

tractile, so that the movements of the region will affect these channels, especially as the stroma is lax. Towards the commencement of the lateral nerve-cords, the vascular trunks are found at their inner borders, and in some sections more than one trunk occurs on each side at the commencement. The hypoderm and basement-tissue of the snout are largely developed, the basement-tissue especially being massive in the œsophageal region, where it is more bulky than the circular muscular coat within it. So far as can be observed in sections of the anterior region of the proboscis, the nerves (elastic layer, M'I.) are at least 14 in number*. The cerebral organs are in front of the ganglia, and the gut-pouches do not come forward to the brain, the succeeding region, as in *A. lactiflorens*, being occupied by the thick-walled œsophageal section of the alimentary apparatus.

EXPLANATION OF THE PLATES.

PLATE II.

- Fig. 1.* Lateral view of the very young *Phycis blennoides*. Enlarged.
Fig. 2. Ventral view of the foregoing. Similarly enlarged. The expansions of the ventral fins are indicated towards the tip. The straight line indicates the natural size of the example.
Fig. 3. Restoration of the parts at the fork of the *Cerebratulus* from Naples, by Mr. R. C. Punnett, M.A. (Cantab.). $\times 15$ diams.
circ.m., circular muscular fibres; *d.b.v.*, dorsal longitudinal vessel; *i.l.m.*, inner longitudinal muscular fibres; *i.n.c.*, inner nerve-cords; *l.b.v.*, lateral blood-vessel; *n.c.*, outer nerve-cords (ordinary); *o.l.m.*, outer longitudinal muscular layer; *o.n.c.*, outer nerve-cord of bifid region; *rh.c.*, proboscis-sheath.

PLATE III.

- Fig. 1.* Bifid *Cerebratulus angulatus*, sent by Dr. C. H. Williamson from Aberdeen Bay. The left side shows the ventral aspect with the mouth in front, whilst the bifid tail is viewed from the dorsum. About natural size.
Fig. 2. Bifid *Cerebratulus "marginatus"* from Naples. The figure (which is inverted) is copied from a water-colour by Mr. R. C. Punnett.

VIII.—*On the Generic Arrangement of the Australian Rats hitherto referred to Conilurus, with Remarks on the Structure and Evolution of their Molar Cusps.* By OLDFIELD THOMAS.

IN connection with the working out of some Australian Muridæ recently received by the British Museum through the generosity of Sir William Ingram and the Hon. John

* These were best seen in sections of the proboscis by Dr. Tosh.

Forrest, I have had occasion to examine the generic position of the little rat I described in 1889 * as "*Mus*" *argurus*, and, for comparison with that, of all the species hitherto referred to the group of the Jerboa Rats—*Conilurus*.

Without much inquiry into their dental structure, all the Australian long-eared rats were placed by earlier writers in the genus "*Hapalotis*," which was founded by Lichtenstein on the species *H. albipes*. The name, however, being pre-occupied, was rightly superseded by J. D. Ogilby, in 1892 †, in favour of that of *Conilurus*, W. Ogilby, founded on the same well-known species.

In 1898 Mr. Waite, of the Sydney Museum, observing the striking peculiarity of the feet of *Conilurus longicaudatus* and other allied species, separated off the jerboa-footed forms under the name of *Podanomalus*, while he gave to another jerboa-footed form, *C. cervinus*, the generic name of *Thylacomys*, which, being preoccupied, he afterwards altered to *Ascopharynx*.

But in doing so Mr. Waite did not notice that Lesson had already given the name of *Notomys* to the "*Dipus Mitchelli*" of Ogilby, one of the jerboa-footed species, and therefore *Podanomalus* becomes a synonym of *Notomys*. Moreover, as *cervinus* agrees both in dental and pedal structure with *Mitchelli* and *longicaudatus*, I am not at present prepared to consider its possession of a gular pouch as a character of generic importance, and should therefore also place *Ascopharynx* as a synonym of *Notomys*.

But it has not been hitherto noticed that, besides the difference in foot-structure that separates *Notomys* from all the other jerboa rats, there are found in the group two quite different types of molar teeth, the differences being similar to those which separate *Micromys* from *Mus*, but even more distinct and sharply defined.

For while, as shown in Mr. Waite's figures, the species of *Notomys* and both *Conilurus apicalis* and *murinus* have the same number of molar cusps as *Mus*, *C. albipes*, *penicillatus*, *hirsutus*, and certain other species have those described in my "*Mus*" *argurus*, i. e. three inner cusps to both m^1 and m^2 , a postero-internal cusp being present which is absent in *Mus*. This type of tooth was figured in my paper on *Mus argurus*, and proves to be so constant throughout a number of species that it should clearly be considered as of generic importance. The resemblance of the teeth of *Mus argurus* to those of

* Ann. & Mag. Nat. Hist. (6) iii. p. 433 (1889).

† Cat. Austr. Mamm. p. 113 (1892).

Conilurus hirsutus was noted when I described the former, but I did not then carry the investigations as far as I should have done.

By this character, then, *Conilurus apicalis* and *murinus* are at once separable from all the other rat-footed members of the group, and are brought into the neighbourhood of true *Mus*, to which, through *M. lineolatus*, they are very closely allied.

Indeed it might be thought that they should actually be referred to *Mus*; but as it is an advantage to separate from that protean genus as many species as possible, I would consider the long ears of these two species as indicating generic distinction (as has always hitherto been done), and would propose for them the special name of *Leporillus*.

Then among the species with three internal cusps to the molars I find two types of skull-structure. In one group, consisting of *Conilurus albipes* and *penicillatus*, the skull is highly modified in shape, as has been described by previous writers, while in the other, to which the species *hirsutus*, *macrurus*, *pedunculatus*, and *argurus* belong, it is very much as in ordinary rats. For this latter group I would suggest the name of *Ammomys*.

These conclusions may be tabulated as follows:—

I. NOTOMYS.

Type.

<i>Notomys</i> , Less. N. Tabl. R. A., Mamm. p. 129 (1842)	<i>N. Mitchelli</i> , Ogilb.
<i>Podanomalus</i> , Waite, Proc. Roy. Soc. Vic- toria, x. p. 117 (1898)	<i>N. longicaudatus</i> , Gould.
<i>Thylacomys</i> , Waite, t. c. p. 121 (1898) (nec Blyth, 1841)	<i>N. cervinus</i> , Gould.
<i>Ascopharynx</i> , Waite, Ann. & Mag. Nat. Hist. (7) v. p. 223 (1900)	<i>N. cervinus</i> , Gould.

Teeth practically as in *Mus*; no postero-internal cusp on the molars, along the inner edge of whose series there are therefore only 6–7 cusps. Skull considerably modified; anterior edge of zygoma-root deeply concave. Hind feet lengthened, their pads reduced in number to three or four, usually three.

Species: *N. Mitchelli*, *cervinus*, *longicaudatus*, and *Richardsoni*.

II. LEPORILLUS.

Genus novum Type: *C. apicalis*, Gould.

Molars, as in *Conilurus*, without postero-internal cusps.

Skull very much as in *Mus lineolatus*. Hind feet normal, with the usual six pads.

Species: *C. apicalis* and *murinus*.

The gradation of this genus, from *C. apicalis*, through *C. murinus*, *Mus lineolatus*, and *Mus Higginsi*, into true *Mus*, affords an interesting study in evolution. Whether the *Mus lineolatus* group should not also be subgenerically separated from the ordinary species of *Mus* is a question which may have to be considered later.

III. AMMOMYS.

Genus novum Type: *A. hirsutus*, Gould.

Teeth as figured in *Mus argurus*; a distinct and well-defined postero-internal cusp on each molar, so that along the inner edge of the full molar series there are 8-9 cusps. Skull rat-like in general form, a well-developed coronoid process on the mandible. Hind feet normal, with six pads. Mammæ, so far as known, 0-2=4.

Species: *A. hirsutus*, *macrurus*, *pedunculatus*, and *argurus*.

IV. CONILURUS.

Type.

Hapalotis, Licht. Darst. Säug. text to pl. xxix.

(1829) (nec Hübner, 1816) *C. albipes*, Licht.

Conilurus, Ogilb. Tr. Linn. Soc. xviii. p. 124 (1838). *C. albipes*, Licht.

Teeth and foot-structure as in *Ammomys*. Skull highly modified, broad, flattened, the interorbital region concave, the palatal foramina enlarged, and the mandibular coronoid process and incisive capsule reduced or absent.

Species: *C. albipes* and *penicillatus*.

Of the other species described as members of this group, *arboricola*, Krefft, is a *Mus rattus*; *personatus*, Krefft, also probably belongs to *Mus*; and *caudimaculata*, Krefft, and *papuanus*, Ramsay, to *Uromys*.

With regard to the development and evolution of the additional postero-internal cusp on the molars, Dr. Winge, our greatest authority on the subject, when treating* of its presence in *Micromys*, has considered that it is a new development, the two original internal cusps (numbered by him on his general scheme "6" and "7") having been pushed forward

* "Græske Pattedyr," Vid. Medd. For. Copenhagen, 1881, p. 17 (under "*Mus mystacinus*"), and 1882, pl. iii. fig. 10.

to form the present antero-internal and median internal cusps. However this latter point may be—and even after having had the advantage of discussion with Mr. Knud Andersen over Dr. Winge's theories I still find it difficult to believe—I certainly think the postero-internal cusp cannot be explained as he supposes. He would call it 5 *c*, on the ground that it represents an off-splitting of the inner corner of the main central posterior cusp "5" of the tooth as found in typical *Mus*, and is therefore of very recent origin. But if we consider the distribution of the forms which possess it, scattered as they are about the Old World—*Micromys* in the Palæarctic region, "*Mus*" *arborarius* and *rutilans* in Africa, *Crateromys* and *Lenomys* in the Philippines and Celebes, *Pogonomys* and *Hyomys* in New Guinea,—it seems impossible to believe that these forms have all in widely separated localities independently developed exactly the same structure from a type, as I suppose, so advanced and certainly so dominant as *Mus*. It would rather appear natural to suppose that (even if a later growth as compared with the very primitive Cricetine series of Muridæ) it is an early development within the true Murinæ, occurring here and there in the group, and has then been reduced in some forms and lost in others, among which latter would be the dominant and highly developed genus *Mus*.

Dr. Winge has shown himself such a genius in disentangling the complicated homologies of molar cusps that it is with much diffidence that I put forward this modification of his views about this postero-internal cusp, which, for purposes of discussion and not to prejudge the question, might be called the *x* cusp. I would only recall that nearly all the forms in which it occurs have been either discovered or had their tooth-structure described since he wrote his work on the subject, and that he therefore had *Micromys* alone to examine, and was without the opportunity of considering the very important argument from distribution and occurrence in otherwise widely separated forms which I have now ventured to bring forward.

That many of the small additional cusps found in such multicuspid Muridæ as *Leggada*, *Chiruromys*, and others are recent supplementary additions, as Dr. Winge supposes, I would freely admit; but I do not think this to be the case with the interesting *x* cusp, which is in Australia the diagnostic mark of *Ammomys* and *Conilurus*.



Thomas, Oldfield. 1906. "On the generic arrangement of the Australian rats hitherto referred to *Conilurus*, with remarks on the structure and evolution of their molar cusps." *The Annals and magazine of natural history; zoology, botany, and geology* 17, 81–85.

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