

W. K. Gregory

NOTES ON THE PORCUPINES OF THE MALAY  
PENINSULA AND ARCHIPELAGO

BY

MARCUS WARD LYON, JR.

Assistant Curator, Division of Mammals, U. S. National Museum

No. 1552.—From the Proceedings of the United States National Museum,  
Vol. XXXII, pages 575-594, with Plates LIV-LVII

Published June 29, 1907



Washington  
Government Printing Office  
1907



15

# NOTES ON THE PORCUPINES OF THE MALAY PENINSULA AND ARCHIPELAGO

BY

MARCUS WARD LYON, JR.

Assistant Curator, Division of Mammals, U. S. National Museum

No. 1552.—From the Proceedings of the United States National Museum,  
Vol. XXXII, pages 575-594, with Plates LIV-LVII

Published June 29, 1907



Washington  
Government Printing Office  
1907



## NOTES ON THE PORCUPINES OF THE MALAY PENINSULA AND ARCHIPELAGO.

By MARCUS WARD LYON, Jr.,

*Assistant Curator, Division Mammals, U. S. National Museum*

The following notes are of a preliminary nature only, and are written with the idea of bringing together in one place a consideration of the systematic names of the Malayan porcupines and the characters by which these animals are arranged into natural groups, both of which considerations are at present scattered through various publications. The main features brought out in this paper are the division of the Old World porcupines into two subfamilies; the revival of Cuvier's name *Acanthion* as a genus for the short-tailed Malayan porcupines; the revival of Linnaeus's name *Hystrix brachyura* as the proper specific designation of the short-tailed porcupine of the Malay Peninsula; the description of a new genus and species of short-tailed porcupine collected in northern Sumatra by Dr. W. L. Abbott in 1906; and the description of a new species of *Atherurus* from Pulo Terutau, off the west coast of the Malay Peninsula. The presence of two distinct genera of long-tailed porcupines in the Malayan region caused considerable confusion in the use of names by the older writers, but Jentink,<sup>a</sup> in 1894, clearly pointed out the true status of these groups. Seba was well acquainted with three of the four genera of Old World porcupines that have been recognized up to the present time, and it was largely from his descriptions and plates that Linnaeus in the tenth edition of the *Systema Naturae* based three names of the Old World porcupines, which at that time were regarded as so many distinct species and not as distinct generic types as they have since been considered.

It is to be regretted that more examples of the typical genus *Hystrix* have not been available in the preparation of these notes for determining the true status of the genus, *Acanthion*, which has usually been

<sup>a</sup> Notes Leyden Museum, XVI, 1894, p. 205.

considered synonymous with part of *Hystrix*. However, the material at hand shows very considerable differences between *Hystrix* proper and *Acanthion*, which will be pointed out further on. With regard to some of the species in the various genera of Malayan porcupines, I have not seen a sufficient number of specimens to determine the characters satisfactorily. Where several forms of one group, each form occupying a definite and isolated geographic area, have been named I have made use of the names bestowed upon them even if their specific characters are not clear, believing this plan better than to place them under one specific name, for material is as lacking to show their identity as it is to show their distinctness.

The list of works to which reference has been made in preparing these notes will be found under the synonymy of the different species or referred to in footnotes. The specimens on which these notes are based are listed in the table of measurements, page 593. They represent forty individuals from Malaya, thirty-three skins with skulls, two odd skulls, and five skeletons. All but three of these specimens were collected by Dr. W. L. Abbott, and have been presented by him to the U. S. National Museum.

KEY TO THE GENERA OF MALAYAN PORCUPINES.

- a* Tail short, less than one-fourth length of head and body; caudal hairs terminating mostly in hollow capsule-like structures, molars rootless, sacral vertebrae four ..... Subfamily HYSTRICINÆ, p. 578
- b* Dorsal profile of skull arched, nasals extending back to level of lacrymals, and contained into dorsal outline two and one-half times..... *Acanthion*, p. 578
- bb* Dorsal profile of skull nearly straight, nasals extending back to level of anterior border of infraorbital foramen, contained into dorsal outline three and one-half times..... *Thecurus*, p. 582
- aa* Tail long, one-third to one-half length of head and body, terminating in a tuft of modified bristles, molars rooted, sacral vertebrae three.  
..... Subfamily ATHERURINÆ, p. 584
- c* Each caudal scale subtended by three hairs, terminal bristles alternately expanded and contracted ..... *Atherurus*, p. 584
- cc* Each caudal scale subtended by a single hair, terminal bristles of uniform width throughout ..... *Trichys*, p. 588

*Tabular view of the principal external and cranial characters of the genera of Old World porcupines.*

Characters.	<i>Hystrix</i> .	<i>Acanthion</i> .	<i>Thecurus</i> .	<i>Atherurus</i> .	<i>Trichys</i> .
Tail short, less than one-fourth head and body.....	×	×	×	×	×
Tail longer, one-third to one-half head and body.....				×	
Tail longer, one-half head and body.....					×
Caudal hairs terminating mostly in a hollow, open, capsule-like structure four to five times longer than wide.....	×	×			
Caudal hairs terminating mostly in a hollow, open or closed capsule-like structure three times longer than wide.....			×	×	
Caudal hairs, flattened bristles alternately expanded and contracted.....				×	
Caudal hairs, flattened bristles of uniform width throughout.....					×

*Tabular view of the principal external and cranial characters of the genera of Old World porcupines—Continued.*

Characters.	<i>Hystrix.</i>	<i>Acanthion.</i>	<i>Therurus.</i>	<i>Atherurus.</i>	<i>Trichys.</i>
A mane or crest of long bristles on nape and upper back .....	×				
Nape and upper back mainly covered with flattened, grooved spines.....	×	×	×	×	×
Long quills (150 to 300 mm.), dark, with light rings, on lower back .....	×	×			
Long quills (130 mm.), dark, with light base and apex and grooved flattened spines on lower back.....			×		
No quills in pelage, all grooved flattened spines, a few long stiff bristles on lower back.....				×	×
Width of a single nasal contained in its length less than three times.....	×				
Width of a single nasal contained in its length about four times.....		×	×	×	×
Nasals extend backward on upper surface of skull as far back as squamosal roots of zygomatic, contained in dorsal outline one and one-half times.....	×				
Nasals mainly confined to rostrum, back only to level of lacrymal, contained into dorsal outline two and one-half times.....		×			
Nasals confined to rostrum, back to anterior margin of infraorbital foramen contained into dorsal outline three and one-half times.....			×	×	×
Malar thin but relatively very broad, without groove on lateral face.....	×	×	×	×	
Malar thick but relatively narrow, with well-marked groove on lateral face.....					×
Inferior bar of infraorbital foramen slender.....	×	×	×		
Inferior bar of infraorbital foramen heavy.....				×	×
Outer bar of infraorbital foramen heavy.....	×	×			
Outer bar of infraorbital foramen slender.....			×		×
Zygomatic process of maxilla forming only a very slight support for malar.....	×	×	×	×	
Zygomatic process of maxilla forming a well-marked backward support for malar.....					×
No interorbital constriction.....	×	×			
Interorbital constriction slightly indicated.....			×		
Evident, but slight interorbital constriction.....				×	
Well-marked interorbital constriction.....					×
A depression on top of skull at meeting of sagittal and coronal sutures at a level posterior to squamosal roots of zygomatic.....	×				
No depression on top of skull at meeting of sagittal and coronal sutures which meet on line with squamosal roots of zygomatic.....		×	×	×	×
Supero-posterior lateral aspect of maxilla angular.....	×				
Supero-posterior lateral aspect of maxilla rounded.....		×	×	×	×
Basal-occipito-sphenoid scarcely narrowed between pterygoids.....	×	×		×	
Basal-occipito-sphenoid much narrowed between pterygoids.....			×		×
Well-marked fossa on outside of mandible just beneath condylo-coronoid notch.....				×	×
No well-marked fossa on outside of mandible just beneath condylo-coronoid notch.....	×	×	×		
Number of dorsal vertebrae.....		14	14	14	16
Number of lumbar vertebrae <sup>a</sup> .....		5	5	5	5
Number of sacral vertebrae <sup>a</sup> .....		4	4	3	3
Number of caudal vertebrae <sup>a</sup> .....		15	17	24	25
Neural spine of axis large and much compressed laterally.....		×		×	×
Neural spine of axis much smaller, tri-prismatic in form.....			×		
Seventh cervical with a neural spine 2 to 3 times the length of the spine of the sixth.....		×			
Seventh cervical with a neural spine no longer than that of sixth.....			×	×	×
Number of sternal segments.....		7	7	6	7
Molars rootless, hypsidont.....	×	×	×		
Molars rooted, brachydont.....				×	×

<sup>a</sup>Apparently there is some variation in the number of vertebrae, especially lumbar, sacral, and caudal. See Cederblom, Zool. Jahrb., XI, 1897-98, p. 499.

## Subfamily HYSTRICINÆ.

The subfamily Hystricinae is characterized among the Hystricidae by having a short external tail, without a well-marked hairless scaly portion between its base and apex, in having the terminal hairs of the tail modified into hollow capsule-like structures, mostly open at the ends, in the possession of well-developed quills on the back, in having four sacral vertebrae, and rootless, hypsodont molars. It contains three genera: *Hystrix* (not considered in these notes, because not found in the Malayan subregion), *Acanthion*, page 578, and *Thoeurus*, page 582.

## ACANTHION F. Cuvier.

1822. *Acanthion* F. Cuvier, Mem. Mus. Hist. Nat. Paris, IX, 1822, p. 413, pl. xx bis, figs. 3, 4.

*Type*.—*Acanthion javanicum*, from Java.

*Species*.—*Acanthion brachyurum* (Linnaeus), Malay Peninsula; *A. longicaudum* (Marsden), Sumatra; *A. javanicum* F. Cuvier, Java; *A. crassispinis* (Günther), Borneo.

*Diagnostic characters*.—Externally similar to *Hystrix*, but without a crest or mane and quills not so long. Cranially it differs in having much smaller nasals, extending back only as far as on a level with the lachrymal bones, and contained into the dorsal outline two and one-half times, instead of extending as far back as the squamosal roots of the zygomata and contained into the dorsal outline one and one-half times, as in *Hystrix*. No depression on upper surface of skull at the union of sagittal and coronal sutures. Molars rootless.

*External characters*.—Size large; head and body about 600 to 700 mm.; tail short, about one-fifth length of head and body. Upper surface of head clothed with stiff, rounded, bristly hairs, those on the nape considerably elongated, but not forming the well-defined mane or crest found in *Hystrix*. Upper half of back and shoulders covered with flattened spines, usually each with dorsal and sometimes ventral grooves. About the middle of the back these spines replaced by large heavy quills, light in color, with a single dark band near the middle or toward the basal side of the middle. The quills vary in length from 50 to 250 mm., and are longest toward the middle of the back, becoming quite short near the rump, where, however, they are still quills and bear no resemblance to the flattened spines found on the upper half of the back. On the base of the tail the quills become longer again. The distal portion of the tail is clothed with peculiar hairs. (Plate LVII, fig. 1.) The basal portion of each (10 to 15 mm.) is quite hair-like, but it abruptly expands out into a hollow cylinder, like an elongated capsule, about 5 mm. wide and about four to five times as long. Nearly always the ends of these capsule-like hairs are open, but rarely the sides of the capsule are prolonged to meet in a



pointed apex. The sides of head, the under parts, and the legs are in general covered with soft flattened spines similar to those in the upper back, but shorter and not so stiff.

*Skeleton*.—The main features of the skull of the genus *Acanthion* have previously been pointed out. The relative size and shape of the skull and of its various parts are clearly shown in fig. 5, Plates LIV, LV, and LVI, so that no detailed description is necessary here. The vertebral formula is Cy. 7, D. 14, L. 5, S. 4, Cd. about 15. The axis bears a large rectangular neural spine, projecting backward as a thin plate of bone, laterally compressed. (Plate LVII, fig. 11.) The seventh cervical bears a long pointed neural spine, about three times the length of the neural spine in front of it, and about half the size of the first dorsal spine. The lumbar vertebrae have large rectangular lateral processes, directed forward. (Plate LVII, fig. 12.) The first and half of the second sacral vertebrae serve for the attachment of the ilia. The presternum is relatively long, and its expanded part relatively narrow. The limb bones are relatively short and heavy, the scapulae wide.

#### ACANTHION BRACHYURUM (Linnæus).

1758. [*Hystrix*] *brachyura* LINNÆUS, Systema Naturæ, I, 10th ed., p. 57. Based on SEBA, Rerum Nat. Thesaur., I, p. 81, pl. LI, fig. 1, from Java, Sumatra, and from Malacca. In view of Seba's name *Hystrix malaccensis* and his especial reference to its locality as Malacca, that country may properly be considered the type-locality.

1866. *Acanthochorus groti* GRAY, Proc. Zool. Soc. London, 1866, p. 310, pl. XXXI. Type-locality: Malacca. (See Proc. Zool. Soc. London, 1866, p. 417.)

1871. *Hystrix longicauda*, SCLATER, Proc. Zool. Soc. London, 1871, p. 234.

1900. *Hystrix longicauda*, FLOWER, Proc. Zool. Soc. London, 1900, p. 364.

1903. *Hystrix groti*, BONHOPE, Fasc. Malay. Zool., I, July, 1903, p. 39, pl. III.

*Distribution*.—Malay Peninsula.

*Diagnostic characters*.—Apparently the largest of the Malayan species. Greatest length of skull, 135 to 150 mm.

*Color*.—Upper half of back, top of head, underparts, and legs and feet, an indefinite blackish brown or brownish black; a dirty white or dirty buff patch on throat, partly extended upward and backward along the side of neck. This is followed by a blackish brown collar and this in turn by a lighter collar, but this latter is not always well marked. The quills are dirty white or dirty buff in color, each with a band of blackish brown 20 to 30 mm. wide at or below the middle.

*Skull*.—The only peculiarity of the skull of this species apparently is its large size, total length of an old adult being 150 mm. and of a young adult about 140 mm.

*Measurements*.—See table, page 593.

*Specimens examined*.—One old female from Champang, Tenasserim; two adults and two young from Trong, Lower Siam.

## ACANTHION LONGICAUDUM (Marsden).

1810. *Hystrix longicauda* MARSDEN, History of Sumatra, 3d ed., 1811, p. 118, name only, without description, and pl. XIII n. l. with legend: "The Landak, *Hystrix longicauda*. Published by W. Marsden 1810." Type-locality: Sumatra.
1871. *Hystrix mülleri* MARSHALL, Proc. Zool. Soc. London, 1871, p. 235, footnote. Type-locality: "Padang-bessie (Sumatra)." See Jentink, notes Leyden Museum, I, 1879, p. 91.
1879. *Hystrix mülleri* JENTINK, Notes Leyden Museum, I, 1879, p. 89.
1888. *Acanthion mülleri*, JENTINK, Cat. Syst. Mammifères, Mus. Hist. Nat. Paysbas, XII, p. 104.
1905. *Hystrix longicauda*, WILLINK, Natuurkundig Tijdschrift Nederlandsch-Indië, LXV, p. 265.
1905. *Hystrix longicauda*, SCHNEIDER, Zool. Jahrb., Syst. Geogr. Biol., XXIII, p. 113.

*Distribution*.—Sumatra.

*Diagnostic characters*.—Similar to *Acanthion brachyurum*, but apparently slightly smaller; with less conspicuous throat collars.

*Color*.—As in *A. brachyurum*, but in the single available specimen the light throat collar very poorly defined and the sides of body are lighter in color, owing to the spines having lighter bases than in *A. brachyurum*.

*Skull*.—Evidently smaller than that of *A. brachyurum*. Jentink<sup>a</sup> gives the total length of the skull of an old male as 135 mm. The skull of a young male in the U. S. National Museum measures 103 mm. total length, against 110 mm. total length in a skull of the same age, as judged by the teeth, from the Malay Peninsula.

*Measurements*.—See table, page 593.

*Specimens examined*.—One, a young male, from Aru Bay, Sumatra.

*Remarks*.—Jentink<sup>b</sup> records *Acanthion mülleri* and *Acanthion javanicum* from Sumatra, Tanjong Morawa. No description of them is given, but it is to be supposed that they differ, as pointed out by Jentink<sup>a</sup> in 1879, mainly in size—in which case there are two distinct forms of *Acanthion* in Sumatra. That Jentink did not have a specimen of *Thecurus*, is evident from the fact that the smaller of his species, *A. javanicum*, has a skull length of 118 mm., while the skull length of *Thecurus* is scarcely more than 100 mm.

## ACANTHION JAVANICUM F. Cuvier.

1822. *A[canthion] javanicum* F. CUVIER, Mem. Mus. Hist. Nat. Paris, IX, 1822, p. 431, pl. xx bis, figs. 3, 4. Type-locality: Java.
1836. *Hystrix torquata* VAN DER HOEVEN and DE VRIESE, Tijdschrift Natuur. Geschied. en Physiol., III, 1836, p. 110.
1844. *H[ystrix] brevispinosa* WAGNER, Supplementband Schrebers Säugethiere, IV, p. 20.

<sup>a</sup> Notes Leyden Museum, I, 1879, p. 91.

<sup>b</sup> Idem, XI, 1889, p. 28.

- 1839-64. *H[ystrix] javanicum*, BLAINVILLE, Osteog. Mamm., IV, pl. II.  
 1848. *Hystrix javanica*, WATERHOUSE, Nat. Hist. Mamm., II, p. 465, pl. XX, fig. 4.  
 1854. *Acanthion javanicum*, GERVAIS, Hist. Nat. Mamm., p. 332.  
 1866. *Acanthion javanicum*, GRAY, Proc. Zool. Soc. London, 1866, p. 310.  
 1871. *Hystrix javanica*, MARSHALL, Proc. Zool. Soc. London, 1871, p. 235, footnote.  
 1879. *H[ystrix] javanica*, JENTINK, Notes Leyden Museum, I, 1879, pp. 87, 88.  
 1888. *Acanthion javanicum*, JENTINK, Cat. Syst. Mammifères Mus. Hist. Nat. Pays-bas, XII, p. 103.  
 1905. *Hystrix javanica*, WILLINK, Natuurkundig Nederlandsch-Indië, LXV, p. 266.

*Distribution.*—Java.

*Remarks.*—I have seen no specimens of this species. There is a skeleton of an old individual in the National Museum, labeled "*Hystrix javanica*; Java." It was purchased from a dealer several years ago, and probably labeled "Java" because it had been identified as *Hystrix javanica*. The total length of the skull measures 135 mm. It is distinctly smaller than skulls of like age from the Malay Peninsula, but at the same time much larger than the 118 mm. given by Jentink<sup>a</sup> as the total length of a Javan *Acanthion* skull.

• **ACANTHION CRASSISPINIS** (Günther).

1876. *Hystrix crassispinis* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 736, fig. 1, p. 737; fig. 1a, p. 738; pl. LXX.  
 1893. *Hystrix crassispinis*, HOSE, Mammals of Borneo, p. 60.  
 1905. *Hystrix crassispinis*, WILLINK, Natuurkundig Tijdschrift Nederlandsch-Indië, LXV, p. 266.

*Distribution.*—Borneo.

*Diagnostic characters.*—Size small; skull, total length 110 mm. Spines thick, equal twice the diameter of an incisor, longitudinally grooved on their upper surfaces.

*Remarks.*—I have seen no specimens of this species, but Günther's original description shows that it is a well-marked form. His plate would indicate that it is a lighter (brownier) colored animal than either *Acanthion brachyurum* or *longicaudum*. His measurements show it to be a smaller animal than *A. javanicum*.

In *Mammals of Borneo*,<sup>b</sup> Hose records *Hystrix mülleri* Jentink, also from Borneo, saying: "This porcupine is like *Hystrix crassispinis*, but distinguished from it by its black belly and somewhat different caudal quills. The skull also differs, but the size of the animals are much the same." In all probability *A. crassispinis* has a dark belly, although there is nothing in the original description to show that the belly is light or dark. It is thus impossible to say how Hose's second species of short-tailed porcupines from Borneo differs from *Acanthion*

<sup>a</sup> Notes Leyden Museum, I, 1879, p. 91.

<sup>b</sup> Page 60.

*crassispinis*. It is possible that two or more species of the genus *Acanthion* are found on Borneo; but at present there is nothing in the literature to show this fact satisfactorily or to indicate what their characters are.

#### THECURUS, new genus.

*Family*.—Hystricidae, subfamily Hystricinae.

*Type*.—*Thecurus sumatrarum*, new species. (Description on page 583.)

*Species*.—The type species is the only known one in the genus so far as known.

*Diagnostic characters*.—Externally like a small *Acanthion*, but capsule-like ends of caudal hairs, smaller and relatively shorter, often closed at the ends (Plate LVII, fig. 2), quills smaller, and replaced on lower rump by grooved spines similar to those on upper back. Cranially very similar to the genus *Atherurus*, but brain-case relatively wider, rostrum narrower, and no well-marked fossa on outer side of mandible just beneath condylo-coronoid notch; molars rootless.

*External characters*.—About half the size of *Acanthion*, to which it has a striking resemblance, but it has no bristly hairs on the head or neck, but merely soft, flattened spines. The flattened spines extend farther down the back than they do in *Acanthion* and are more conspicuously grooved, and they are also found on the lower back and rump instead of the short quills of *Acanthion*. The large heavy quills occupy about the third fourth of the back. They are much less numerous and shorter than those of *Acanthion*, the largest not exceeding 150 mm. These quills are dark in color, with a light base and apex. A very few long stiff bristles are interspersed among the quills. Some short quills are found on the base of the tail, while the terminal portion of that organ is covered with peculiar modified hairs, but the capsules are relatively much shorter and a great many more of them are closed at the apex—drawn out to a point. (Plate LVII, fig. 2.) The sides of the head, the underparts, and the legs, are in general clothed with rather soft, flattened, grooved spines.

*Skeleton*.—The main features of the skull of the genus *Thecurus* have previously been pointed out. The relative size and shape of the skull and its various parts are clearly shown in fig. 1, Plates LIV, LV, and LVI, so that no detailed description is here necessary. The vertebral formula is: Cv. 7, D. 14, L. 5, S. 4, Cd. 17. Although the skeleton of *Thecurus* as a whole, aside from the skull, is in general strikingly like that of *Acanthion*, yet in one or two points it is quite different. Instead of having a large, laterally compressed neural spine on the axis, that vertebra bears a relatively short, tri-prismatic spine, not compressed laterally any more than it is antero-posteriorly. (Plate LVII, fig. 9.) The seventh cervical vertebra in *Thecurus* has no long neural spine. The long neural spine on the seventh cervical seen in *Acan-*

*thion* has been shifted backward in *Thecurus* and is found on the first dorsal vertebra; the very long neural spine on the first dorsal of *Acanthion* occurs on the second dorsal in *Thecurus*. The lumbar vertebra (Plate LVII, fig. 10) in *Thecurus* have large rectangular lateral processes, directed anteriorly much as in *Acanthion*, but the processes are rather more slender. The first and one-half of the second sacral vertebrae serve for the attachment of the ilia. The presternum is relatively shorter in *Thecurus* than in *Acanthion* and the expanded part is relatively wider. The limb bones are relatively short and heavy, proportioned as they are in *Acanthion*, but the anteriorly projecting "knee" at about the middle of the tibia is more pronounced. The scapula is somewhat wider, in proportion to size, in *Thecurus* than in *Acanthion*. It is almost identical in size and shape to the scapula of *Atherurus*.

THECURUS SUMATRÆ, new species.

*Type*.—Skin and skull of adult male, Cat. No. 143432, U.S.N.M., collected at Aru Bay, east coast of Sumatra, January 17, 1906, by Dr. W. L. Abbott. Original No. 4637.

*Distribution*.—Known only from the vicinity of Aru Bay, Sumatra.

*Diagnostic characters*.—The same as given for the genus above.

*Color*.—General color on top of head and anterior half of back, much like a dark drab of Ridgway, specked, especially on top of neck and toward the sides with the dirty white tips of the spines. Sides of head and neck and underparts drab, conspicuously specked with the dirty white tips of the spines. Under side of neck dirty white or cream-buff, crossed by a drab collar 25 to 30 mm. wide. The feet and legs are darkened almost to Ridgway's seal brown. The quills are blackish, with dirty whitish tips of 20 to 25 mm. Spines on the lower back blackish with short (about 5 mm.) light-colored tips.

*Skull and teeth*.—The characters of the skull have already been described. The skulls as a whole show a great deal of individual variation in respect to size, comparative width of skull, and length of nasals. (See table of measurements, p. 593.) The teeth show equal variation in size, No. 143434 having the length of upper toothrow 19.5 mm. and No. 143435, with teeth worn to the same extent, 17.2 mm. Wear produces very striking effects on the teeth; reentrant angles seen in the young and in the young adults are entirely lost in old individuals, and judging by the teeth alone one might easily consider young and aged adults to belong to different genera.

*Measurements*.—External measurements. (See table, p. 593.) Cranial measurements of the type: Basal length, 92.3 mm.; basilar length, 85; condylo-basal length, 99.4; greatest length, 108; upper length, 103.7; palatal length, 51.3; zygomatic breadth, 56; distance between outer margins of external auditory meatus, 42.8; interorbital constrict-

tion, 31.8; greatest length of nasal, 29.6; width of both nasals together, 15; maxillary toothrow (alveoli), 19.3; mandibular toothrow (alveoli), 19.5.

*Specimens examined.*—Nine skins with skulls, one odd skull, and one skeleton, all from Aru Bay, east coast of Sumatra.

*Remarks.*—*Thecurus sumatrarum* is a very distinct form of porcupine and apparently bears little resemblance to other described genera or species. Externally it closely resembles a small *Acanthion*, while cranially it has so many points in common with *Atherurus* that there are almost no characters, aside from rootless molars, by which the two may be generically separated. In many respects it is an intermediate link between *Acanthion* and *Atherurus*.

In 1879<sup>a</sup> Doctor Günther described a small porcupine from the island of Paragua, Philippine Islands, under the name of *Hystrix pumila*. I have seen no specimens of this species nor any figures of it, but the original description and the detailed measurements given lead me to believe that *Hystrix pumila* is closely related to *Thecurus sumatrarum* and may possibly be a second species of that genus. Whatever the relationship, Doctor Günther's measurements indicate that *Hystrix pumila* is a distinctly smaller animal than *Thecurus sumatrarum*.

#### Subfamily ATHERURINÆ.

The subfamily Atherurine is distinguished among the Hytriciidæ in the possession of a rather long external tail, with a well-marked scaly portion between its base and apex, which is terminated by a long tuft of modified hairs or bristles; in not having well-developed quills on the back, but merely stiff grooved spines; in having three sacral vertebrae and rooted, brachydont molars. It contains two genera: *Atherurus*, page 584, and *Trichys*, page 588.

#### ATHERURUS F. Cuvier.

1829. *Atherurus* F. CUVIER, Diet. Sci. Nat., LIX, p. 483.

*Type.*—*Hystrix macroura* Linnaeus, from Malacca.<sup>b</sup>

*Species.*—(In Malayan region) *Atherurus macrourus* (Linnaeus), from Malacca; *A. zygomaticus* Miller, from Pulo Aor; and *A. terutaus*, new (page 587) Pulo Terutau.

*Diagnostic characters.*—A small sized porcupine, without quills, with a large scaly tail, each scale subtended by three hairs, and terminated by a tuft of bristles, mostly flattened and alternately contracted and expanded one to five times. (Plate LVII, fig. 3.) Skull

<sup>a</sup>Ann. Mag. Nat. Hist., IV, 1879, p. 106.

<sup>b</sup>See Jentink, Notes Leyden Museum, XVI, 1894, p. 207, Lyon, Proc. Biol. Soc. Washington, XIX, December 31, 1906, p. 199, and Thomas, Proc. Biol. Soc. Washington, XX, p. 66, June 12, 1907.

in many respects like that of *Thecurus*, but relatively narrower and with less abrupt rostrum, and with a well marked fossa on side of mandible beneath the condylo-coronoid notch and with rooted molars. Differs from the skull of *Trichys* in the absence of postorbital processes, and in having distinctly heavier malars.

*External characters.*—Size small, a little less than that of *Thecurus*, tail long, about one third head and body. Entire upper parts and sides of body and base of tail covered with heavy, somewhat flattened spines, with a large groove on their dorsal aspect, and a shallow groove on their underside at the base. The spines are longest on the lower back, rump, and base of tail where they are about 75 mm. long. No quills proper are found on this porcupine, but interspersed among the flattened, grooved spines on the lower back are a few rounded stiff bristles, somewhat quill-like at the base, having a length of 100 to 125 mm. The head, underparts, and the legs, are clothed with soft, flat spines. The basal fourth of the tail is covered with spines, like those of the lower back; the middle two-fourths are covered with scales, each of which is subtended by three short hairs, a median stiff, long one, with a shorter finer one on either side; the terminal fourth of the tail is mainly covered with peculiar flattened hollow hairs and some ordinary bristles. Each of these peculiar hairs begins with a hair-like base, but soon expands into a small, narrow, hollow, flattened capsule, followed by a short hair-like space and then another flat, hollow capsule, some hairs having as many as five such expansions. These hairs always terminate in an expansion with a long drawn-out apex. (Plate LVII, fig. 3.)

*Skeleton.*—The main features of the skull of the genus *Atherurus* have previously been pointed out. The relative size and shape of the skull and of its various parts are clearly shown in fig. 2, Plates LIV, LV, and LVI, so that no detailed description is here necessary. The vertebral formula is Cv. 7, D. 14, L. 5, S. 3, Cd. 24. The axis bears a large neural spine flattened from side to side, similar to that found in *Acanthion*, but subtriangular in outline and directed backward at a sharper angle. (Plate LVII, fig. 7.) The seventh cervical has a short neural spine, like that of the sixth, and the long spine of the seventh seen in *Acanthion* has been shifted backward to the first dorsal, as in *Thecurus*. The lumbar vertebrae have rather narrow lateral processes, directed forward at a more acute angle than they are in the two preceding genera, and the ends of the processes are somewhat enlarged. (Plate LVII, fig. 8.) Only three vertebrae compose the sacrum in *Atherurus*, and the first alone serves for the attachment of the ilia. The presternum is relatively short, and its expanded portion relatively narrow. The humerus is relatively more slender in *Atherurus* than it is in *Acanthion* or *Thecurus*; the deltoid ridge is less promi-

ment, and the olecranon process of the ulna is shorter. The femur, tibia, and fibula are proportioned about as they are in the two preceding genera, but the metatarsals and phalanges are relatively longer. The scapula of *Atherurus* is broad.

**ATHERURUS MACROURUS (Linnaeus).**

1758. [*Hystrix*] *macroura* LINNAEUS, Systema Naturæ, 10th ed., I, p. 57. Based on SEBA, Rerum Nat. Thesaur., I, p. 84, pl. LIH, fig. 1. Locality not known, other than East Indies.<sup>a</sup>
1801. *Hystrix macroura*, SHAW, Gen. Zool., II, Pl. 1, p. 9, pl. CXXIV.
1830. *Atherura fasciculata*, BENNETT, Gardens and Menagerie Zool. Soc. London, pp. 175-178.
- 1839-64. *H[ystric] fasciculata*, BLAINVILLE, Osteog. Mamm., IV, pl. II.
1844. *H[ystric] fasciculata*, WAGNER, Supplementband Schrebers Säugethiere, IV, p. 23.
1844. *Hystrix macroura*, WAGNER, Supplementband Schrebers Säugethiere, IV, pl. CLXX.
1848. *Atherura macroura*, WATERHOUSE, Nat. Hist. Mamm., II, p. 472.
1854. *Atherurus fasciculatus*, GERVAIS, Hist. Nat. Mamm., p. 333.
1876. *A[therura] macroura*, GÜNTHER, Proc. Zool. Soc. London, 1876, p. 742, fig. 3.
1879. *H[ystric] macroura*, JENTINK, Notes, Leyden Museum, I, 1879, p. 87.
1891. *Atherura macroura*, BLANFORD, Fauna British India, Mamm., p. 446.
1894. [*Atherura*] *macroura*, JENTINK, Notes, Leyden Museum, XVI, 1894, p. 207.
1905. *Atherura macroura*, WILLINK, Natuurkundig Tijdschrift Nederlandsch Indië, LXV, p. 267.

*Distribution.*—Malay Peninsula, Burma, and perhaps various Malayan Islands.

*Color.*—General effect of top of head, upper back, and of feet, Ridgway's drab, rather dark. The heavier spines are a blackish brown. On the sides, thighs, and underparts the spines have dull, dirty whitish bases and subterminal apical bands, with a drab or drab-gray band between them, and a very slight drab-gray apex. The chin and upper throat are particularly light, as well as an ill-defined band across the chest. The light color of the bases and of the subterminal rings of the spines show to a marked extent on the sides and underparts. The tuft of bristles at end of tail vary from dirty whitish to a dirty cream buff.

*Measurements.*—See table, page 593.

*Specimens examined.*—Four, from Trong, Lower Siam.

<sup>a</sup>Seba's figure shows an animal much less spiny than any Malayan specimens I have seen. The description of the tail does not agree with specimens of this genus in the U. S. National Museum. Seba likens the swelling on the caudal bristles to grains of rice inclosed in an envelope. In the specimen at hand each bristle, while hollow, is flat and alternately widened and contracted laterally in one plane only, and the expansions are much longer than are the enlargements shown in Seba's figure. It is barely possible that the animal usually designated as *Atherurus macrourus* (Linnaeus) is really an undescribed species. At least it would so appear if Seba's account is at all accurate.



## ATHERURUS ZYGOMATICUS Miller.

1903. *Atherura zygomatica* MILLER, Smithsonian Miscell. Coll., XLV, November 6, 1903, p. 42, pl. ii, fig. 4. Type-locality: Pulo Aor, off coast of Johore.

*Distribution*.—Known only from Pulo Aor, off coast of Johore.

*Type*.—Adult female, skin and skull, Cat. No. 112429, U.S.N.M., collected on Pulo Aor, off coast of Johore, June 6, 1901, by Dr. W. L. Abbott, Original No. 1009.

*Diagnostic characters*.—Like *Atherurus macrourus*, but color darker, and zygoma shorter and deeper, under side of malar bone with a conspicuous tooth-like process directed backward, lachrymal bone much smaller, scarcely appearing on dorsal aspect of skull.

*Color*.—Very similar to that of *Atherurus macrourus*, but slightly darker, especially along the sides, due to the light area of the spines being less in evidence.

*Skull and teeth*.—In general, the skull is very similar to that of *Atherurus macrourus* of the Malay Peninsula, but in size it is somewhat smaller and differs conspicuously in regard to the lachrymal bones and the zygomata.

In *Atherura macroura* the lachrymal is fully 8 mm. in length below the rim of the orbit, while above it extends forward as a triangle of bone at least 5 mm. long, and is a noticeable feature of the dorsal aspect of the skull. In *A. zygomatica* its length below rim of orbit is usually about 5 mm., \* \* \* while the forward extension is often obsolete and never large enough to be more than barely visible when the skull is viewed from above. Zygoma shorter than in *Atherura macroura*, the jugal deeper in proportion to its length, more abruptly concaved above, and its lower contour invariably \* \* \* broken by a strongly developed concavity beneath posterior jugal suture, this concavity terminating anteriorly on the posterior upper surface of a well-marked tooth-like projection.<sup>a</sup>

*Measurements*.—For a comparison of the cranial measurements of the type, with the type of *Atherurus terutaus* and with an adult female from Trong, Lower Siam, see page 588. For measurements of the series, see table, page 593.

*Specimens examined*.—Seven; all from Pulo Aor.

## ATHERURUS TERUTAUS, new species.

*Type*.—Skin and skull of adult male, Cat. No. 123971, U.S.N.M., collected on Pulo Terutau (also written Trotau and Trotto), about 15 geographical miles west of the Malay Peninsula, where the one hundredth meridian east of Greenwich cuts the west coast of the Malay Peninsula, April 10, 1904, by Dr. W. L. Abbott. Original No. 3223.

*Diagnostic characters*.—Like *Atherurus macrourus* of the Malay Peninsula, but smaller, with shorter tail; lachrymal bone much smaller, scarcely appearing on the dorsal aspect of the skull. It

<sup>a</sup>Miller, Smithsonian Miscell. Coll., XLV, p. 42, November 6, 1903, and especially Plate II, figs. 4 and 5, where the above characters are well shown.

resembles *A. zygomaticus* from Pulo Aor in its small lachrymal, but lacks the heavy zygoma and the step-like projection on its inferior border. Caudal bristles shorter than in either *A. macrourus* or *A. zygomaticus*, and with the single (in the other species these are usually three to five on a bristle) expansion relatively narrower and longer. The bristles, however, have a worn appearance, which might account for this difference.

*Color*.—The color of *Atherurus teritatus* so closely resembles that of *A. zygomaticus* that no detailed description is necessary.

*Skull and teeth*.—In general, similar to those of *Atherurus macrourus*, but distinctly smaller, rostrum and nasals relatively shorter, constriction between the orbits more pronounced, depression on top of skull greater; lachrymal bone much smaller, scarcely any of it appearing on the dorsal aspect of the skull; in this respect resembling the skull of *A. zygomaticus*; zygomata of the same form as in *A. macrourus*; auditory bullæ, smaller. Teeth of same form as in *A. macrourus*, but smaller.

*Measurements*.—See table, page 593. Cranial measurements of the type: Greatest length, 93.2 mm. (94.3, 99);<sup>a</sup> basal length, 82.2 (82.6, 87.4); basilar length, 76.1 (75.6, 80.5); condylo-basal length, 87.8 (89, 94.2); palatal length, 44.7 (45.5, 47.6); greatest length of nasal, 22 (25.3, 26.3); zygomatic breadth, 45.8 (45.3, 47.5); least interorbital breadth, 24.5 (26.1, 28.4); maxillary toothrow (alveoli), 15.7 (17.1, 17.2); mandibular toothrow (alveoli), 17.3 (17.9, 18.8).

*Specimens examined*.—One, the type.

*Remarks*.—Although but one specimen of *Atherurus teritatus* is known, its peculiarities are so well marked that its specific distinctness from *A. macrourus* and *A. zygomaticus* can not be doubted. It possesses the peculiar lachrymal bones of *A. zygomaticus*, but its zygomata are exactly as they are in *A. macrourus* from the mainland.

#### TRICHYS Günther.

1876. *Trichys* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 739, fig. 2; p. 740, fig. 2a, p. 741 and pl. LXXI.

*Type*.—*Trichys lipura*, from Borneo.

*Species*.—*Trichys fuscicincta* (Shaw), from Malacca; *T. lipura* Günther, from Borneo; *T. macrotis* Miller, from Sumatra.

*Diagnostic characters*.—A small porcupine externally resembling *Atherurus* but with a relatively longer tail, each scale of which is subtended by a single hair and with the brush at end of tail composed of flat, grooved bristles, with parallel sides. (Plate LVII, fig. 4.) Skull small, different from that of *Atherurus* in possessing distinct postorbital

<sup>a</sup> Measurement in parentheses are those of the type of *Atherurus zygomaticus* Miller, from Pulo Aor, and of an adult female, Cat. No. 84433, U.S.N.M., of *A. macrourus*, from Trong, Lower Siam.

processes, a more slender and pronounced rostrum, zygomata more converging anteriorly, and a heavy grooved malar of nearly uniform width throughout its length, which is subtended by a considerable backward extension of the maxillary portion of the zygoma. Molars rooted.

*Description of skin.*—Size small, somewhat less than that of *Atherurus*, tail relatively longer. Upper parts and sides of body covered with spines more flat and less stiff than in *Atherurus*, grooved both above and below, of about the same length (25 to 36 mm.) all over the back. Interspersed among them are a very few stiff bristles, about 75 mm. long. The head, underparts, and the legs are covered with softer, shorter bristles. The extreme base of the tail is covered with spines like those on the back. The greatest portion of the tail is covered with well-defined scales, each subtended by a single hair. Toward the tip the scales grow larger and the subtending hairs become longer (about 100 mm.), flat, hollow bristles of uniform width throughout their extent. (Plate LVII, fig. 4.)

*Skeleton.*—The main features of the skull of the genus *Trichys* have previously been pointed out. The relative size and shape of the skull and of its various parts are clearly shown in fig. 3, Plates LIV, LV, and LVI, so no detailed description is here necessary. The vertebral formula is: Cv. 7, D. 16, L. 5, S. 3, Cd. 25. The axis bears a large laterally-compressed neural process, strongly curved and bent backward. (Plate LVII, fig. 5.) The neural spine of the seventh cervical is short as it is in *Thecurus* and *Atherurus*. The lateral processes of the lumbar vertebrae are rather slender, curved, and directed forward, and with a somewhat pointed apex. (Plate LVII, fig. 6.) The sacrum is of form similar to that of *Atherurus*; it contains three vertebrae, and to the first of these the ilia are attached. The presternum is relatively short, and with a relatively narrow anterior expansion. The humerus and the bones of the forearm are proportioned as they are in the genus *Atherurus*. The femur is relatively more slender in *Trichys* than in the other genera, and the metatarsals and phalanges are somewhat longer than they are in the genus *Atherurus*. In *Trichys* the scapula is much narrower than in the other genera, and its anterior border is strongly rounded off.

#### TRICHYS FASCICULATA (Shaw).<sup>a</sup>

1801. *Hystrix fasciculata*, SHAW, Gen. Zool., II, Pt. 1, Mamm., p. 11, pl. cxxiv. Type-locality: Malacca.

1830. *Atherura fasciculata*, BENNETT, Gardens and Menagerie Zool. Soc. London, pp. 175-178.

<sup>a</sup>While these notes have been going through the press Mr. Oldfield Thomas (Proc. Biol. Soc. Washington, XX, p. 66, June 12, 1907) has attempted to show that *Hystrix fasciculata* Shaw, based on Buffon's *Porc-épic de Malacca*, is a synonym of *Hystrix macroura* Linnaeus. Although Mr. Thomas is probably right in his conclusion as to

- 1839-1864. *H[ystrix] macroura*, BLAINVILLE, Osteog. Mamm., IV, pl. II.  
 1841. *Acanthion macrourum*, GÉRAIS, Voyage autour du Monde sur la Bonite, pp. 60-63, Atlas, pl. XI.  
 1848. *Atherura fasciculata*, WATERHOUSE, Nat. Hist. Mamm., II, p. 470.  
 1854. *Atherurus macrourus*, GÉRAIS, Hist. Nat. Mamm., p. 333.  
 1876. *A[therura] fasciculata*, GÜNTHER, Proc. Zool. Soc. London, 1876, p. 742.  
 1879. *H[ystrix] fasciculata*, JENTINK, Notes, Leyden Museum, I, 1879, p. 87.  
 1894. *Trichys fasciculata*, JENTINK, Notes, Leyden Museum, XVI, 1894, p. 205.  
 1900. *Trichys lipura*, BONHOTE, Proc. Zool. Soc. London, 1900, p. 881.

*Distribution.*—Malay Peninsula.

*Remarks.*—I have seen no specimens of this species which has usually been considered synonymous with the Bornean *Trichys lipura*. Because of the general distinctness of mammals of the Malay Peninsula and those from Borneo, that view does not appear probable, and, both animals having been named, those names are here retained. It is possible, on the other hand, that the Sumatran *Trichys macrotis* may be very close to the Malay Peninsula animal.

#### TRICHYS LIPURA Günther.

1876. *Trichys lipura* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 730; fig. 2, p. 740; fig. 2a, p. 741; pl. LXXI. Type-locality: Borneo, opposite Island of Labuan, see p. 424 of the foregoing reference.  
 1889. *Trichys lipura*, GÜNTHER, Proc. Zool. Soc. London, 1889, p. 75.  
 1889. *Trichys guentheri* THOMAS, Proc. Zool. Soc. London, 1889, p. 235. A new name proposed for *T. lipura*, because the animal normally possesses a tail.  
 1893. *Trichys lipura*, HOSE, Mammals of Borneo, p. 61.  
 1894. *Trichys fasciculata*, JENTINK, Notes, Leyden Museum, XVI, 1894, p. 208.  
 1903. *Trichys fasciculata*, MILLER, Proc. U. S. Nat. Mus., XXVI, p. 469.  
 1905. *Trichys fasciculata*, WILINK, Natuurkundig Tijdschrift Nederlandsch-Indië, LXX, p. 267.

*Distribution.*—Borneo.

*Color.*—General color above a sort of drab-brown. The bases of the spines are whitish, which is the general color of the underparts owing to absence of drab-brown tips of the spines. On the sides the color gradually passes from the almost complete drab-brown of the upper parts to the whitish of the belly.

*Skull and teeth.*—These are well figured by Günther,<sup>a</sup> and need no detailed description here.

Buffon's *Porc-épic de Malacca*, I think he is in error in saying that the genus *Trichys* is not known in Malacca, for it seems to have been clearly recorded from the Malay Peninsula by Bonhote (Proc. Zool. Soc. London, 1900, p. 881) and by Jentink (Notes Leyden Museum, XVI, 1894, p. 207). If *Hystrix fasciculata* Shaw is a synonym of *Hystrix macroura* Linnaeus, the species of *Trichys* on the Malay Peninsula (if it is distinct from the Bornean and Sumatran animals, as is probable) has not yet received a valid name. Having seen no specimens of *Trichys* from the Malay Peninsula, I can not venture to state whether it is distinct from the two species already named or with which one it should be associated. Accordingly I have left the matter standing as originally written, but with this explanation.

<sup>a</sup>Proc. Zool. Soc. London, 1876, pp. 740 and 741.

*Measurements.*—See table, page 593.

*Specimens examined.*—Two, skin and skull of nearly adult male from Mount Salikan, Borneo, and the skeleton of an adult from British North Borneo.

#### TRICHYS MACROTIS Miller.

1903. *Trichys macrotis* MILLER, Proc. U. S. Nat. Mus., XXVI, p. 469, February 3, 1903. Type-locality: Tapanuli Bay, west coast of Sumatra.

1905. *Trichys macrotis*, WILLINK, Natuurkundig Tijdschrift Nederlandsch-Indië, LXV, p. 268.

*Distribution.*—Sumatra.

*Type.*—Skin and skull of adult female, collected at Tapanuli Bay, west coast of Sumatra, February 20, 1902, by Dr. W. L. Abbott. Original No. 1555.

*Diagnostic characters.*—Like *Trichys lipura* from Borneo, but with longer ears, more angled hamulars, and smaller lachrymal bone.

*Color.*—The color of *Trichys macrotis* differs in no way from that of *T. lipura*.

*Ears.*—The ears in *Trichys macrotis* are much longer than they are in *T. lipura*, and the tips broader and more rounded. Length of ear from meatus in the type of *T. macrotis*, 28 mm., in *T. lipura*, Cat. No. 83940, from Borneo, 18 mm.

*Skull.*—The skull closely resembles that of *Trichys lipura*, but the hamular process of the pterygoid bone has a more pronounced bend or angle on its inferior aspect, and the tip, instead of ending in a point barely in contact with the audital bulla, is considerably thickened and generally in contact with the bulla. The lachrymal bone is apparently much longer in the Bornean animal than in *T. macrotis*, although in many specimens of the latter species the sutures are so obliterated as to render it impossible to determine its exact size. Greatest length of the lachrymal bone in the two Bornean skulls, 8 and 9 mm. respectively, in four Sumatran skulls, 4 to 5.5 mm.

*Measurements.*—See table page 593.

*Specimens examined.*—Seven, 5 from Tapanuli Bay and 2 from Aru Bay, Sumatra.

#### RELATIONSHIPS OF THE FOUR GENERA OF MALAYAN PORCUPINES.

The most primitive and unrelated to the others of the Malayan porcupines is the genus *Trichys*. Externally *Trichys* and *Atherurus* are much alike, but the terminal tail bristles of *Trichys* are peculiar and bear no distinct relation to those of *Atherurus* or to the other genera. Both *Trichys* and *Atherurus* have rooted molars, while the molars in the other two genera are rootless. Osteologically *Trichys* shows many peculiarities not possessed by the other genera, such as the generalized form of the skull, large number of dorsal vertebrae and narrowed

scapulæ. Its skull and teeth show resemblances to those of *Atherurus*, and the sacra in the two genera are practically identical. *Atherurus*, although showing strong affinities to *Trichys*, appears in certain ways to be related to *Thecurus*. Most of the skeleton of *Atherurus* is much like that of *Thecurus*, the only striking difference being in the lessened number of sacral and caudal vertebræ in *Atherurus*, and in the peculiar axis of *Thecurus*, which does not resemble in any way the axis of any of the other three genera. The caudal bristles of *Atherurus* might have been derived from those of *Thecurus*, or the reverse. If the caudal bristles of *Atherurus* had but one enlargement, and that more inflated and less flattened, they would be of the type found in *Thecurus*. *Thecurus* differs from any of the other three genera by its peculiar axis. Without its skull and axis it could not be differentiated from *Acanthion*, while if only its skull were known there would be little excuse for separating it from *Atherurus*, provided no account were taken of its rootless molars. *Acanthion* is clearly closely related to *Hystrix* and less different from that genus than it is from *Thecurus*, *Atherurus*, or *Trichys*. The five genera of Old World porcupines may be arranged serially thus:

*Hystrix* \* *Acanthion* \* \* *Thecurus*—*Atherurus* \* \* \* \* *Trichys*, with the most different genera at the extremes of the line and the most closely related next to one another. A break occurs between *Thecurus* and *Atherurus* so that two subfamilies may be recognized. *Hystrix* and *Acanthion* are evidently directly and closely related to one another, and *Thecurus* is certainly much closer to them than it is to the *Atherurus-Trichys* group. Whether *Atherurus* and *Trichys* are directly related to each other or are only distantly so related through a remote ancestry is difficult to say. The two subfamilies, Hystricine and Atherurine are scarcely of equal rank, the members of the former being much more homogeneous than those of the latter. *Trichys*,<sup>a</sup> with its generalized structure is evidently the most primitive of the Hystricidæ and at the opposite end stands *Hystrix* (Plates LIV, LV, and LVI, fig. 4), the most specialized, with its peculiar much modified skull and highly developed quills.

<sup>a</sup> See Cederblom, Zool. Jahrb., XI, 1897-98, p. 513, and Winge, Jordfundne og nulevende Gnævere, Lagoa Santa, Brasilien, 1887, pp. 128, 129.

Table of external and cranial measurements of Malayan porcupines.

Name.	Locality.	Number.	Sex and age.	Head and body.	Tail.	Hind foot with claws.	Greatest length of skull.	Zygo-matic width.	Greatest length of mesals.
<i>Acanthion javanicum</i> .	Java ?	a 22974	Old	mm. b 670	mm. b 175	mm. b 95	mm. 135	mm. 68	mm. 56.4
<i>Acanthion bra-chyurum</i> .	Champang, Tenasserim.	c 124020	Female, old	d 725	d 140	e 112.5	150		
Do	Trong, Lower Siam.	e 83521	Male, adult	d 711	d 114	e 85	142.5	61	58.4
Do	do	e 83519	Female, adult	d 635	f 64	e 92	134	66.6	58
Do	do	g 49465	Young <sup>h</sup>				132	65	58.5
Do	do	e 83520	Young, male <sup>i</sup>	e 480	e 85	e 80	110	59	42
<i>Acanthion longicaudum</i> .	Aru Bay, Sumatra.	c 143431	do	d 515	d 95	e 72	103	55	41.5
<i>Theruraxsumatra</i>	do	c/j 143432	Male, old	d 540	d 100	d 70	108	56	29.6
Do	do	c 143433	do	d 495	d 90	d 70	102.3	56.1	31
Do	do	c 143434	do	d 510	d 110	d 71	105.8	56	29.7
Do	do	c 143435	Female, old	d 455	d 90	d 68	99.5	49.1	34.9
Do	do	c 143438	do	d 525	d 90	d 73	102.3	53.2	30
Do	do	c 143439	do	d 500	f 30	d 70	98.6	55	29.5
Do	do	a 49870	Male, old	b 480	b 110	b 70	97.6	53	31
Do	do	g 143451	Male, adult	d 490	d 90		98.7	52.5	30.1
Do	do	c 143430	do	d 550	d 110	d 75	108.6	53.2	32
Do	do	c 143436	Female, adult	d 495	d 100	d 73	102.6	50.6	29.6
Do	do	c 143437	Female, young <sup>h</sup>	d 450	d 95	d 62	93.7	47.8	25
<i>Atherurus macrourus</i> .	Trong, Lower Siam.	a 49498	Old	b 480	b 240	b 70	101.6	48.2	38.2
Do	do	e 84433	Female, old	d 445	d 229	e 66	99.2	47.7	26.2
Do	do	e 83500	Female, adult	d 482	d 203	e 65	98.1	44.7	27.4
Do	do	e 84432	Male, young <sup>k</sup>	d 470	d 231	e 65	91.9	43.2	25.0
<i>Atherurus zygomaticus</i> .	Pulo Aor.	c 112432	Male, old	d 485	d 165	e 64	96.5	46.4	24.3
Do	do	c 112433	do	d 510	d 140	e 65	99.6	45.3	27.8
Do	do	c/j 112429	Female adult	d 520	d 200	e 67	94.3	45.4	25.6
Do	do	c 112431	do	d 500	d 145	e 66	95.9	45.8	28.6
Do	do	c 112434	Female, old	d 500	d 140	e 64	93.7	46.2	26.1
Do	do	a 49632	Adult	b 480	b 175	b 65	94.4	46.1	26.5
Do	do	c 112430	Female, young <sup>h</sup>	d 470	d 190	e 62	88.9	41.4	24.1
Do	do	e 112435	Male, young <sup>k</sup>	m 470	m 170	m 63	86.4	41	21
<i>Atherurus tenuitars</i> .	Pulo Terutau.	c/j 123971	Male, adult	d 440	d 110	e 62	93.1	45.7	22
<i>Trichys lipura</i>	Mount Sallikun, Borneo	e 83940	Male, nearly adult	e 450	e 175		83.7	43.8	25.6
Do	British North Borneo.	a 34785	Adult	b 350	b 230	b 65	83.4	44	27.1
<i>Trichys macrotis</i>	Tapanuli Bay, Sumatra.	c 114489	Male, old	d 410	d 180	e 64	82.7	44	26.3
Do	do	c 114490	Male, adult	d 415	d 185	e 62	83.4	44.3	27.4
Do	do	c 114487	Female, old	d 425	d 130	e 64	85	42.4	26
Do	do	c/j 114488	do	d 428	d 225	e 65	82.5	43.5	26.5
Do	do	c 114491	Female adult	d 422	d 195	e 60	81.8	43	25.2
Do	Aru Bay, Sumatra.	c 143441	do	d 415	d 200	e 60	78	42.8	22.4
Do	do	c 143440	Female, im-mature <sup>h</sup>	d 420	d 220	e 65	79.7	44.2	22.7

<sup>a</sup> Skeleton.

<sup>b</sup> Estimated from skeleton.

<sup>c</sup> Skin and skull.

<sup>d</sup> Collector's measurements.

<sup>e</sup> Measured from skin.

<sup>f</sup> Tail injured.

<sup>g</sup> Skull only.

<sup>h</sup> Last upper molars just coming into place.

<sup>i</sup> Second upper molars just coming through alveoli.

<sup>j</sup> Type.

<sup>k</sup> Last molar not through alveolus.

<sup>l</sup> Tail damaged. The loss of the external tail seems to be of rather common occurrence among the long-tailed porcupines, and shows of how little practical use that organ is to them.

<sup>m</sup> Estimated from mounted skin.

## EXPLANATION OF PLATES.

## PLATES LIV, LV, AND LVI.

Dorsal, lateral, and ventral views of skulls of Old World porcupines. All figures one-half natural size.

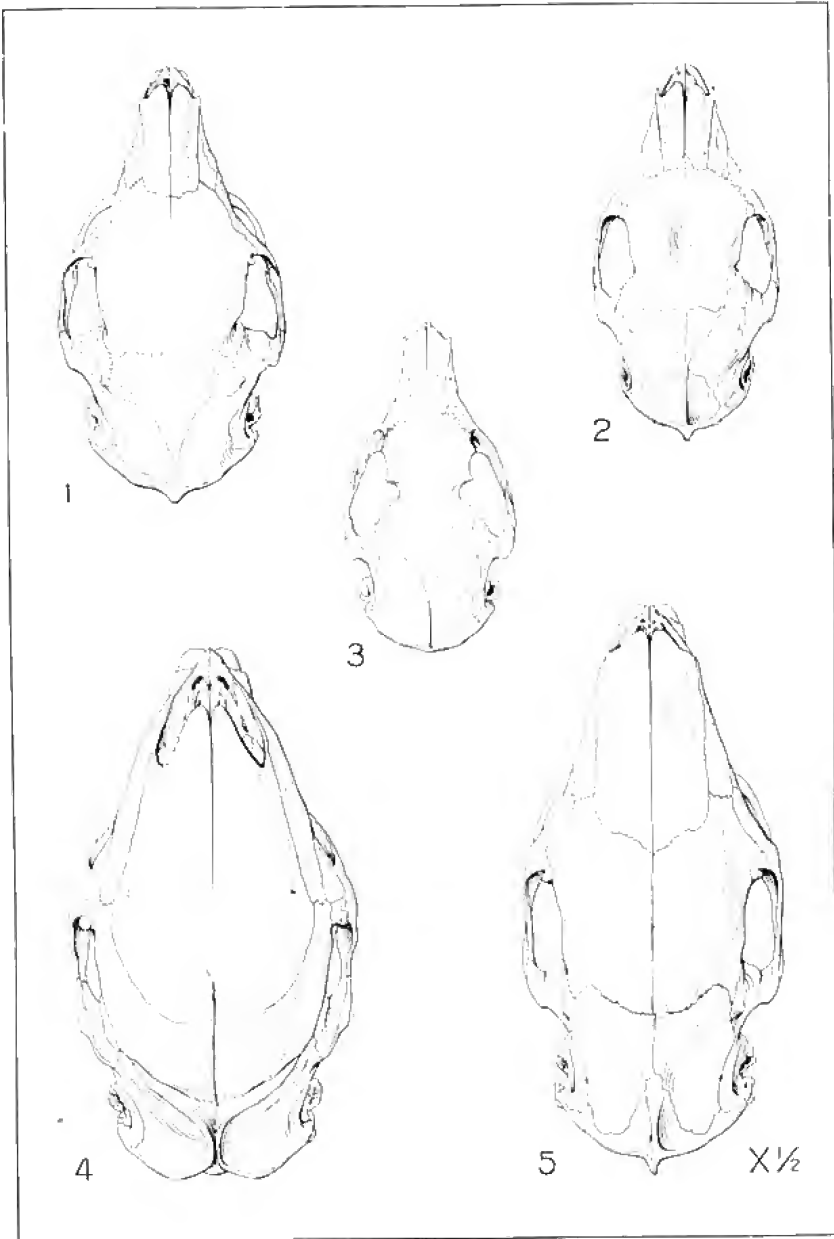
- Fig. 1. *Thecurus sumatrae*. Type, Cat. No. 143432, U.S.N.M., Arn Bay, Sumatra.  
2. *Atherurus teritans*. Type, Cat. No. 123971, U.S.N.M., Pulo Terutau, west coast Malay Peninsula.  
3. *Trichys macrotis*. Type, Cat. No. 114488, U.S.N.M., Tapanuli Bay, Sumatra.  
4. *Hystrix cristata*. Cat. No. <sup>49348</sup><sub>60048</sub> U.S.N.M., received from National Zoological Park.  
5. *Acanthion brachyurum*. Cat. No. 83519, U.S.N.M., Trong, Lower Siam.

## PLATE LVII.

Tail bristles and cervical and lumbar vertebrae of Malayan porcupines. All figures three-fourths natural size.

- Fig. 1. Tail bristle of *Acanthion*.  
2. Tail bristles of *Thecurus*.  
3. Tail bristle of *Atherurus*.  
4. Tail bristle of *Trichys*.  
5. Axis or second cervical vertebra of *Trichys*.  
6. Lumbar vertebra of *Trichys*.  
7. Axis or second cervical vertebra of *Atherurus*.  
8. Lumbar vertebra of *Atherurus*.  
9. Axis or second cervical vertebra of *Thecurus*.  
10. Lumbar vertebra of *Thecurus*.  
11. Axis or second cervical vertebra of *Acanthion*.  
12. Lumbar vertebra of *Acanthion*.

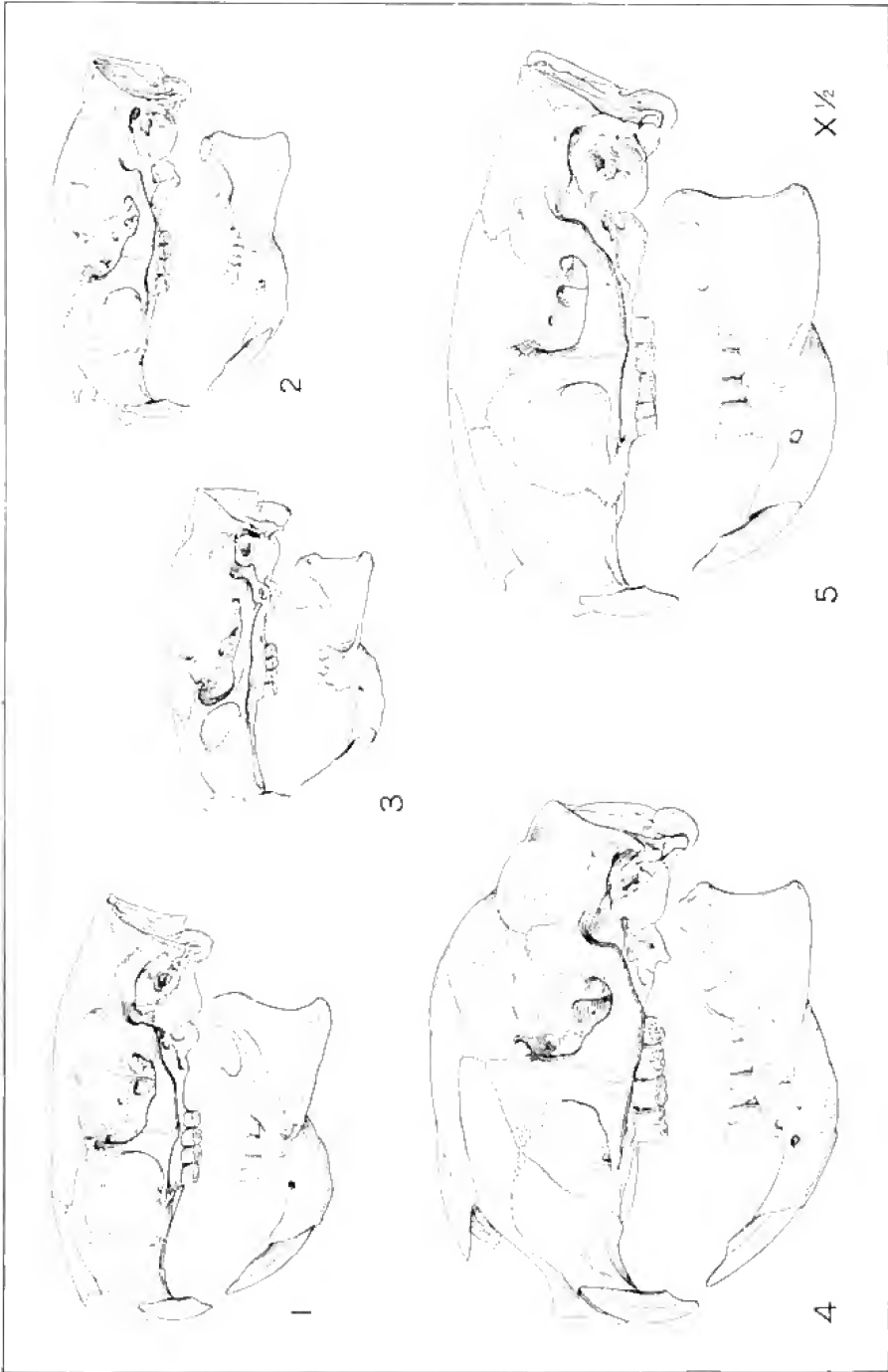




SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.

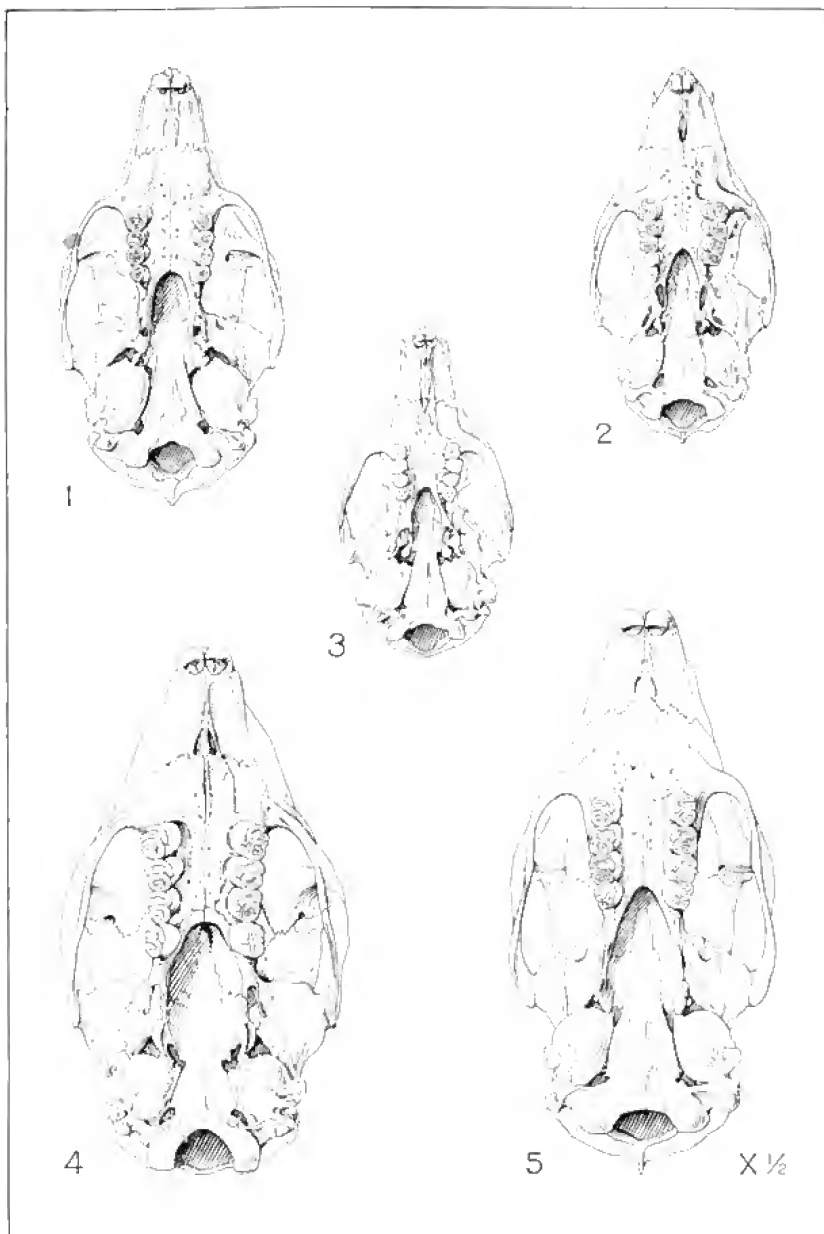




SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.

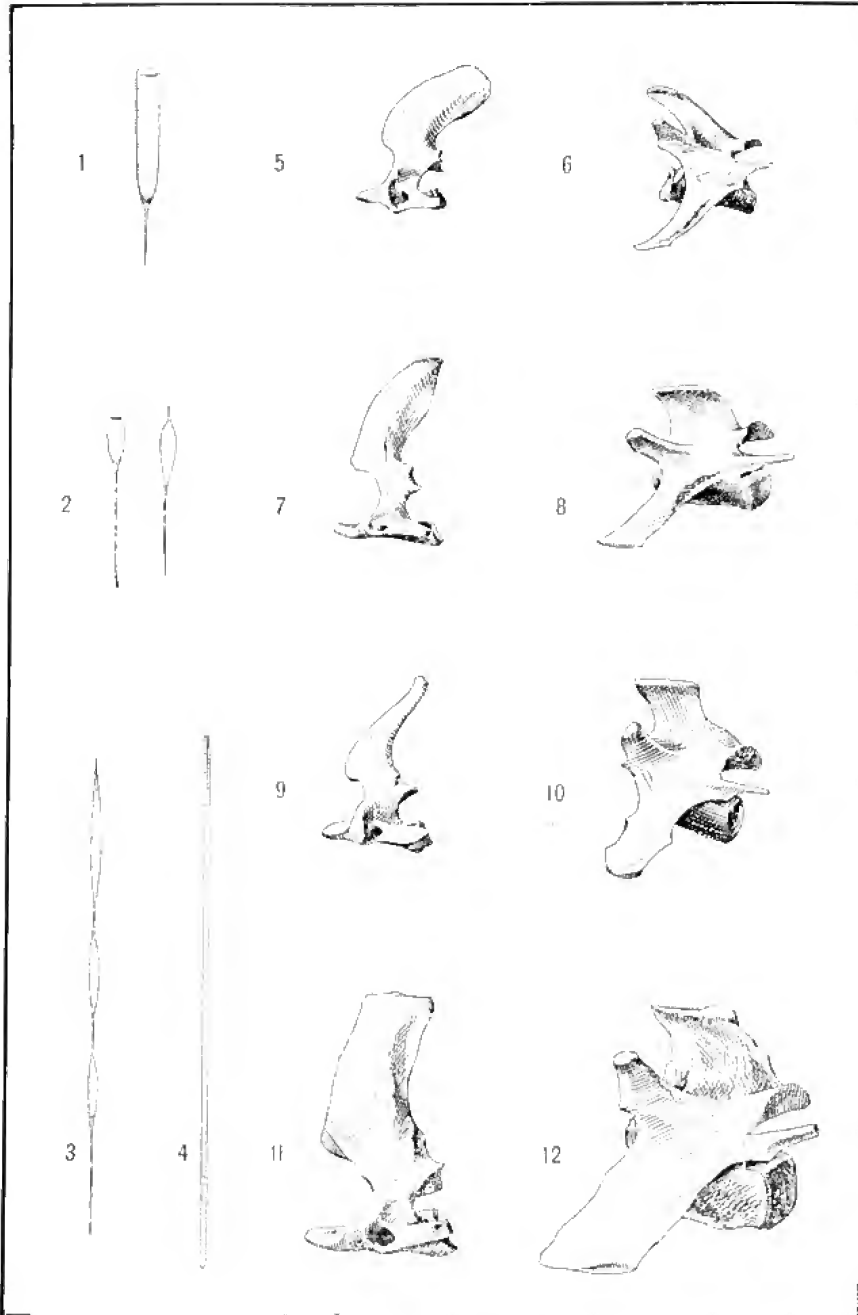




SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.





TAIL BRISTLES AND VERTEBRÆ OF MALAYAN PORCUPINES.

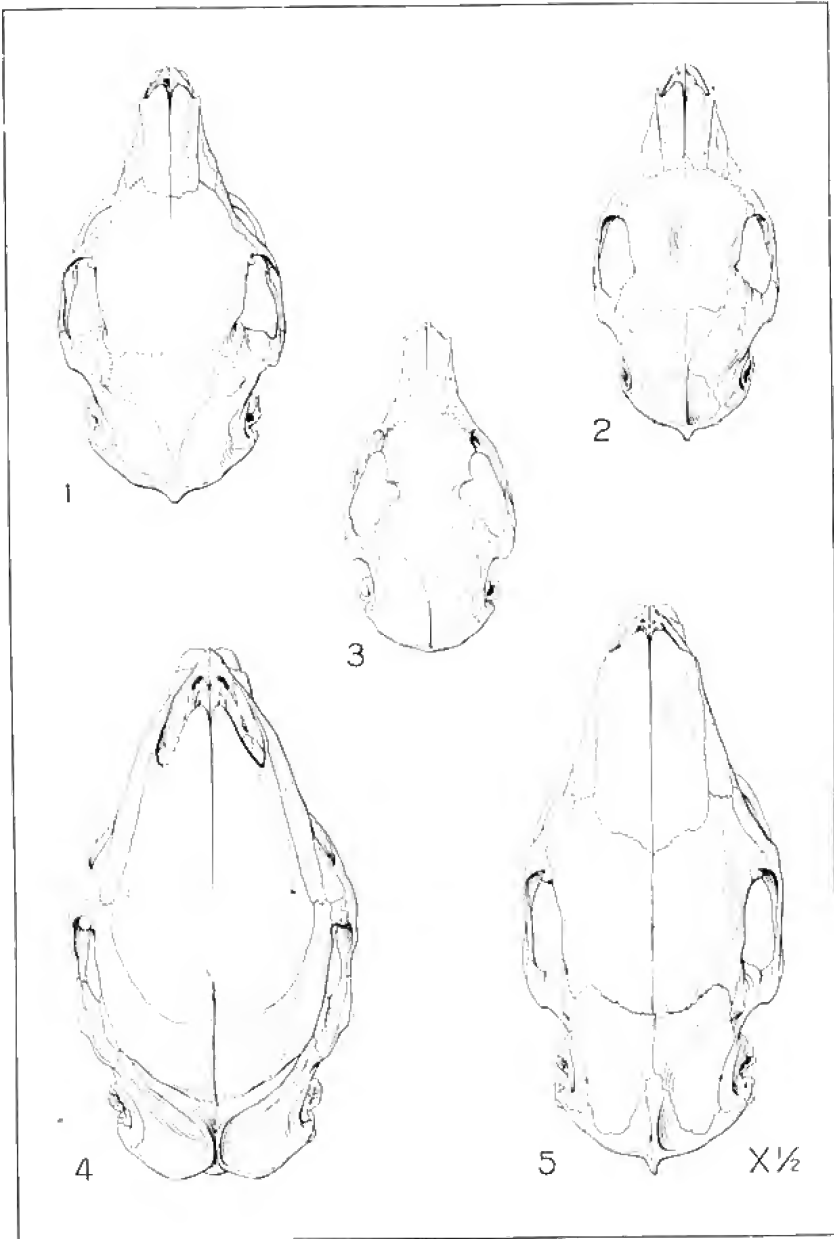
FOR EXPLANATION OF PLATE SEE PAGE 594.





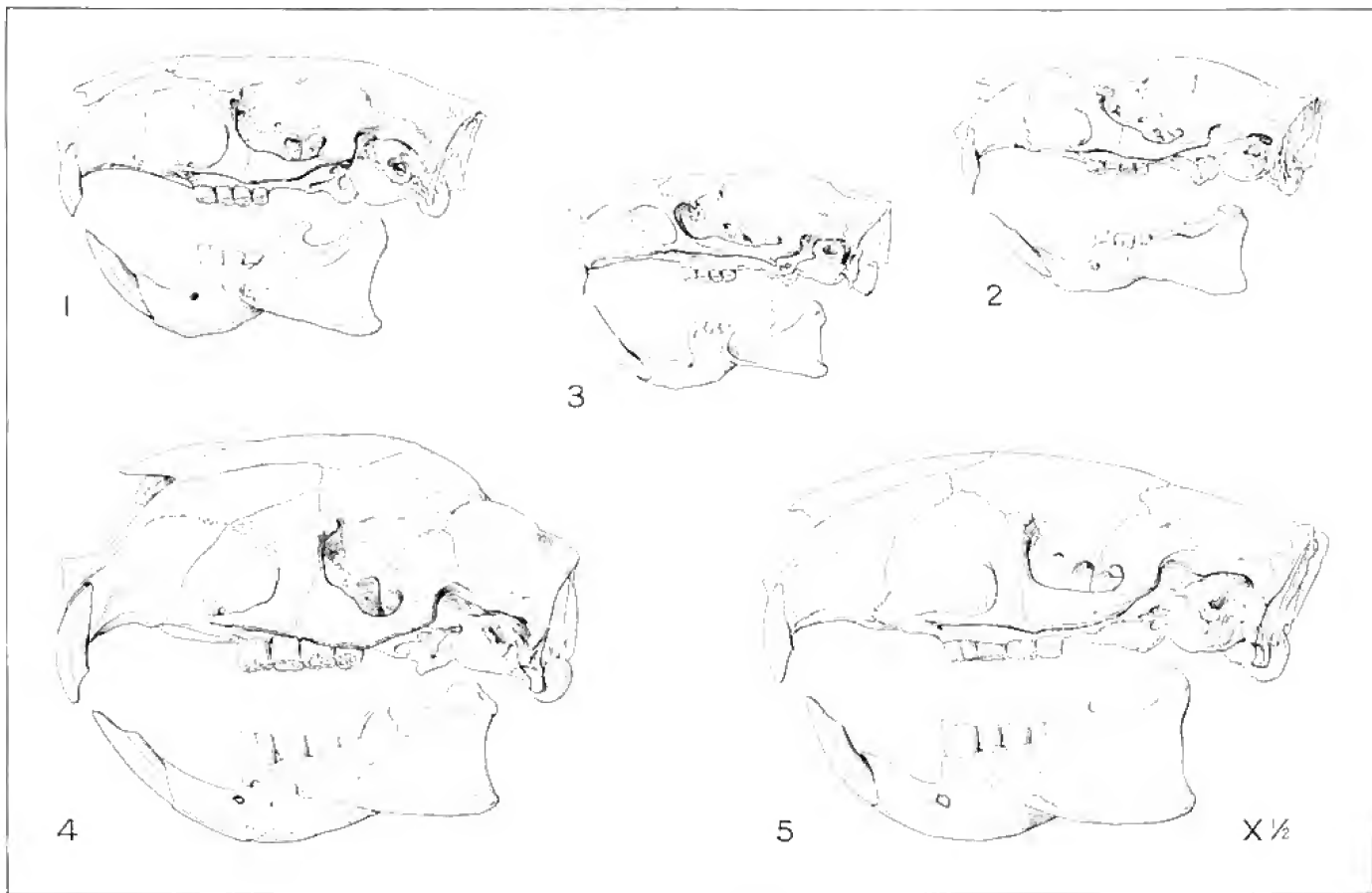






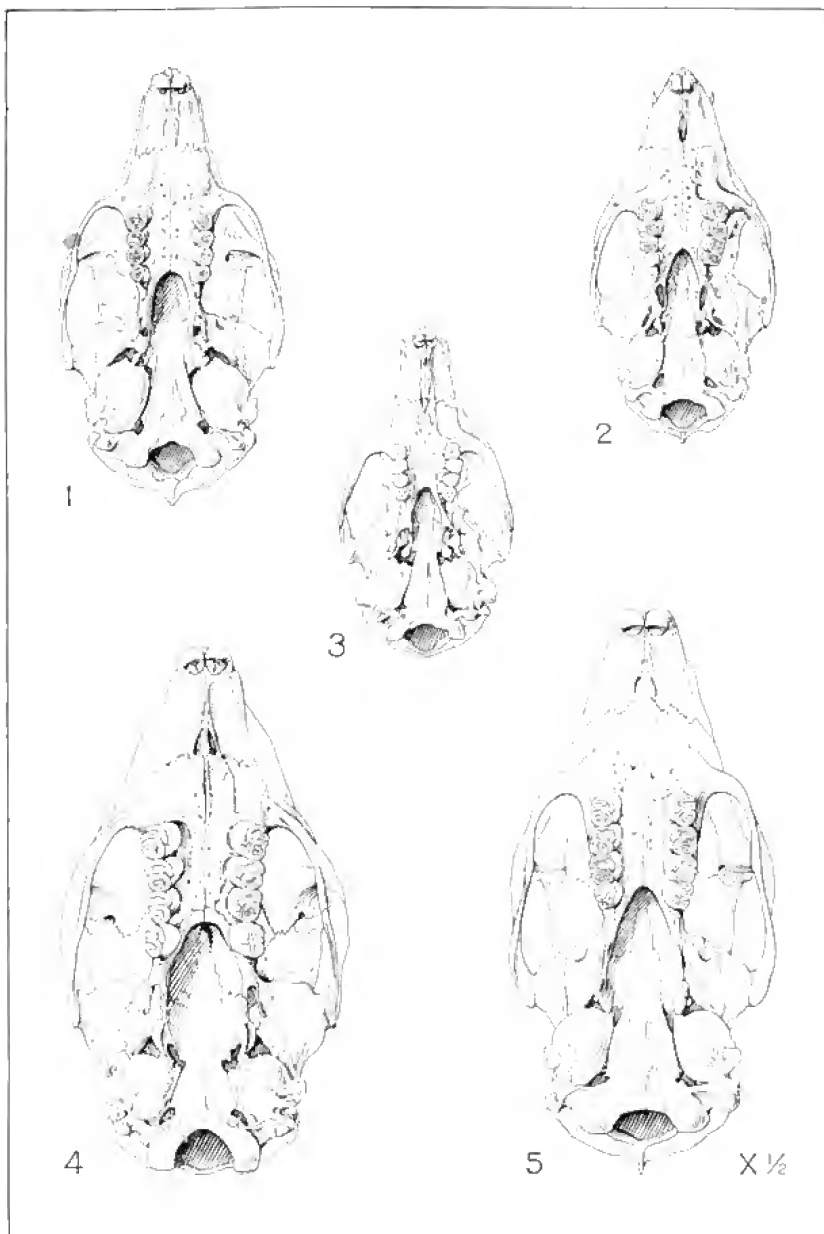
SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.



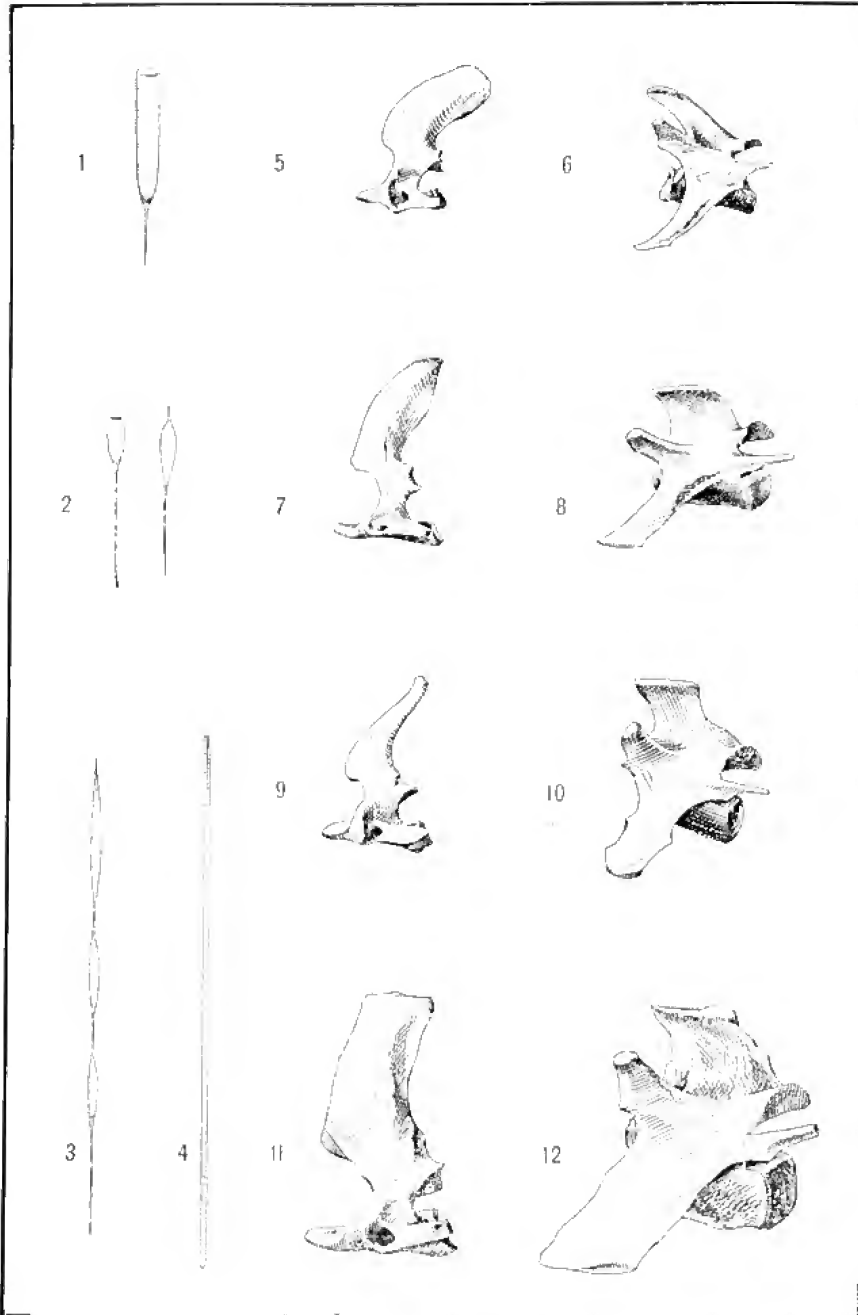
SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.



SKULLS OF OLD WORLD PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.



TAIL BRISTLES AND VERTEBRÆ OF MALAYAN PORCUPINES.

FOR EXPLANATION OF PLATE SEE PAGE 594.