. The Erromangan name for this cloth is "Namās-itsa," which means simply beaten cloth. It was made by beating the inner bark of a banyan tree on a log with a wooden beater called "Næko." The result was a tough serviceable material. The women still wear the native dresses, but calicoes and coloured prints have taken the place of the beaten cloth. The men now wear a lava-lava of calico or print and a shirt. It makes a dress very like the Scotchman's kilt, except that it is light enough for use in a tropical climate. Many, however, have attained to the dignity of trousers, shirts, coats and hats. The head-dress of the women now is a coloured handkerchief—of the men a comb.

The weapons of the Erromagans consisted of clubs, bows and arrows, spears and stone hatchets. There were three kinds of clubs:—"Telungumti" (splitear), the starheaded club, which was made at the south of the island and is now very rare; "Netnevrie," a club with a flattened disc at each end, and divided into two parts of unequal length by a pair of similar discs, the shorter part being thickened or bulged; "Novwan" (fruit), a club similar in shape, but with a raised beading along one side. The bows are made of a hard red wood from a tree resembling the willow ; they are shaped by means of a pig's tusk, which scrapes away the wood without breaking or cutting the fibre as a knife or sharp tool would do. They are stained with cocoanut oil and smoke, and in course of time acquire a beautiful dark polish. The arrows are made from the reeds which grow everywhere in abundance, the barbs being from the wood of the tree-fern, neatly lashed into the reeds by a strand of cocoanut fibre. Spears were made of wood and sometimes with a barb of tree-fern, but were not much used. Stone axes were rather a tool than a weapon ; they were used for cutting down trees, digging out canoes with the aid of fire, and other such work ; they were roughly set in wooden handles. The axe now in use is a modern iron blade, into which is set a native club handle, forming a useful weapon, a combination of old and new civilisation.

The Erromangan canoe is usually made from the trunk of the bread fruit tree. It is roughly shaped, and hollowed out, formerly with primitive tools, by fire and patient digging ; now it is made more easily with iron tools; it is steadied by an outrigger. There is no ornamentation or fancy work about it, and the fastenings are simply lashings of cocoanut fibre. These canoes are very light and buoyant. They are propelled by paddles, and sometimes by sails, but they are never of any great size : the largest would carry perhaps five or six men.

The food of the Erromangans consists principally of yams, cocoanuts, breadfruit, taro, native cabbage a kind of hibiscus, native beans, and other local products, with fish, fowl or pig occasionally. A primitive but efficient system of cultivation is followed. The yam garden consists of a clearance in the forest where the yams are planted, and the creeper trained over canes and trunks of trees. The garden implements consist of a pointed stick and a pair of hands. Some gardens are fenced in, and so luxuriant is the vegetation that the fences sprout and grow—giving an appearance of truth to the saying, "If you plant your walking-stick it will grow." These clearances are not used two years in succession, but each year the old garden is abandoned and a new clearance made. The cooking oven is made by scooping a hollow in the ground, lining it with stones and lighting a fire on it. When the stones are thoroughly hot the fire is scraped away, the food to be cooked is wrapped up in banana leaves, placed in the oven, covered up with the hot stones, ashes and earth, and left till ready. The tongs used for lifting the heated stones are simply a branch of a tree split up for two or three feet. I have tasted native puddings cooked in that way and found them very enjoyable.

The houses are built of reeds interlaced and covered with thatch, and can be made very comfortable; they are open at one end, and the fireplace is just at the entrance. The stem of the bastard cotton wood is much used for rafters and uprights. It is a soft perishable wood, but as it grows in crooked shapes it naturally fits the curves of the roof, and the smoke of the fire seems to preserve it. Some of the houses rise in graceful curves from the ground to the ridge about 15 or 20 feet high, others have straight sides and a roof starting about six feet from the ground.

The Erromangan words of salutation are "Kik-e-pou" (my love to you), the same expression being used both for welcome and farewell; the following are a few other words of the native language:—

Native Word.	Translation.	Pronunciation.
Erromanga	the name of the island	Eromang-a
Umbogkora	name of place at Dillon's Bay	Umbongkora
Misi	Mr. or Missionary	meesee
elum	come	ælum
elum kik	come thou	ælum kyk
eve	go, begone	ævæ
ĭtnum	haste ye	ytnum
owi lap	wait	oweelap
asso	pull	asso
ire	to-day	eeræ
dan	day	dan
būmrok	night	boomrock

NATIVE WORD.	TRANSLATION.	PRONUNCIATION.
aïpaunen	sun	nypnoonen
ïtis	moon	ytees
mosi	star	mosee
ōrun mosi	stars	ōrun mosee
pot	head or principal	pot
nūp	yam	noop
tal	taro	tal
nos	banana	nos
taiek	Fiji banana	ta-ee-æk
nessi	popow apple	næssee
alēepo	sleep	alæeepo
yx	me	yow
enyx	mine	eenyow
kïk	thou	kyk
monokowo	yes	monochowo
tawi	no	tawee
kù ?	or	koo
marima	just now, immediately	mareema
metùk	gently (as pouring into a bottle)	meetook
pah	alas	pah
kïk-e-px	my love to you	kyk-æ-pow
kïmi-e-px	love to you all	kymee-æ-pow

Specimens of the articles described in this paper are to be seen in the Australian Museum.

NOTES AND EXHIBITS.

Mr. Brazier exhibited *Trochus Pfefferi*, Dohrn, *T. constellatus*, Souverbie, and *T. concavus*, Gmelin (this species having the aperture so oblique as to resemble a *Calyptræa)* from Lifau, Loyalty Islands, a new locality; collected by Mr. R. C. Rossiter. Also, *Calyptræa radians*, Lam., from Chili, West coast of S. America, to show how much it resembles *Trochus concavus*, Gmelin.

Mr. Hugh Dixson showed a large and handsome orchid—an undetermined species of *Dendrobium* belonging to the *D. undulatum* group—received from the Solomon Islands, and now flowering.

Mr. Baker exhibited specimens of the new *Isopogon*, and of other species from various localities in N. S. Wales, in illustration of his paper.

Messrs. Maiden and Baker exhibited *Pterostylis barbata*, Lindl., collected by Miss Combes at Glanmire, near Bathurst. Mr. Fitzgerald states that it has only, as regards this Colony, been previously found at Cootamundra, where he observed a solitary plant. It may be mentioned that this is the only species of *Pterostylis* extending to New Zealand, where it is very rare.

Mr. Woolrych exhibited specimens of snakes from Kenthurst, Dural, near Parramatta, including a death-adder *(Acanthophis antarctica)*, with an unusual colour-pattern.

Mr. Lea exhibited the insects described in his paper; examples of a tick more than usually abundant at Manly this year; and the shell of a mollusc, *Cypræa mauritiana*, L., obtained alive some years ago at Long Bay—a species not previously recorded from N.S. Wales.

Mr. Sinclair exhibited an interesting series of native dresses, weapons and implements, and, with the aid of a lantern, photographs of the natives and scenery of Erromanga.

Dr. Cox exhibited a fine example of an aboriginal shield [native name *Woonda; cf.* Brough Smyth's "The Aborigines of Victoria," Vol. i. p. 338, fig. 148] from West Australia. He also showed specimens of what he believed to be *Chiton Sinclairi*, Gray; and he communicated the following Note:—"Mr. H. A. Pilsbry, of Philadelphia, has recently published in the Proceedings of the Academy of Nat. Sciences of Philadelphia for 1894 (p. 69) a list of Port Jackson Chitons, with a revision of Australian *Acanthochitidæ* of much interest to our local collectors, and of value to those engaged in the scientific study of *Polyplacophora* (Chitons).

The author has included in that list as from Port Jackson:—

1. *Callochiton platessa*, Gould.
2. *Ischnochiton Haddoni*, Pilsbry; a common form in our waters, formerly considered to be *Lepidopleurus longicymba*, Quoy.
3. *Ischnochiton fruticosus*, Gld.
4. *Ischnochiton divergens*, Reeve.
5. *Ischnochiton (Ischnoradsia) australis*, Sowb.
6. *Ischnochiton (Haploplax) smaragdinus*, Angas.

6A. *Ischnochiton smaragdinus picturatus*, var.nov.

7. *Ischnochiton (Haploplax) lentiginosus*, Sowb.
8. *Callistochiton antiquus*, Reeve.
9. *Plaxiphora petholata*, Sowb.
10. *Acanthochites (Loboplax) costatus*, Adams and Angas.
11. *Acanthochites (Meturoplax) retrojectus*, Pilsbry.
12. *Acanthochites Coxi*, Pilsbry.
13. *Acanthochites granostriatus*, Pilsbry.
14. *Cryptoplax striatus*, Lamarck.
15. *Chiton pelliserpentis*, Q. and G.
16. *Chiton muricatus*, A. Ad.
17. *Chiton jugosus*, Gld.
18. *Chiton Coxi*, Pilsbry.

19. *Loricella Angasi*, Ad.

20. *Liolophura Gaimardi*, Blainv.; another common form formerly recognised in Australian Collections as *Chiton piceus.*

21. *Onithochiton rugulosus*, Angas.

22. *Onithochiton quercinus* Gould.

Mr. Pilsbry does not include *O. Lyellii*, Sowb., which he seems to look upon as probably a variety of one or other of the two *Onithochitons* enumerated. My own impression is that the three are all one and the same variable species.

To Mr. Pilsbry's list I have to add:—

23. *Lorica volvox*, Reeve.

24. *Chiton Sinclairi*, Gray; or what at present I take to be such.

The collection on which Mr. Pilsbry's list is based consisted very largely of specimens sent to him by myself. By an accidental omission *L. volvox* was not included amongst them; it has been previously recorded as occurring in Port Jackson by Angas, and it is in most of the local private and public collections."

WEDNESDAY, NOVEMBER 28TH, 1894.

The President, Professor David, B.A., F.G.S., in the Chair.

Mr. J. A. Lewis was introduced as a visitor.

The Rev. Henry Plume, M.A., Kurrajong Heights, was elected a Member of the Society.

The President announced that the Annual General Meeting, together with the next Ordinary Monthly Meeting—the first of the Session for 1895—would be held on March 27th, 1895, at the Linnean Hall, Elizabeth Bay.

DONATIONS.

"Royal Physical Society, Edinburgh—Proceedings." Vol. xii. Part 2 (1893-94). *From the Society.*

"Société d' Horticulture du Doubs, Besançon—Bulletin," n.s. No. 45 (Sept., 1894). *From the Society.*

"Perak Government Gazette." Vol. vii. (1894), Nos. 21-24. *From the Government Secretary.*

"Zoologischer Anzeiger." xvii. Jahrg. (1894), Nos. 457-458 (Sept.-Oct.). *From the Editor.*

"Zoological Society of London—Transactions." Vol. xiii. Part 9 (1894): "Proceedings, 1894." Part 3. *From the Society.*

Four Conchological Pamphlets, by Edgar A. Smith, F.Z.S. (1894). *From the Author.*

"Bombay Natural History Society—Journal." Vol. viii. No. 5; Vol. ix. No. 1. *From the Society.* .

"Madras Government Museum—Bulletin, No 1, Pearl and Chank Fisheries of the Gulf of Manaar" (1894). *From the Superintendent.*

"Senckenbergische Naturforschende Gesellschaft in Frankfurt a/M.—Bericht, 1894." *From the Society.*

"Department of Agriculture, Brisbane—Botany Bulletin," No. ix. (1894); "Botany Abridged." By F. M. Bailey, F.L.S. (1894). *From the Under Secretary for Agriculture.*

"American Naturalist." Vol. xxviii. (1894), Nos. 333-334 (Sept.-Oct.). *From the Editors.*

"Missouri Botanical Garden—Fifth Annual Report, 1894." *From the Trustees.*

"U.S. Department of Agriculture—Division of Entomology: Insect Life." Vol. vi. No. 4 (1894). *From the Secretary of Agriculture.*

"Museum of Comparative Zoology at Harvard College—Bulletin." Vol. xxv. No. 8 (Sept., 1894). *From the Museum.*

"Tufts College Studies," No. iii. (Sept., 1894). *From the College.*

Pamphlet entitled—"On the Myology of *Notoryctes typhlops.*" By Professor J. T. Wilson, M.B. (1894). *From the Author.*

"Victorian Naturalist." Vol. xi. No. 7 (Oct., 1894). *From the Field Naturalists' Club of Victoria.*

"Naturwissenschaftlicher Verein des Reg.-Bez. Frankfurt a Oder—Helios." xii. Jahrg. (1894) Nos. 4-6: "Societatum Litteræ." viii. Jahrg. (1894), Nos. 7-9. *From the Society.*

"Agricultural Gazette of N.S.W." Vol. v. (1894), Part 10. *From the Hon. the Minister for Mines and Agriculture.*

"Asiatic Society of Bengal—Journal." Vol. lxiii. (1894), Part ii. No. 2: "Proceedings, 1894." Nos. vii.-viii. (July-August). *From the Society.*

"Indian Museum—Natural History Notes." Series ii. Nos. 15-16 (1894). *From the Museum.*

"Société des Sciences, des Arts et des Lettres du Hainaut—Mémoires et Publications." v^{me} Serie. T. iv.-v. (1891-92).

"Australasian Journal of Pharmacy." Vol. ix. (1894), No. 107 (Nov.). *From the Editor.*

"Royal Society of South Australia—Transactions." Vol. xviii. (1893-94). *From the Society.*

"Smithsonian Institution, Washington—Annual Report of the Board of Regents to July, 1891." *From the Institution.*

"Smithsonian Institution, Washington—Report of the U.S. National Museum for the year ending June, 1891." *From the Museum.*

"Smithsonian Institution, Washington: Bureau of Ethnology—Ninth Annual Report" (1887-88): "Bibliography of the Salishan Languages." By J. C. Pilling (1893). *From the Bureau.*

"New York Academy of Sciences—Annals." Vol. v. Nos. 9-12 (1890); Vol. vi. Nos. 7-12 and Title-page and Index (1892); Vol. vii. Nos. 6-12 (1894); Vol. viii. No. 4 (1894): "Transactions." Vol. xi. Nos. 6-8 and Index (1891-92). *From the Academy.*

"American Museum of Natural History—Bulletin." Vol. v. (1893), also Sheet 1, pp. 1-16; Vol. vi. Sheets 10-17, pp. 240-272 (1894): "Memoirs." Vol. i. Part i. (1893): "Annual Report for the year 1893." *From the Museum.*

"American Academy of Arts and Sciences—Proceedings." Vol. xxviii (1893). *From the Academy.*

"Boston Society of Natural History—Proceedings." Vol. xxvi. Part i. (1893): "Memoirs." Vol. iv. No. xi. (1893). *From the Society.*

"Cincinnati Society of Natural History—Journal." Vol. xvi. Nos. 2-4; Vol. xvii. No. 1 (1893-94). *From the Society.*

"Essex Institute—Bulletin." Vol. xxv. Nos. 4-12; Vol. xxvi. Nos. 1-3 (1893-94). *From the Institute.*

"Johns Hopkins University, Baltimore—Studies from the Biological Laboratory." Vol. v. Nos. 2-4 (1893). *From the University.*

"Academy of Science of St. Louis—Transactions." Vol. vi. Nos. 9-17 (1893-94). *From the Academy.*

"American Philosophical Society—Proceedings." Vol. xxxi. No. 142; Vol. xxxiii. No. 144. *From the Society.*

"Academy of Natural Sciences of Philadelphia—Proceedings, 1893, Parts ii.-iii.; 1894, Part i." *From the Academy.*

"Meriden Scientific Association—Annual Address for the year 1893." *From the Association.*

"Museu Nacional do Rio de Janeiro—Archivos." Vol. viii. (1892). *From the Museum.*

"Kaiserliche Leopoldino-Carolinische deutsche Academie der Naturforscher, Halle—Nova Acta." Bd. lvii. Nr. 5; Bd. lviii. Nr. 4 (1891-92): "Leopoldina." xxviii. Heft (1892). *From the Academy.*

"Naturforschende Gesellschaft zu Freiburg, i. B.—Bericht." viii. Band (1894). *From the Society.*

"Naturhistorisches Museum in Hamburg—Mittheilungen." x. Jahrg. (1892). Zweite Hälfte. *From the Museum.*

"K.K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen." xliii. Band, (1893), 3-4 Quartal. *From the Society.*

"Naturwissenschaftlicher Verein für Schleswig-Holstein—Schriften." Band x. (1893) Erstes Heft. *From the Society.*

PAPERS READ.

RE-DESCRIPTION OF *ASPIDITES RAMSAYI*, MACLEAY.

By Edgar R. Waite, F.L.S.

(Zoologist, Australian Museum, Sydney.)

(Contributions from the Australian Museum.)

(Plate L.)

Mr. W. J. C. Ross, of the Technological Museum at Bathurst, recently forwarded for identification a large snake of the genus *Aspidites*, obtained at Bourke, New South Wales. This specimen has become the property of the Australian Museum. Although, apparently, it does not entirely agree with the type of *A. ramsayi*,* I have no hesitation in regarding it as that species.

As the type specimen, unfortunately, appears to have been lost, and as the original description is somewhat unsatisfactory, I have thought it wise to describe and figure the above mentioned specimen.

Whilst searching for Macleay's example, I was pleased to find a specimen (without data) which agrees with the one from Bourke in all essential particulars. Both these examples differ from the type as follows :—The anal shield is undivided, the tail is between a ninth and a tenth of the total length, and the first eleven lower labials are narrow. In the type, *fide* Macleay, there are two anal shields, the tail is about one-sixth of the total length, and the first seven lower labials are narrow. In addition to these points Boulenger remarks† that it "differs from the preceding [*A. melanocephalus*, Krefft] in having the eye separated from the labials by a subocular."

* Macleay, Proc. Linn. Soc. N S.W. 1882, vi. p. 813.
† Brit. Mus. Cat. of Snakes, I. p. 92.

As the British Museum Catalogue does not indicate that the author possessed any material, nor literature other than that quoted in this paper, I regard this passage as a misinterpretation of the following remark of Macleay's:—"The eye is surrounded by nine shields including the superciliary." In *A. melanocephalus** there are only eight shields surrounding the eye, and it appears probable that Boulenger has considered the extra shield to be a subocular. In both of our specimens there are also nine circum-ocular shields, the extra one being a præocular. As Macleay does not refer to this point, it is only reasonable to argue that the same conditions existed in the type.

Description.—Rostral broader than deep, the portion visible from above one-fifth as long as its distance from the frontal; internasals longer than broad, two-thirds the length of the anterior præfrontals, their posterior borders forming a straight line, that of each shield being equal to the median suture; anterior præfrontals longer than broad and wholly larger than the internasals; posterior præfrontals as broad as long, the median suture long, two-thirds that of the internasals; frontal a little longer than broad; parietals large, separated by three or four small shields; three loreals, the posterior one rather small; three præoculars; four postoculars; fourteen upper labials, the seventh just entering the eye; nineteen lower labials, the anterior eleven narrow. Scales in fifty-three to sixty-three rows; ventrals two hundred and ninety-nine; anal entire; subcaudals fifty-three, the last seven divided.

Colours.—Dark brown above, lighter on the sides, with regular well-marked darker brown bands from the head to the tail; ventrals bright yellow with irregular bluish-grey markings, more defined anteriorly.

Total length 1830 millim.; tail 190 millim.

Registered number, R. 1607.

Having examined three specimens of *A. melanocephalus* and two of *A. ramsayi*, I submit the following as a summary of their distinguishing features. The slight differences observable between

* Krefft, Proc. Zool. Soc. 1864, p. 20, and figures.

the previous and the following descriptions of *A. ramsayi* are due to the incorporation of the features of my second example.

A. melanocephalus, Krefft. The portion of the rostral visible from above one-third to half as long as its distance from the frontal, internasals as broad as long, posterior præfrontals just touching each other in front of the frontal, parietals subdivided into small shields, one large loreal, eleven or twelve upper labials, the sixth broadly entering the eye, lower labials fourteen (Krefft) to sixteen. Scales in forty-nine to fifty-five rows, ventrals three hundred and twenty-one to three hundred and thirty, anal entire, subcaudals sixty to sixty-four.

A. ramsayi, Macleay. The portion of the rostral visible from above one-fifth as long as its distance from the frontal, internasals longer than broad, posterior præfrontals in contact for some distance in front of the frontal, parietals large, separated by small shields, two or three loreals, fourteen upper labials, the seventh just entering the eye, lower labials nineteen. Scales in fifty-three to sixty-three rows, ventrals two hundred and ninety-three (Macleay) to two hundred and ninety-nine, anal entire or (?) divided (Macleay), subcaudals fifty-three.

EXPLANATION OF PLATE.

Aspidites ramsayi.

Fig. 1.—Head; upper view; nat. size.

Fig. 2.—The same; profile; nat. size.

Fig. 3.—Circumocular shields; × 2.

A. melanocephalus.

Fig. 4.—Circumocular shields; × 2.

ON A NEW TYPHLOPS PREVIOUSLY CONFOUNDED WITH *TYPHLOPS UNGUIROSTRIS*, PETERS.

By G. A. Boulenger, F.R.S.

(*Communicated by Edgar R. Waite, F.L.S.*)

In preparing the first Volume of the Catalogue of Snakes, I referred to Peters's *Typhlops unguirostris*, a specimen which differed only from the description and figure in the number of scales round the body (22 instead of 24) and in the position of the first labial shield entirely in advance of the nasal cleft. The former discrepancy I attributed to individual variation, the latter to inaccuracy on the part of the artist—Peters, on this occasion, having omitted to describe the exact position of the anterior labials. The resemblances seemed to me to outweigh the differences and I concluded to specific identity.

After reading a note on the subject by Mr. Edgar R. Waite (Proc. Linn. Soc. N.S.W. ix. 1894, p. 13) I feel compelled to alter my view. The disagreement which Mr. Waite has observed between Peters's figure and my description is due to no oversight on my part, but to the fact that Peters's and my type are of different species, as becomes evident now that further examples of *T. unguirostris* have come to light.

I must therefore establish a new species for the specimen which I have referred to *T. unguirostris*, and I cannot do better than to connect with it the name of the author whose remarks have led to the discovery of the error in which I had fallen. The specimen in the British Museum should in future stand as *Typhlops waitii*.

The three closely allied species which are now sufficiently diagnosed may be easily distinguished as follows :—

Typhlops unguirostris, Ptrs. Nasal cleft proceeding from the first labial. 24 scales round the body. Tail nearly as long as broad.

Typhlops waitii, Blgr. Nasal cleft proceeding from the second labial. 22 scales round the body. Tail nearly as long as broad.

Typhlops affinis, Blgr. Nasal cleft proceeding from the second labial. 18 scales round the body. Tail longer than broad.

DESCRIPTION OF A NEW AUSTRALIAN EEL.

By J. Douglas Ogilby.

(*Communicated by Edgar R. Waite, F.L.S.*)

Gymnothorax prionodon, sp.nov.

Length of head $3\frac{1}{3}$, height of body (above the vent) 9 in the trunk; length of trunk $1\frac{1}{8}$ in that of the tail. Eye of moderate size, its diameter three-fourths of the length of the snout, to the tip of which it is much nearer than to the angle of the mouth: snout short, compressed, and transversely truncated, its length one-seventh of that of the head: anterior nasal tube short, about three-sevenths of the diameter of the eye; posterior nostril an oblong slit, situated above the orbit, and surrounded by a low rim, its length one-third of the gill-opening. A series of three large pores along each ramus. Cleft of mouth of moderate size, $2\frac{2}{5}$ in the length of the head; the mouth can be completely closed. Occipital region elevated, fleshy. Gill-openings narrow, four-fifths of the diameter of the eye. Teeth in the jaws uniserial, acute; the anterior teeth in the upper jaw the longest, serrated on the basal half posteriorly: vomer edentulous: mandibular teeth entire, about fourteen on each ramus, the three front ones enlarged and subulate, the lateral ones subequal.

General colour (*in alcohol*) rich yellowish-brown, the fins darker; undersurface and sides of the head and the throat livid gray, the latter with numerous narrow, brown, longitudinal streaks; entire body and dorsal fin with round or oblong whitish or pale blue spots, not exceeding the orbit in size; they are small and faint on the opercular region, beyond which they do not extend; on the dorsal they are concurrent across the margin.

The species above described belongs to the old collection of Australian Fishes, and was labelled "*Anguilla, sp., Port Jackson.*" It is closely allied to the Atlantic *G. ocellatus*, Agass., (Rio Janeiro to Florida and Texas) from which it differs in its much smaller head—*prionodon* $\frac{3}{10}$, *ocellatus* $\frac{1}{2}$ of the trunk—in the greater number of mandibular canines—*prionodon* 3, *ocellatus* 1 in each ramus—with some minor characters.

I at one time thought that the species might prove to be Schneider's *G. wilsoni* (see Günther, Catal. Fish. viii. p. 93), but his description is insufficient to determine the point with accuracy.

Some of the anterior maxillary teeth being serrated, it falls into Kaup's restricted genus *Priodonophis*, but as these serrations, according to Jordan and Davis (Rep. U.S. Fish Comm. pp. 589 and 607, 1888) disappear with age, that genus becomes synonymous with *Gymnothorax*.

The length of the specimen is 322 millimetres.

Type in the Australian Museum, Sydney.

Register number, I. 3324.

BOTANICAL NOTES FROM THE TECHNOLOGICAL MUSEUM.

No. III.

By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S.

Ranunculaceæ.

Clematis Fawcettii, F.v.M., Fragm. x. 1.

(*Clematis glycinoides*, D.C., var.? *submutica*, B.Fl. I. 7.)

Baron von Mueller in *Fragm.* x. 1 describes the leaves of this species as *glabrous*, while every specimen seen by us is loosely pubescent underneath as described by Bentham, B.Fl. I. 7.

Rutaceæ.

Geijera Muelleri, Benth.

This species has been collected at Lismore, Richmond River, by W. Bäuerlen, and so must now be added to the flora of this colony. It seems to have quite as limited a range here as in Queensland, as far as recorded, but as the general appearance of the tree greatly resembles that of *G. salicifolia* it may have been passed by for that species, from which it is botanically distinguished by the imbricate æstivation of the petals.

Halfordia scleroxylon, F.v.M.

Collected at Lismore (W.B.). The only previous recorded locality is Rockingham Bay in Queensland by Baron Mueller, *Frag.* vii. 142. Both species of this genus have now been recorded for New South Wales.

Sapindaceæ.

Nephelium coriaceum, Benth.

This species, hitherto only recorded from Queensland, has now been found over the border, having been collected at Lennox Head and North Creek, Ballina (W.B.).

LEGUMINOSÆ.

ACACIA LONGIFOLIA, var. SOPHORÆ, F.v.M.

A remarkable form of this variety was recently collected on the sea coast at Wollongong by Miss Meares, M.A. The phyllodes were 3 inches long and over 2 broad, and exceedingly fleshy, measuring $\frac{1}{8}$ in thickness when fresh. Of course certain sea coast and desert plants exhibit a marked tendency to succulence of foliage, but the sample noted is an extreme form.

LORANTHACEÆ.

LORANTHUS BIDWILLI, Benth.

Is only recorded from Queensland as a littoral species and then only from one locality, viz., Wide Bay. In this colony it has been collected well inland, viz., at Murrumbo (R.T.B.) for the first time for this colony.

COMPOSITÆ.

PODOLEPIS LONGIPEDATA, A. Cunn.

New localities for this species are:—Mt. Kosciusko (W.B.), Mt. Victoria and Thirlmere (J.H.M.) with *P. acuminata*.

ASCLEPIADEÆ.

MARSDENIA FRASERI, Benth.

This common climber around Moreton Bay is now found to extend to this colony, having been collected at Wardell, near Ballina, by W. Bäuerlen.

EUPHORBIACEÆ.

ACTEPHILA MOOREANA, Benth.

This species has been collected as far south as Ballina (W.B.).

Urticeæ.

Ficus Bellingeri, C. Moore.

Previously only recorded from Bellinger River. Has recently been collected as far north as Lismore, Richmond River (W.B.).

Liliaceæ.

Xanthorrhœa bracteata, R.Br.

Bentham was in doubt whether this species extended to Queensland, as his material was too imperfect, but it probably does occur in that colony, as it has been collected as far north as Ballina, Richmond River (W.B.), Port Jackson and Parramatta (N.S.W.) being the only previously known localities for it.

Filices.

Lindsaya cultrata, Swartz.

Is mostly known from Northern Queensland, although occasionally found in the south. The Museum collector, Mr. Bäuerlen, has sent it from Brunswick River, so that it must be also now recorded as a New South Wales species.

A BRITISH BIVALVE MOLLUSC (*CRYPTODON FLEXUOSUS*, MONT.) FOUND IN AUSTRALIA AND TASMANIA, WITH ITS DISTRIBUTION.

By John Brazier, F.L.S., C.M.Z.S.

In 1874, while dredging for the Macleay Museum off Port Stephens, I obtained a number of odd and broken valves of a Lamellibranch. A number of similar valves were dredged in 1880 by a party from the Australian Museum, also off Port Stephens; these are referred to as *Cryptodon*, sp.nov., in my list of the Mollusca then obtained [*vide* Australian Museum Report for 1881]. Still more recently I have received on loan from Miss Mary Lodder, a specimen of the same species dredged at Port Esperance, South Tasmania. Careful examination has convinced me that all the above examples are referable to Montague's *Cryptodon flexuosus*, the species evidently being cosmopolitan. Following is the synonymy:—

Cryptodon flexuosus, Montague.

Tellina flexuosa, Montague, Testacea Brittanica, p. 72, 1803.

Venus sinuosa, Donovan, Nat. Hist. British Shells, ii. pl. 42, fig. 2, 1804.

Tellina flexuosa, Maton and Rackett, Trans. Linn. Soc. viii. p. 56, No. 16, 1807; Wood's General Conch. p. 188, pl. 47, figs. 7-8, 1815; Dillwyn's Descrip. Catal. Recent Shells, i. p. 99, 1817; *T. flexuosa?* Maton; Lam., Anim. sans Vert., v. p. 543, 1818.

Amphidesma flexuosa, Lam., *loc. cit.* v. p. 492, No. 9, 1818.

Lucina sinuata, Lam., *loc. cit.* v. p. 543, No. 16, 1818.

Thyasira flexuosa, Leach; Lam., *loc. cit.* v. p. 492, 1818.

Tellina flexuosa, Turton's Conch. Dictionary of the British Islands, p. 177, 1819.

Cryptodon flexuosa, Turton, Conch. Dith. Ins. Brit. p. 121, pl. 7, figs. 9-10, 1822.

Amphidesma flexuosa, Dubois, Epitome of Lamarck's Arrangement of Testacea, p. 50, 1824.

Lucina sinuata, Dubois, *loc. cit.* p. 61, 1824.

Tellina flexuosa, Woods Ind. Test. pl. 4, fig. 78, 1825.

Lucina flexuosa, Fleming, Hist. Brit. Anim. p. 442, 1828; Gould, Report Invert. of Massachusetts, pl. 71, fig. 52, 1841.

Thiatyra flexuosa, Sowb., Conch. Man. 2nd Ed. p. 274, 1842.

Lucina sinuata, Hanley, Cat. Recent Bivalve Shells, p. 77, 1843.

Lucina sinuosa, Thorpe, British Marine Conch. p. 74, 1844.

Cryptodon flexuosus, Macgillivray, History Mollusc. Anim. Scotland, p. 278, 1844.

Amphidesma flexuosum, Catlow and Reeve, Conch. Nomenclator, p. 17, No. 13, 1845.

Lucina sinuata, Catlow and Reeve, *loc. cit.* p. 27, No. 26, 1845.

Axinus flexuosus, Lovén, Ind. Moll. Scand. p. 38, No. 281, 1846.

Lucina flexuosa, Forbes and Hanley, Brit. Moll. ii. p. 54, pl. 35, 1848.

Cryptodon flexuosa, Turton, Conch. Dith. Ins. Brit. 2nd Ed. p. 121, pl. 7. figs. 9-10, 1848.

Thyatira flexuosa, Gray, List Brit. Anim. in Coll. Brit. Mus. Part vii. Moll. Acep. and Brachiop. p. 100, No. 1, 1851.

Lucina (Cryptodon) flexuosa, Woodward, Man. Moll. Part ii. p. 293, pl. 19, fig. 7, 1854.

Lucina flexuosa, Hanley in Wood's Ind. Test. No. ii. p. 28, pl. 4, fig. 78, 1855.

Cryptodon flexuosa, H. and A. Adams, Gen. Recent Moll. ii. p. 470, 1857.

Lucina flexuosa, Reeve, Conch. Icon. vi. pl. 11, fig. 62; Sowb., Illus. Ind. British Shells, pl. v. fig. 15, 1859.

Cryptodon flexuosus, Chenu, Man. de Conch. Part ii. p. 121, fig. 583, 1862.

Axinus flexuosus, Jeffreys, Brit. Conch. ii. p. 247; v. p. 179, pl. 33, fig. 1, 1863-69: Petit, Cat. des Mollusq. Test. des Mers d' Europe, pp. 41, 189, 1869; Brown, Moll. Firth of Clyde, p. 19, 1878; Norman, Journ. Conch. ii. pp. 18-43, No. 55, 1879; Jeffreys, Proc. Zool. Soc. p. 701, 1881.

Cryptodon flexuosus, Tryon, Struct. and Syst. Conch. iii. p. 211, pl. 119, fig. 4, 1884; Smith, Report Lamellibranch. H.M.S. "Challenger," Zoology, xiii. p. 192, 1885; Norman, Ann. Mag. Nat. Hist. Series 6, xii. p. 365, No. 137, 1893.

Hab.—Off Aberdeen, Scotland (*Prof. Macgillivray*); Rothesay Bay, Scotland (*Mr. A. Brown*); Iceland (*Verkrüzen*); Spitzbergen (*Torell*); Massachusetts (*Gould*); Norway (*Lovén*); Spain, Mogador and Canary Islands (*McAndrew*); Mediterranean and Ægean Seas (*Prof. Forbes*); Spitzbergen, Siberian Coasts, Iceland and Greenland to the Archipelago and Adriatic, Mogador, Canaries, Azores, Queen-Charlotte Islands, West Coast of North America and Korea (*Dr. Gwyn Jeffreys*): opposite Bernestangen Oster Fiord off Eide, Trondhjem and Rödberg (*Rev. Canon Norman*); Station 75, off Fayal, Azores (*H.M.S. Challenger*); one mile north-east of Cabbage-Tree Island, off Port Stephens, N.S.W., 25-30-40 fathoms, mud and sandy mud bottom (*Brazier*, 22nd *November*, 1874): north of Cabbage-Tree Island, opposite the entrance to Port Stephens, 24 fathoms (*Excursion Party, Australian Museum, November*, 1880, *vide Brazier's Official Report*, 1881); Port Esperance, South Tasmania (*Miss M. Lodder*).

The three well-known varieties, *rotunda*, *polygona*, and *sarsii*, are found off the New South Wales coast.

ROSSITERIA, A NEW SUBGENUS OF THE FAMILY *TROCHIDÆ*.

By John Brazier, F.L.S., C.M.Z.S.

Dr. Paul Fischer in his Monograph, Genre Troque, in Kiener's Coquilles Vivantes, Paris, 1880, p. 417, placed the *Trochus nucleus*, Philippi, in a new subgenus under the name of *Solanderia*, and defined its characters in the Manuel de Conchyl., p. 824. The name *Solanderia* is already in use in another branch of Zoology, given by Duchassaing and Michelotti in 1846, in the Class Cœlenterata. I therefore propose to replace Dr. Fischer's *Solanderia* by a new name, *Rossiteria*.

Rossiteria, Brazier, 1894.

Umbilicus narrow, columella arcuate, obliquely plicate, terminating in a strong anterior tooth. *Trochus nucleus*, Philippi.

Gibbula (Rossiteria) nuclea, Philippi.

Trochus nucleus, Philippi, Zeitschr. f. Mal. p. 171, 1849; Conch. Cab. p. 306, pl. 44, fig. 3; Fischer, Coq. Viv. p. 256, pl. 86, fig. 2, 1880.

Monilea (*Solanderia*) *nuclea*, Pilsbry, in Tryon's Man. Conch. Vol. xi. pp. 256-257, pl. 61, figs. 31, 32, 1889.

Hab.—Noumea Harbour, New Caledonia, from low water under stones down to 8 fathoms among dead coral and stones, somewhat common all round the New Caledonian Coast, Japan (*Pilsbry*); Fiji or Viti Islands (*Captain Garrett*); Bird Island and Wreck Reef, Coral Sea, outside the great Australian Barrier Reef (*Brazier*, 1855, 1856); Darnley Island, Torres Straits, sandy mud and shells 30 fathoms (*Brazier*).

In washing some dredgings for Bryzoa I came across one single specimen of this species from sandy mud obtained during the Chevert Expedition; the specimen is very much smaller than those found at New Caledonia and Bird Island, and differs in marking from a very dark green with maculations.

NOTES ON SOME LAND PLANARIANS COLLECTED BY THOS. STEEL, ESQ., F.C.S., IN THE BLUE MOUNTAINS, N.S.W.

By Arthur Dendy, D.Sc., F.L.S., Professor of Biology in the Canterbury College, University of New Zealand.

The specimens upon which the present notes are founded were collected for me by Mr. Thos. Steel at Blackheath and Wentworth Falls, and were sent to me partly alive and partly in spirit, together with notes on the living animals. I wish to express my most sincere thanks to Mr. Steel for the great amount of time and trouble which he has expended in obtaining the specimens, which I particularly desired for the purpose of comparison with the Victorian species. In all nine species were obtained, of which seven are known to be represented in Victoria by identical or slightly varietal forms. Of the two remaining one has been found in Tasmania (*G. variegata*), and has therefore probably as yet simply escaped observation in Victoria, while the other (*R. moseleyi*) is represented in Victoria by a closely allied if not specifically identical form (*R. simulans*). The most interesting forms in the collection are varieties of *Rhynchodemus victoriæ* and *Geoplana fletcheri*, which seem worthy of varietal names, while a variety of the Victorian *G. quadrangulata* is also abundant. None of these three species have hitherto been recorded from New South Wales. The remaining six species are already more or less well known in New South Wales from the writings of the late Professor Moseley and Messrs. Fletcher and Hamilton.

I have at length ventured to revise the nomenclature of the common and widely distributed *Geoplana sanguinea*, which has been described under a different name by nearly every writer who has dealt with it. The reasons for this confusion lie in its variability in colour, the absence of definite markings, and the poorness of the original description.

GEOPLANA SANGUINEA, Moseley, sp.

Cœnoplana sanguinea, Moseley, Quart. Journ. Micr. Sci. Vol. xvii. N.S. p. 285; *Rhynchodemus testaceus*, Hutton, Trans. N.Z. Inst. Vol. xii. p. 277; *Geoplana sanguinea*, Fletcher and Hamilton, Proc. Linn. Soc. N.S.W. Ser. 2, Vol. ii. p. 363; *Geoplana rubicunda*, Fletcher and Hamilton, *loc. cit.* p. 370; *Geoplana alba*, Dendy, Trans. R.S. Victoria, Vol. ii. Part 1, p. 75, &c.

Mr. Steel obtained many specimens of this much-named species from Blackheath and also found it at Wentworth Falls. The specimens differ in no wise from those common in Victoria and also found in New Zealand, the usual colour being rich Indian red all over the dorsal surface and nearly white ventrally.

GEOPLANA CŒRULEA, Moseley, sp.

Cœnoplana cœrulea, Moseley, Quart. Journ. Micr. Sci. Vol. xvii. N.S. p. 285.

I received specimens of this common species alive from Blackheath and in spirit from Wentworth Falls. The living specimens had the usual narrow yellow stripe and pink tip, and the latter feature is still shown by those preserved in spirit. All the specimens showed an ill-defined paler streak of the ground colour towards each margin of the dorsal surface, which I believe to be commonly present in the species.

GEOPLANA SULPHUREA, F. & H.

Geoplana sulphureus, Fletcher and Hamilton, Proc. Linn. Soc. N.S.W. Ser. 2, Vol. ii. p. 365.

Numerous typical examples of this species were sent to me from Blackheath. The ground colour was yellow, with four nearly black stripes on the dorsal surface, the outer pair being much broader than the inner. The yellow ground colour appeared paler between the stripes than on the sides and ventral surface and came out very freely in spirit. The specimens were all much smaller than is usually the case with the closely related Victorian species (or variety) *G. hoggii.*

GEOPLANA QUINQUELINEATA, F. & H.

Geoplana quinquelineata, Fletcher and Hamilton, Proc. Linn. Soc. N.S.W. Ser. 2, Vol. ii. p. 366.

I received several typical specimens of this widely distributed species both from Wentworth Falls and Blackheath. In life the ground colour was yellow, with five narrow brown stripes.

GEOPLANA VARIEGATA, F. & H.

Geoplana variegata, Fletcher and Hamilton, Proc. Linn. Soc. N.S.W. Ser. 2, Vol. ii. p. 364.

This beautiful and well-characterised species was found both at Wentworth Falls and Blackheath, and I received numerous specimens both alive and in spirit. The prevailing tint of the markings was brown on a yellow ground.

GEOPLANA FLETCHERI, var. BOREALIS nov.

Geoplana fletcheri, Dendy, Trans. Roy. Soc. Vic. Vol. ii. Part 1, p. 78, &c., &c.

This is a very handsome and well-marked variety, almost worthy of a distinct specific name except for the known variability of the species.* It is characterised (1) by the entire absence of speckles from the yellow ground colour, except just along the margins, (2) by the presence of three very intense and bold, sharply defined black stripes, a median very narrow one and a pair of broad ones each half way between the median one and the margin.

There are six specimens, collected at Blackheath, and all exactly alike in markings except as regards the amount of the brown marginal speckling. In the peculiar shape of the body,

* *Vide* Dendy, Proc. R.S. Vic. 1893, p. 186, Pl. x. where a number of the pattern varieties are figured.

which is convex ventrally in spirit and usually broader behind than in front, and in the characteristic posterior position of the genital aperture, this variety agrees closely with the typical form of the species.

The species has not hitherto been recorded from New South Wales.

GEOPLANA QUADRANGULATA, Dendy, var.

Geoplana quadrangulata, Dendy, Trans. R.S. Victoria, Vol. ii. Part 1, p. 77, &c.

A considerable number of specimens of this species were sent to me from Blackheath. They differ from the type of the species as originally figured in the more speckled character of the dorsal and lateral surfaces, the greater breadth of the median dorsal black stripe, and the concentration of the speckles towards the margins of the dorsal surface to form a pair of more or less well-defined, narrow dark stripes. The dorsal surface in spirit specimens is also more convex than in the typical form, and the section therefore less markedly quadrangular. They closely resemble my *G. quadrangulata* var. *wellingtoni*, from Mount Wellington, Gippsland, Victoria, but attain a much larger size, one specimen being 46 mm. long when crawling. They also form an interesting connecting link between the typical *G. quadrangulata* and the common New Zealand species which I have named *subquadrangulata*, and which is distinguished chiefly by the much stronger development of the paired stripes, far surpassing that of the median one.

As suggested to me by Mr. Steel, the specimens collected by him also make a near approach to Messrs. Fletcher and Hamilton's description of their *Geoplana ornata*, but they certainly differ much in appearance from their figure.

RHYNCHODEMUS MOSELEYI, F. & H.

Rhynchodemus moseleyi, Fletcher and Hamilton, Proc. Linn. Soc. N.S.W. Ser. 2, Vol. ii. p. 371.

With considerable hesitation I refer to this species two small specimens described as follows by Mr. Steel :—"Length of largest specimen when crawling about 40 mm., breadth 1 to $1\frac{1}{2}$ mm. Ventral surface uniform light ashy grey. Dorsal surface uniform black. No stripes on either surface. Eyes two, usual position, conspicuous. Same specimen in spirit, length 38 mm., breadth 3 mm." To this I may add that in spirit the peripharyngeal aperture in one specimen is situate near the hinder end of the middle third, and the genital aperture rather nearer to the posterior end than to the peripharyngeal. Another specimen in spirit shows a distinct median longitudinal stripe of darker tint on the dorsal surface.

Obviously the specimens approach more nearly Messrs. Fletcher and Hamilton's *R. obscurus* than to their *R. moseleyi*, but I am forced to the conclusion that the distinction between most of the described Australian species of *Rhynchodemus* is too slight to be maintained, and that the first name, *R. moseleyi*, will probably have to cover at any rate *R. obscurus*, *R. trilineatus* and *R. niger* of Messrs. Fletcher and Hamilton, and perhaps also my own Victorian *R. simulans*.

The localities of Mr. Steel's specimens are Blackheath and Wentworth Falls.

RHYNCHODEMUS VICTORIÆ, var. STEELII, nov.

Rhynchodemus victoriæ, Dendy, Trans. R.S. Victoria, 1890, p. 79.

When crawling about 35 mm. long and 1·5 mm. broad. Eyes two as usual, very near the anterior end, in the broad bands of dark ground colour and therefore difficult to distinguish.

Ground colour of dorsal surface ashy black, with three pairs of very narrow stripes of pinkish white, arranged as follows:—One pair encloses a narrow median band of ground colour of about the same width as themselves. Outside these on each side comes a broad band of ground colour extending nearly to the margin; then another narrow stripe of pinkish white like the preceding; then a band of ground colour about twice as broad as the white stripe; then another narrow pinkish white stripe as before, and then, on the margin, a narrow band of dark ground colour not very much wider than the pinkish white stripes. The ground colour of the ventral surface is ashy grey with three stripes of pinkish white, a median one of moderate width and a marginal one on each side of little more than half the width. The intervening band of ground colour on each side is only a little wider than the median white stripe.

In living specimens all the light stripes are very clear and distinct, and persistent to both extremities. In spirit they lose their pinkish tint but remain plainly visible.

In spirit the body is long and narrow, convex above and flattened below, rounded in front and much more pointed behind, about 24 mm. in length by 2·5 mm. in greatest breadth. The peripharyngeal aperture is situated a little behind the middle of the ventral surface and the genital aperture a little nearer to it than to the posterior extremity. The pharynx, as exserted in spirit, is narrow and cylindrical.

I received from Mr. Steel four well-preserved specimens of this worm collected under logs at Wentworth Falls, together with his notes on the living animal. He also sent me two specimens in spirit from Blackheath, which he thought might be Messrs. Fletcher and Hamilton's *Rhynchodemus coxii*. It appears to me certain, however, that one at any rate of these belongs to *R. victoriæ*, var. Moreover Mr. Fletcher informed me some years ago that *Rhynchodemus coxii* is really a *Geoplana*.

This new variety bears a close resemblance to the type of *R victoriæ*, from Croajingolong, which I described in 1890 from a single specimen only.* It differs from it, however, in the presence of an additional pair of narrow white stripes on the dorsal surface.

I have much pleasure in associating the name of the discoverer with this new variety, as a slight recognition of the valuable assistance which he has repeatedly rendered me in my investigations on the Cryptozoic Fauna of Australia.

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* The Victorian Land Planarians. Trans. R.S. Victoria, 1890, p. 79.

A REVIEW OF THE FOSSIL JAWS OF THE *MACROPODIDÆ* IN THE QUEENSLAND MUSEUM.

By C. W. De Vis, M.A.

(*Abstract.*)

The very fine collection of over eleven hundred dissociated jaws or portions of jaws in the Queensland Museum has been studied in the light of a knowledge of the nature and range of the variations, individual and specific, presented by the skulls of 479 individuals referable to sixteen existing species. The following species are described as new:—*Palorchestes parvus*, *Sthenurus pales*, *S. oreas*, *Halmaturus vinceus*, *H. thor*, *H. dryas*, *H. odin*, *H. indra*, *H. siva*, *H. vishnu*, *Macropus magister*, *M. pan*, and *M. faunus*.

This paper, with illustrations, will appear in the next Part of the Proceedings.

ON A NEW SPECIES OF ENTEROPNEUSTA (*PTYCHODERA AUSTRALIENSIS*) FROM THE COAST OF NEW SOUTH WALES.

By James P. Hill, Demonstrator of Biology, University of Sydney.

(*Abstract.*)

The name *Ptychodera australiensis* is proposed for the first described Australian species of Enteropneusta. It is like other species of the genus, littoral in its habits, and occurs in considerable abundance at certain points along the coast of New South Wales.

Individuals vary very much in size; the largest specimen found measured when fully extended over 25 cm. in length, but the majority are very much smaller. The two sexes can readily be distinguished from each other by the different colouration of the sexual glands. In the males the testes are of a very deep yellow, or in some cases of an orange colour; while in the females the ovaries are of a light yellow or almost whitish colour. In both sexes the proboscis is of a light yellow colour, the collar of a slightly deeper yellow, while the tail region is almost colourless.

The species is especially characterised externally by the great development of the genital wings, which completely hide the gill area and extend far into the hepatic region, and by the presence of two longitudinal epidermal stripes extending over the anterior two-thirds of the tail region, and overlying the two ciliated bands of the intestine. The liver sacs present a distinctly paired arrangement in two longitudinal rows. The number of sacs averages between 40 and 50 on each side, but there may be as many as 60.

In the mode of formation of the proboscis pore *Pt. australiensis* appears to be the most variable of all Enteropneusts hitherto described. In the majority of the individuals examined the pore

occupies a median position, and then it may be formed in three ways: (1) from the union of both dorsal proboscis pockets into a single proboscis canal; (2) from the left pocket alone forming the canal; (3) from the right pocket alone. Then again the pore may be single and on the right side of the median line, or median and double.

The notochord (Eicheldarm) of this species does not essentially differ from that of *Pt. minuta* as described by Spengel. It possesses a distinct lumen extending to within a short distance of the apex; and opening into the lumen are numerous secretory cells.

An interesting feature is presented by the ventral wall of the heart-bladder. It is infolded into the cavity of the bladder forming a tube free anteriorly and communicating with the central blood space by a narrow longitudinal slit. This is regarded as a special modification to insure the better performance of the propelling function of the ventral wall of the heart-bladder.

The nerve cord of the collar essentially resembles that of *Pt. minuta.* As in that species a central lumen is absent. The "cord hollows" are, however, not so numerous as in that species. Two lateral longitudinal rows of such hollows are present, while smaller less regularly arranged hollows may be present mesially.

The "roots" vary in number from 1-4. The gonads are much branched, and in the genital region proper there are in connection with each genital pore at least six lesser branches.

As in the majority of the species of the genus two ciliated bands are present in the intestine. They extend forward for a considerable distance into the genital region proper.

The most interesting point in connection with the vascular system is the presence of a well-marked vessel which passes in the "chondroid" tissue occupying the space between the anterior portion of the "keel" of the proboscis skeleton and the posterior portion of the "end plate," and connects the two efferent proboscis vessels.

This paper, with illustrations, will appear in the next Part of the Proceedings.

ON A PLATYPUS EMBRYO FROM THE INTRA-UTERINE EGG.

By J. P. Hill, Demonstrator of Biology, and C. J. Martin, M.B., B.Sc. (Lond.), Demonstrator of Physiology, in the University of Sydney.

(*Abstract.*)

The paper is based on the examination of two embryos taken from eggs just ready to be laid. The eggs, both exactly of the same size, measured 18 by 13·5 mm., being somewhat larger than those described by Caldwell.

The embryo was found lying on the surface of a thin-walled vesicle with its long axis corresponding to the long axis of the egg. It measured 19 mm. in length from the anterior end of the medullary plate to the posterior end of the primitive streak. The vesicle on which the embryo lay consisted of two layers all over, an outer layer of cubical ectoderm cells, and an inner layer of large cells occupied almost entirely by yolk spheres—vitelline-entoderm cells. Between the ectoderm and the vitelline-entoderm the mesoderm extends round from a quarter to one-half of the circumference of the vesicle in the posterior region of the embryo. The vesicle completely filled up the interior of the shell, and contained a thin albuminous fluid. From the relatively very early great lateral extension of the mesoderm, and from the presence of a very distinct yolk-containing entoderm the vesicle of the Platypus embryo of this stage is regarded as transitional between the yolk-sac of Sauropsida and the typical mammalian blastodermic vesicle.

The embryo, with the exception of a slight head-fold, is quite flat. Medullary folds are absent except in the anterior region of the future fore-brain, where slight lateral upgrowths of the medullary plate appear. The appearance of medullary folds in this region is probably to be associated with the very early appearance of the optic grooves.

In the head region the cerebral vesicles are indicated by widening of the medullary plate. In the region of the hind-brain there are four pairs of well-marked neuromeres, and in the anterior region of the mid-brain a single pair of neuromeres, much less distinct than those of the hind-brain. Opposite the 2nd and 3rd neuromeres there exists on each side an extensive auditory plate already slightly grooved.

There are 17 pairs of somites which in the middle region of the trunk possess distinct cavities. Just external to the outer edges of the somites (with the exception of the first three) and between them and the lateral zone of mesoderm there occurs a narrow intermediate zone containing the Anlage of the Wolffian body. From the 7th somite posteriorly the Anlage of the Wolffian duct is free from the Anlage of the tubules. At its posterior end the Anlage of the Wolffian duct becomes reduced to a single cell which passes directly over into the ectoderm.

Double heart Anlagen are present, situated in greater part opposite the hind-brain region. No trace of a vascular area was visible in the fresh condition, though in the hardened blastoderm developing vessels are indicated by a mottling both in and around the amniotic area.

A distinct blastopore is present. It leads into the blastoporic canal which runs forward in the head process of the primitive streak and opens into the cavity of the vesicle.

The primitive streak extends behind the blastopore to a distance of 1·5 mm. The embryo more nearly resembles that of the Virginian Opossum (*Didelphys*) of 73 hours, described by Selenka, than any other embryo known to the authors. The Platypus embryo is, however, much longer. The marked retardation in the formation of the medullary folds and in the folding of the embryo is one of the most characteristic features of the embryo at this stage. This may be due to the mechanical effect of the rapid imbibition by the ovum of nutritive fluid secreted by the uterine glands.

This paper, with illustrations, will appear in the next Part of the Proceedings.

NOTES AND EXHIBITS.

Messrs. Maiden and Baker exhibited the plants referred to in their paper.

Mr. Maiden exhibited on behalf of the Forest Department specimens of the handsome bright red fruits of *Hicksbeachia pinnatifolia*, F. v. M., (Proteaceæ), from the Tweed River, the seeds of which are edible.

Mr. A. Sidney Olliff sent for exhibition a number of specimens of a species of *Psylla* from Jarrahdale, W. Australia, which makes elongate, semi-transparent, horny, larval coverings, or tests, on the foliage of the Flooded Gum (*Eucalyptus rudis*, Endl.). In structure and habits the species is closely related to *Psylla eucalypti*, Dobs., recorded from Tasmania; and economically it is of importance as it sometimes occurs in such numbers as to cause serious injury to its food-plant, a useful West Australian timber. The insect was collected by Messrs. W. Paterson and A. Despeissis, and it is proposed by Mr. Olliff to call it *Psylla periculosa*.

Mr. Edgar R. Waite exhibited specimens of the snake *Aspidites ramsayi* described in his paper; a Golden Perch, *Ctenolates ambiguus*, Richardson, attacked by a fungus, *Saprolegnia ferax*, causing the so-called Salmon disease; and a small Mullet, *Mugil dobula*, Gunther, from the head of which a small seaweed was growing. It would appear as though the fish had sustained some damage in this part, as the scales are absent, and that the alga had rooted itself in the flesh.

Mr. Froggatt showed a remarkable branched fungus growing out of the mouth of a shell (*Helix poma*), from Port Darwin, possibly vegetating on the remains of the animal.

Mr. A. G. Hamilton sent for exhibition a specimen of *Phascologale minutissima*, Gould, from Mt. Kembla, N.S.W., the species having previously came under his notice at Guntawang, near Mudgee. Thus it is without doubt a member of the New

South Wales mammalian fauna. The distribution given in the B.M. Catalogue of Marsupialia and Monotremata (1888), is "Central and Southern Queensland" and "Clarence River, Moreton Bay."

Mr. Steel exhibited specimens of eight species of Land Planarians in illustration of Dr. Dendy's paper.

Messrs. Hardy and J. A. Despeissis exhibited a fur cloak, a bone pin used for fastening the same, a broad flat form of womerah made of jarrah wood, and a knife made from a piece of glass fixed on a cylindrical wooden handle, all obtained from an aboriginal tribe living in the neighbourhood of Lake Muir in the S.W. corner of West Australia, about 100 miles inland from Cape Leeuwin. Mr. Despeissis, who procured the specimens, also gave the following particulars about the habits of the natives, and the native names of the objects exhibited:—

"The cloak they call *Bwoucka;* the spear-thrower, made from jarrah wood, *Meerā;* the spear, *Kidgee:* the boomerang, *Gārlee*; a male aboriginal, *Nimgar;* a female aboriginal, *Yoack*. The tribe consisted of about a dozen men, eight or nine females, one or two children, and one halfcaste. The southern part of the colony is in the winter very cold and wet; so some sort of clothing is a necessity. Kangaroos, however, are plentiful. The *bwoucka* is made from the skins of "joeys" or young kangaroos. The fur is carried inside, and the hide is made soft and pliable by rubbing with kangaroo fat and then hung up in the smoke of fire made with the trunks of the Grass-tree ("Black-boys" or *Xanthorrhœa*). In the evening the natives stand by the fire-side with their cloaks on, a piece of stick about twelve inches long put in the hollow of the sternum, the other end against the cloak, which is then stretched out a little or some distance from the body; in the hands they take a few chips of black-boy wood which burns like matches, being very resinous; these they light and hold close up to their naked body under the cloak, which they thus warm nicely."

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Names in Italics are Synonyms.

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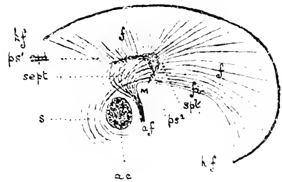

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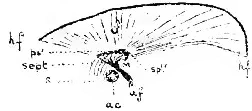

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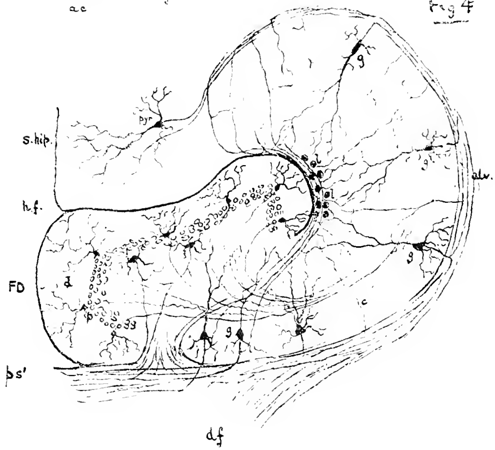

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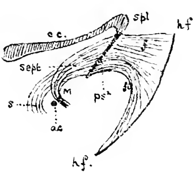

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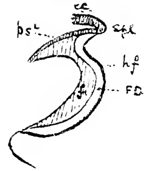

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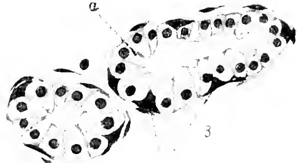

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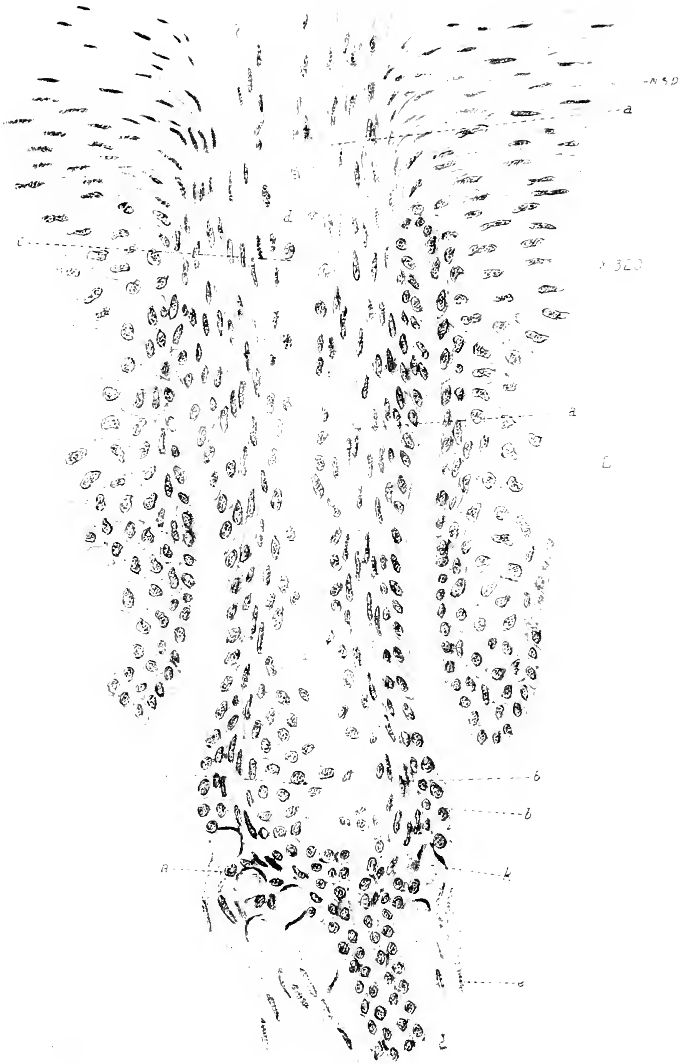
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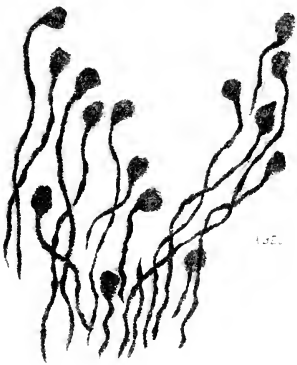

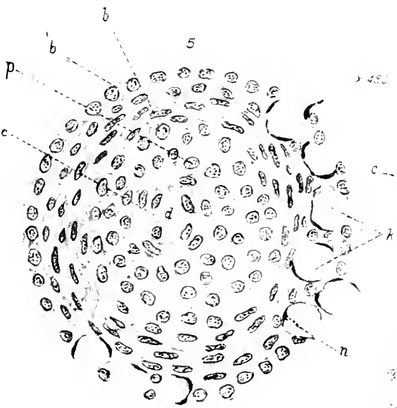

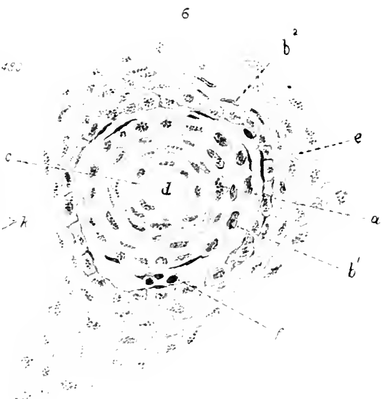

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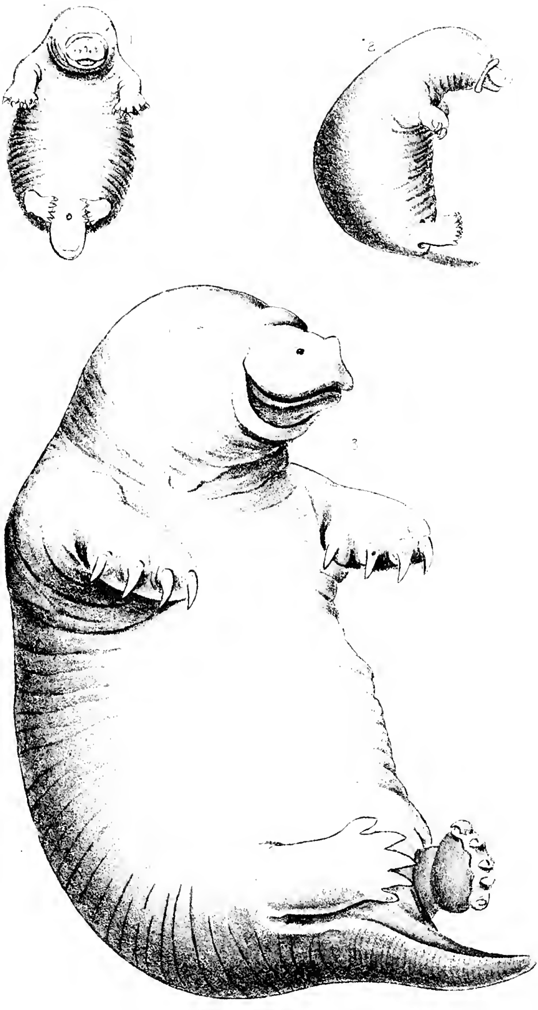

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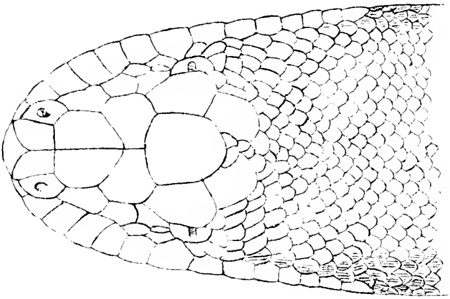

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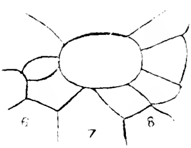

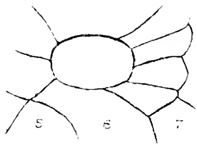

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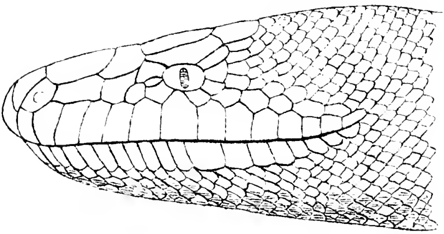

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ASPIDITES RAMSAYI, Macleay.

Issued September 4, 1894.

THE

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OF

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