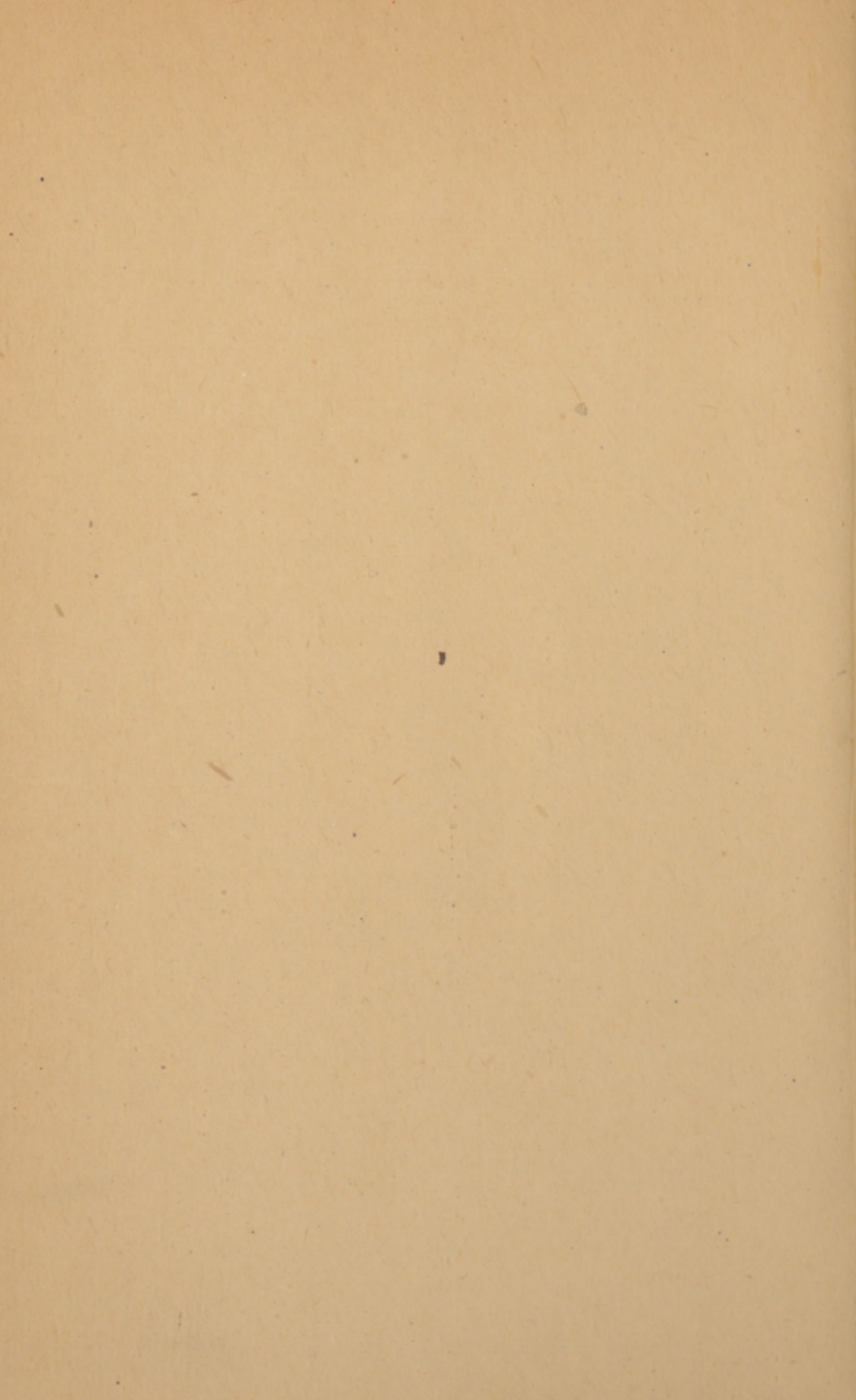


MERRIAM (C.H.)

A new subfamily of
murine rodents x x x x x





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A NEW SUBFAMILY OF MURINE RODENTS—THE NEOTOMINÆ—WITH
DESCRIPTION OF A NEW GENUS AND SPECIES AND A SYNOPSIS
OF THE KNOWN FORMS.

BY DR. C. HART MERRIAM.

A study of the rich collections of American Murine Rodents brought together by the U. S. Department of Agriculture, shows that the genus *Neotoma* is one of a group of closely allied forms which differ so radically from the tuberculate crowned Murines, with which they have been commonly associated, that the propriety of separating them as an independent subfamily seems evident.

The unparalleled series of Mexican Rodents collected by Mr. E. W. Nelson in connection with his work for the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture, contains a large number of wood rats, several of which are not properly referable to the genus *Neotoma*. Two of these were described by me sometime ago, under the names *Xenomys nelsoni* and *Neotoma alleni*,¹ the former being made the type of a new genus. In the original account of *Neotoma alleni* attention was called to the circumstance that the crown of the last lower molar is shaped like the letter S, instead of exhibiting two transverse loops as usual in the genus *Neotoma*, and it was remarked that this peculiarity might prove worthy of subgeneric recognition (p. 167). In the course of a subsequent study of the American wood rats, it was discovered that the character in question, which is one of great value, is correlated with a number of important cranial characters, making it obviously undesirable to retain the animal longer in the genus *Neotoma*. Ameghino has described and figured two related rodents from the Pampean Pliocene deposits near Villa de Lujan, in the province of Buenos Ayres, which he has named *Ptyssophorus elegans*² and *Tretomys atavus*.³ His description of the former is based on the broken ramus of the mandible of an apparently immature indi-

¹ Proc. Biological Soc. of Washington, VII, Sept. 1892, 159-163; 167-169.

² Mammíferos Fósiles de la República Argentina, por Florentino Ameghino 1889, 111, 112, and pl. iv, figs. 1, 1c.

³ Ibid., 119, 120, and pl. iv, fig. 16.



vidual; that of the latter is based on a fragment of the maxillary containing the upper molar series. At first, I was inclined to regard Ameghino's specimens of *Ptyssophorus* (fig. 1c) and *Tretomys* (fig. 2) as the lower and upper jaws of the same animal, and to look upon my '*Neotoma*' *alleni* (fig. 1e) as congeneric therewith.⁴ But subsequent study has convinced me that *Ptyssophorus* and *Tretomys* are probably distinct, though closely related genera, and that the living species formerly described as *N. alleni*, together with the new species here named *vetulus*, represent a third genus of the same group. For this genus I propose the name *Hodomys*. *Hodomys* is a more recent type than *Ptyssophorus*, less specialized than *Xenomys*, and more ancient than *Neotoma*.

So far as dental characters go, the group of genera under consideration (*Ptyssophorus*, *Tretomys*, *Hodomys*, *Xenomys*, and *Neotoma*) presents nearly every important step in the evolution of the modern genus *Neotoma* from the *Cricetine* series. *Sigmodon* seems to be the connecting link that bridges the gap between the tuberculate toothed Murine subfamily *Cricetinae* and the flat topped prismatic crowned Neotominae, by which name it seems proper to designate the new subfamily, comprising the 5 genera above enumerated.⁵ *Sigmodon* should be looked upon as an ancestral rather than a contemporary type. It is almost on the dividing line between the tuberculate and flat crowned groups, and is probably on or near the trunk line along which the Neotominae branched off from the tuberculate series. It is evidently an ancient type, dating back to the Pliocene at least,⁶ since which period it has not undergone very marked changes. In early life *Sigmodon* has the outer ends of the loops elevated, forming half tuberculate grinders, much as in the American *Cricetines*, but the projecting loops are soon worn down, leaving flat grinding surfaces (fig. 1d). The loops, however, remain closely appressed or even soldered together, never standing out freely as in *Neotoma* and *Arvicola*.

⁴ While of this mind I stated, in a recent paper on the genus *Neotoma*, that the species of Wood Rats having the crown of the last lower molar shaped like the letter S, were transferred to the genus *Ptyssophorus* of Ameghino (Proc. Biol. Soc. Wash., IX, July 2, 1894, 117).

⁵ It is probable that several other animals described by Ameghino belong to the *Neotominae*—such as *Bothriomys* and some of the species referred to the genera *Oxymycterus*, *Holochilus*, and '*Habrotrix*' (= *Abrotrix*).

⁶ Ameghino has figured an undoubted *Sigmodon* from the Pampean Pliocene (Mamif. Fos. Argentinos, pl. 4, fig. 11a), and has referred the same to *Holochilus vulpinus* Licht.

Whatever the future may show the exact genetic interrelations of these animals to be, it is evident that *Ptyssophorus* is the more primitive type; *Tretomys* and *Hodomys* seem to represent more advanced stages in the evolution of the group, while *Xenomys* and *Neotoma* are more specialized. *Xenomys* retains more primitive characters than *Neotoma*, and consequently must be looked upon as nearer *Tretomys*, with which it agrees closely in dental characters; on the other hand, it is a far more specialized type than *Neotoma* and can in nowise be regarded as holding a place in the direct line of descent between *Ptyssophorus* and *Neotoma*.

The discovery of complete skulls of *Ptyssophorus* and *Tretomys* may show that the line of generic separation should be drawn between *Ptyssophorus*, on the one hand, and *Tretomys* and *Xenomys* on the other; and believers in comprehensive genera may unite the two latter as subgenera of a single genus, the relation of which to *Neotoma* would be that of a specialized ancestral type to a modernized type.

The fact that of the living genera only a single species of *Xenomys* and two of *Hodomys* have been discovered, while nearly thirty species of *Neotoma* are known, is strong evidence that *Hodomys* and *Xenomys* are survivors of the past, bridging over the gap between *Ptyssophorus* and *Neotoma*, and that the latter genus is now at or near the height of its development.

Irrespective of the interrelations of these animals, it is evident that, collectively, they form an important though not highly specialized subdivision of the Murine series, standing somewhat apart from the others. While they resemble the Arvicolinæ in some respects, they differ in numerous important characters and cannot be regarded as intermediate between the Arvicolinæ and Cricetinæ. On the contrary, the Neotominæ and Arvicolinæ seem to be independent offshoots from the half-tuberculate crowned Cricetines. Among the many excellent characters that serve to distinguish these two groups, the following are sufficient for present purposes:—

Subfamily ARVICOLINÆ.

Cranium abruptly and strongly constricted immediately in front of brain case, which is quadrangular, projecting squarely into orbit; orbital and temporal fossæ well differentiated; jugal forming half, or more than half, of outer side of zygoma and always reach-

ing forward more than half way from squamosal root to maxillary plate; sagittal area subquadrate, usually broader than long; angular process of mandible narrow, everted, hamular, and thickened at end; infracondylar notch low and deep.

Subfamily NEOTOMINÆ.

Cranium not abruptly constricted in front of brain case, which is oval, gradually narrowing into orbit; orbital and temporal fossæ indistinguishable, without trace of separation; jugal wholly posterior, forming insignificant part of zygoma and never reaching forward half-way from squamosal root to maxillary plate; sagittal area elongated, at least twice as long as broad; angular process of mandible broadly expanded vertically, inflected, not hamular, and never thickened at end; infra-condylar notch high and shallow.

The dental characters of the Neotominæ may be defined as follows: Molars $\frac{3}{3}$, prismatic, rooted or semi-rooted; the crowns flat, their sides continuously invested with enamel which is folded on itself in such manner as to present on each side of the tooth a series of salient loops, alternating with re-entrant angles or interspaces (figs. 1-5). M $\frac{1}{1}$, $\frac{2}{2}$, and $\frac{3}{3}$, each with three salient loops and two re-entrant angles on outer side; m $\frac{1}{1}$ with three salient loops and two re-entrant angles on inner side;⁷ m $\frac{2}{2}$ and $\frac{3}{3}$ each with two salient loops and one re-entrant angle on inner side; m $\frac{1}{1}$ with three salient loops and two re-entrant angles on outer side and four salient loops and three re-entrant angles on inner side, with or without an anterior lobe; m $\frac{2}{2}$ (normally) with three salient and two re-entrant angles on each side [*Ptyssophorus* resembles *Sigmodon* in having the antero-external re-entrant angle small]; m $\frac{3}{3}$ variable, but normally with two salient and one re-entrant angles on each side.

The subfamily Neotominæ comprises the genera *Neotoma*, *Xenomys*, *Hodomys*, *Tretomys*, and *Ptyssophorus* (and probably one or two others).

The Neotominæ may be distinguished from the Sigmodont Crice-tines by the following characters:—

Molar crowns prismatic; loops distant; enamel folds of equal thickness; crowns flat; antorbital vacuities without spine; palate excavated between posterior molars. . . . Subfamily Neotominæ.

⁷ In *Neotoma desertorum* and *arizonæ* the antero-internal loop is short and shallow and becomes obsolete with wear (fig. 5a).

Molar crowns not prismatic; loops closely appressed; enamel folds of unequal thickness, and rising at the free ends to form half tubercles; antorbital vacuities with a blunt spine projecting forward from top of outer side; palate not excavated between posterior molars. . . . *Sigmodon* (fig. 1*d*), *Scapteromys*, *Holochilus*(?), and other genera.

In order to render the present account of these highly interesting rodents as complete and useful as possible, the genera *Ptyssophorus* and *Tretomys* are redefined, the new and closely allied genus *Hodomys* is characterized (with reference to the more specialized genera *Xenomys* and *Neotoma*), and descriptions of all the known species are added.

Genus **PTYSSOPHORUS** Ameghino [Fossil].

(Fig. 1, *a*, *b*, and *c*.)

Ptyssophorus Ameghino, Mamíferos Fósiles Republica Argentina, 1889, 111, 112, and pl. iv, figs. 1-1*c*. Type *Ptyssophorus elegans* Amegh., from the Argentine Republic.

Crown of m_3 shaped like the letter S placed lengthwise of jaw; projecting part of lower incisor nearly straight, slender, and forming

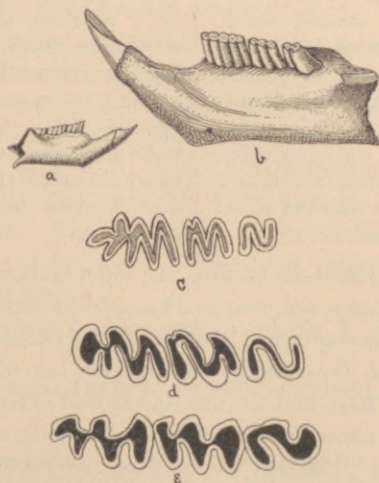


Fig. 1. *a*, *b*, *c*. *Ptyssophorus elegans* (from Ameghino).
a. Right ramus of mandible, outer side.
b. Same, inner side (enlarged).
c. Crowns of right lower molars (enlarged).
d. *Sigmodon hispidus*, crowns of right lower molars.
e. *Hodomys alleni*, crowns of right lower molars.

with its fellow a single sharp, almost spear-shaped, point for piercing; symphysis of mandible long, straight or nearly straight, and usually bent up at a sharp angle with ramus; the two posterior enamel folds of m_1 and m_2 simple, reaching completely across the tooth from side to side as in m_3 ; each re-entrant angle corresponding to a salient loop on opposite side; investing enamel walls parallel, the included dentine forming a continuous narrow band of equal breadth throughout.

Ptyssophorus and *Hodomys* agree in the following characters:—

Crown of m_3 shaped like the letter S placed lengthwise of jaw; projecting part of lower incisor nearly straight, slender, and forming with its fellow a single sharp almost spear-shaped point for piercing; symphysis of mandible long, straight or nearly straight, and usually bent up at sharp angle with ramus.

Ptyssophorus and *Hodomys* differ in the following characters:—

Genus **PTYSSOPHORUS** Ameghino.

(Fig. 1c.)

The two posterior enamel folds of m_1 and m_2 simple, reaching completely across the tooth from side to side as in m_3 ; each re-entrant angle corresponding to a salient loop on opposite side; investing enamel walls parallel, the included dentine forming a continuous narrow band of equal breadth throughout.

Genus **HODOMYS** nob.

(Fig. 1e.)

All enamel folds of m_1 and m_2 reaching only about half-way across tooth; each re-entrant angle corresponding (at least in young) to re-entrant angle of opposite side; investing enamel walls alternately divaricating and approximating, the included dentine broken into disconnected parts.

The principal differences between the lower molars of *Ptyssophorus* and those of *Hodomys* are, that in *Ptyssophorus* most of the enamel folds reach all the way across the tooth; the enclosed dentine is of nearly equal width throughout; the anterior loop of the first molar has an additional lobe, and the first and second external loops of the middle molar are more crowded and less distinctly separated (much as in *Sigmodon*⁸). The only one of these differences of more than

⁸ The enamel pattern of the crowns of m_2 and m_3 of *Ptyssophorus elegans* (fig. 1c) is almost identical with that of young specimens of some living species of *Sigmodon* (fig. 1d), but the character of the teeth is different: In *Sigmodon* the crowns have hardly left the tuberculate condition; the enamel is of unequal thickness, the loops are closely appressed, and the re-entrant angles are of superficial depth vertically; in *Ptyssophorus* the crowns are truly prismatic, perfectly flat on top, the loops well spaced, and the re-entrant angles reach from crown to alveolus.

specific weight is the length of the enamel folds, a character apparently due to antiquity, representing an earlier and more primitive stage in the evolution of the enamel pattern. In Ameghino's single specimen the re-entrant angles or grooves between the folds extend vertically from crown to alveolus, as in the young of *Neotoma* and allied types. Whether they continue below the alveolus to the very root of the tooth as in the Arvicolines, we are not informed; but the characters of the jaw and molar crowns indicate that they do not. The specimen is apparently immature and the teeth are probably rooted or semi-rooted.

Ptyssophorus elegans Ameghino. (Fig. 1, *a*, *b*, and *c*.)

Ptyssophorus elegans Ameghino, Mamíferos Fósiles Repub. Argentina, 1889, 111, 112, and pl. 4, figs. 1, 1c.

Based on a fossil ramus of the mandible (right side) from the Pampean Pliocene deposits near Villa de Lujan, Province of Buenos Ayres.

Specific characters.—Most of the characters have been given above in the generic diagnosis and need not be repeated. The anterior loop of m_1 has a lobe directed forward (see fig. 1c). Ameghino states that the alveolar border is higher on the outer than inner side of the jaw, and that m_1 is nearly as large as m_2 and m_3 together. He gives the following measurements: length of molar series on crowns, 5 mm.; on alveolus, 6; distance from incisor to m_1 , 5; height of ramus at m_3 , 5; distance from front of incisor to back of last molar, 12. The incisor is short, but this may be an individual peculiarity. The hinder part of the mandible is broken off, so that the form of the angle and condylar ramus can only be inferred from allied forms.

Ameghino's figures are here reproduced (fig. 1, *a*, *b*, and *c*).

Genus **TRETOMYS** Ameghino [Fossil].

(Fig. 2.)

Tretomys Ameghino, Mam. Fos. Repub. Argent., 1889, 119, pl. 4, figs. 16 and 16a. Type *Tretomys atavus* Ameghino, from Pampean Pliocene, Argentine Republic.

Generic characters (based on Ameghino's figures and description of part of maxillary bone including upper molar series, maxillary root of zygoma, and upper incisor).—Number of enamel folds as

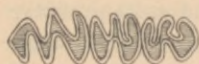


Fig. 2. *Tretomys atavus* (from Ameghino). Left upper molars.

in other members of the subfamily (m^1 with three salient and two re-entrant loops on each side; m^2 and 3 each with three salient and two re-entrant loops on outer side and two salient and one re-entrant loop on inner side); the re-entrant enamel folds from both sides stopping on or very near median line of teeth, and directed inward at nearly right angles to long axis of teeth, instead of obliquely backward as in the other genera; m^2 and 3 subequal in size; m^1 slightly larger; anterior loop of m^1 projecting on inner side as far as middle and posterior loops, and falling short of plane of other two on outer side (reversing the usual condition); zygomatic root of maxillary reaching back to posterior part of m^1 (anterior part in other genera).

Tretomys atavus Ameghino. (Fig. 2.)

Tretomys atavus Ameghino, Mamíferos Fósiles Repub. Argentina, 1889, 119, 120, pl. 4, figs. 16 and 16a.

Based on fossil fragment of maxillary bone containing molar series, and upper incisor, from near city of Cordoba, Argentine Republic.

Specific characters.—Most of the characters have been given above, in the generic diagnosis. The molars are implanted squarely one in front of the other, the longitudinal axis of each tooth being the same as that of the series collectively. In the other genera the upper molars are implanted obliquely, the axis of m^2 and 3 sloping outward as well as backward from the axis of the series as a whole. In *Tretomys* the posterior loop on the inner side and the anterior loop on the outer side of m^2 and 3 are more largely developed than in the other genera, the result being that on each side all of the salient loops of the series end nearly on the same plane. Ameghino's measurements of the molar series are: Series, 5 mm.; m^1 , 2 mm.; m^2 , 1.6 mm.; m^3 , 1.4 mm. The upper incisor is 1 mm. broad and its face is very convex.

Genus *HODOMYS*⁹ nob.

(Pl. IX, Figs. 1-4, 7, 8, and Fig. 3, *a, b, c, d*, in text.)

Type *Neotoma allenii* Merriam, Proc. Biol. Soc. Wash., VII, Sept. 1892, 167-169 (Type from Manzanillo, Mexico).

⁹ *Hodomys*, from ὁδός road, and μῦς mouse, in allusion to the road-making habit of both species.

Generic characters.—Upper molars much as in *Neotoma*,¹⁰ but crowns of m^1 and m^2 with middle transverse loop divided by deepening of enamel fold on inner side; m^1 and m^2 with four roots each; m^3 with three roots; lower molars with enamel folds reaching about half-way across tooth; m_3 shaped like letter S,

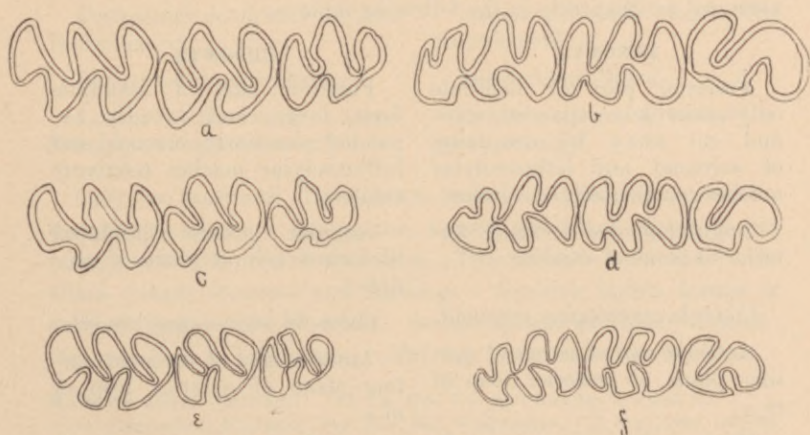


Fig. 3. (x 5.) a and b. *Hodomys alleni*. c and d. *H. vetulus*. e and f. *Xenomys nelsoni*.

a, c, e. Crowns of upper molars. b, d, f. Crowns of lower molars.

with two salient and one re-entrant angle on each side, with a tendency toward the subdivision of the antero-external loop by the development of a notch (or vertical sulcus) on its convexity; upper incisors peculiarly excavated, apparently by the sharp point of the lower ones, leaving a deep cavity behind the enamel face, which is bordered laterally by the outer sides of the teeth. Cranium long and narrow, much as in *Neotoma pennsylvanica*, only narrower; auditory bullæ small, abruptly narrowed anteriorly, the narrow part produced obliquely inward, much as in *Nectomys*; inner side conspicuously excavated by the carotid canal and foramen, which is considerably anterior to middle of bulla; brain case narrow and long; sphenopalatine vacuities closed; mandible with coronoid notch more nearly vertical than horizontal; condylar ramus high,

¹⁰ Most of the accompanying description is drawn with reference to antithesis with *Neotoma*. Probably many of the characters apply to *Ptyssophorus* also, of which animal, unfortunately, the cranium and posterior part of the mandible are unknown.

curved strongly upward and inward; angle produced backward behind plane of condyle, and strongly inflected; ramus of mandible thickened opposite molar teeth and abruptly narrowed and beveled to incisors.

The principal characters that separate *Hodomys* from *Xenomys* are arranged antithetically in the following table:—

XENOMYS.

Posterior part of mandible only moderately expanded, short and cut away by deepening of coronoid and infracondylar notches (particularly the latter).

Angular process decidedly anterior to plane of condyle.

Condyle overtopping coronoid.

Anterior root of coronoid cutting plane of posterior loop of m_2 .

Horizontal ramus nearly straight below molar series.

Cranium short.

Squamosal *not reaching supraoccipital*.

Audital bullæ enormously inflated, wheel-shaped, parallel, broadest anteriorly.

Audital bullæ much longer than molar series and covering more than two-thirds distance from foramen magnum to post-palatal notch.

Carotid canal inconspicuous, far behind middle of bulla.

Orbital borders of frontals produced laterally, forming a shelf-like bead over orbits.

HODOMYS.

Posterior part of mandible long, large, and broadly expanded posteriorly; coronoid and infracondylar notches relatively shallow.

Angular process produced backward behind plane of condyle.

Coronoid overtopping condyle.

Anterior root of coronoid cutting plane of anterior loop of m_3 .

Horizontal ramus decidedly convex downward below molar series.

Cranium long and narrow.

Squamosal *articulating with supraoccipital*.

Audital bullæ very small, subfusiform, abruptly narrowed anteriorly and produced obliquely forward toward median line.

Audital bullæ much shorter than molar series and covering only about one-third distance from foramen magnum to post-palatal notch.

Carotid canal conspicuous, anterior to middle of bulla.

Orbital borders of frontals upturned, not projecting over orbits.

XENOMYS (*Cont.*).

Premaxillæ produced anteriorly in wing-like extensions reaching beyond nasals.

Pterygoid fossæ short—as broad as long.

Postpalatal notch shorter than basisphenoid.

Basioccipital very narrow.

Lower molar series curved strongly outward anteriorly.

HODOMYS (*Cont.*).

Premaxillæ without wing-like extensions.

Pterygoid fossæ long—twice as long as broad.

Postpalatal notch longer than basisphenoid.

Basioccipital broad.

Lower molar series straight or nearly straight.

Only two species of *Hodomys* are known. Both make extensive inosculating runways among the Agaves and other plants on the brushy side hills where they live. This habit is unknown in the allied genera *Neotoma* and *Xenomys*. *Neotoma* builds houses or amasses large piles of sticks, cactus spines, or other rubbish; *Xenomys* lives in hollow trees; *Hodomys* is not known to do either.

Hodomys alleni (Merriam). (Pl. IX, figs. 1-4; and text fig. 3, *a* and *b*.)

Neotoma alleni Merriam, Proc. Biol. Soc. Washington, VII, Sept. 1892, 167-169. (Type from Manzanillo, Mexico.)

General characters.—Size large (larger than any known species of *Neotoma*); ears rather large; tail shorter than head and body, blackish, sparsely haired, the annulations and scales distinctly visible on both sides.

Color.—Upper parts from forehead to base of tail deep fulvous or tawny-ferruginous; nose and sides of face mouse-gray, tinged with bluish in some specimens; under surface whitish, the tips of the hair only being white, the plumbeous basal part showing through; upper surfaces of feet whitish, more or less clouded with dusky; tail blackish all round.

Cranial characters.—Skull very long and narrow; angular; orbital margins of frontals nearly parallel and strongly upturned, with tendency to develop an upturned point opposite middle of orbital fossa; interparietal shield quadrate; nasals produced and pointed anteriorly, truncate or emarginate posteriorly. (Principal characters given under generic diagnosis and not repeated here.)

Measurements of type (taken in flesh).—Total length, 472 mm; tail vertebræ, 225; hind foot, 46; ear, 29 (in dry skin).

Cranial measurements of type.—Total length, 54 mm; basal length, 46.5; basilar length of Hensel, 44; zygomatic breadth, 27; upper molar series on crowns, 10.

Hodomys vetulus sp. nov. (Text fig. 3, *c* and *d*.)

Type from Tehuacan, Puebla, Mexico. No. 53,656 ♂ ad., U. S. Nat. Museum, Department of Agriculture Collection. Collected May 8, 1893, by E. W. Nelson. (Original number 4,784.)

General characters.—This animal bears no close resemblance to any known species except *Hodomys alleni* from Mazanillo (on the opposite side of Mexico), with which it shares the remarkable S-shaped last lower molar, peculiar audital bullæ, closed sphenopalatine vacuities, and many other characters. It is much smaller than *alleni*, has a bicolor instead of concolor tail, white instead of dusky hind feet, and differs also in cranial characters.

Color.—Upper parts dull fulvous from point between eyes to rump, plentifully mixed with black hairs; face gray; fore and hind feet white; tail bicolor, blackish above, soiled white beneath; under parts whitish, clouded from plumbeous under fur and washed with dull fulvous on sides of belly (and in one specimen on breast also).

Cranial characters.—Skull similar to that of *Hodomys alleni*, but smaller, shorter, less angular, and differing further in the following characters: rostrum and nasals shorter; nasals narrower posteriorly; interparietal shield less quadrate and more elongated transversely; incisive foramina shorter (falling considerably short of plane of m^1); palate proportionally longer; audital bullæ smaller; frontals broader posteriorly and less upturned along orbital margins; mandible less expanded posteriorly.

Dental characters.—Similar to *H. alleni*, but m^1 broader and shorter; the antero-external loop larger; postero-internal loop less completely divided; m_3 broader and shorter; more perfectly S-shaped, and without trace of antero-external sulcus.

Measurements (taken in flesh).—Type: Total length, 380 mm; tail vertebræ, 166; hind foot, 38. Ear from anterior base, 29 (in dry skin). Average measurements of 4 specimens from type locality: Total length, 365; tail vertebræ, 163; hind foot, 38.

Cranial measurements of type.—Total length, 47; basal length, 41; basilar length of Hensel, 39; zygomatic breadth, 25; upper molar series on crowns, 9.

Mr. Nelson states that this species is rather common about the foot of the low cliffs and rocky ledges on the hillsides east of Tehuacan, and that it lives in dense patches of *Agave*. He says: "It has the habit of making roads about its haunts, very much after the manner of *N. alleni*. Well-defined trails were found leading along the hillside from rock to rock or to the cover of *Agave* patches, and between neighboring groups of these plants. Under the shelter of a maguey patch a network of trails could be frequently found by forcing ones way among the spiny leaves. Like *N. alleni*, these animals did not take grain bait, and were caught by placing traps in their trails. No signs of the nest building habit, so common in the genus *Neotoma*, were observed."

Genus **XENOMYS** Merriam.

(Pl. IX, figs. 10-13; and text fig. 3, *e* and *f*, and fig. 4.)

Xenomys Merriam, Proc. Biol. Soc. Washington, VII, Sept. 1892, 159-163 (Type from Hacienda Magdalena, Colima, Mexico).

Generic characters.—Skull murine; short; audital bullæ greatly enlarged and inflated, broader anteriorly than posteriorly, wheel-shaped, parallel, carotid foramen posterior to middle of bulla and inconspicuous; squamosal not reaching supraoccipital but ending anterior to plane of auditory meatus, except the slender posterior spicule which reaches over meatus to mastoid; orbital margins of frontals produced laterally forming projecting supraorbital beads; lachrymals large; interparietal large and transversely elongated; premaxillæ produced anteriorly forming a wing-like extension on each side of anterior nares; angle of mandible short, moderately expanded vertically, inflected; condylar ramus long and high, overtopping coronoid process; molars large and heavy; truly rooted (upper with three roots each; lower with two roots each); crowns prismatic, made up of broadly rounded alternating salient loops and open re-entrant angles or interspaces; crown of m_3 , shaped in general like letter S but somewhat angular (fig. 4).

Externally, *Xenomys* resembles a small, highly colored wood rat, with rather soft pelage and a large whitish spot over each eye. The tail is nearly as long as the head and body. Nothing is known of the habits of these animals, except that they are nocturnal and live in hollow trees.

Xenomys agrees with *Hodomys* in having the mandibular symphysis rather long, straight and upturned; the condylar ramus very long,

and curving strongly upward and inward; the coronoid notch nearly vertical; the angle inflected (but not produced backward so far as in *Hodomys*); the incisors slender, meeting in a single sharp point; the molars very large; and m_3 , shaped like the letter S. *Xenomys* differs from *Hodomys* in having the mandible greatly reduced posteriorly; the condylar ramus longer and more slender, overtopping the coronoid, and both coronoid and infracondylar notches larger at the expense of the posterior part of the ramus, which is greatly reduced thereby. In *Xenomys* the anterior base of the coronoid process arises more anteriorly from the horizontal ramus, hiding the whole of the last molar and posterior loop of the middle molar, while in *Hodomys* it arises further back, exposing the anterior loop of the last molar. (In *Neotoma* the line commonly falls between m_2 and m_3 ; in *Ptyssophorus*, according to Ameghino's figure, it apparently is further back, exposing most of m_3 .)

Xenomys nelsoni Merriam. (Pl. IX, figs. 10-13; and text figs. 3, *e* and *f*, and fig. 4.)

Xenomys nelsoni Merriam, Proc. Biol. Soc. Washington, VII, Sept. 1892, 161-163. Type from Hacienda Magdalena, Colima, Mexico.

General characters.—Size about that of a half or two-thirds grown rat, or nearly equaling *Neotoma mexicana*; tail a little shorter than head and body, well haired, particularly above; face ornamented by a distinct whitish spot over each eye and a less distinct one under each ear; color of upper parts rich fulvous; under parts white; ears about half as long as the head and nearly naked (sparsely clothed with fine, inconspicuous hairs); whiskers reaching back to shoulders; fur soft.

Color.—Upper parts fulvous or tawny-rufous, palest on the head and brightest over the rump, flanks, and hips; back sparsely mixed with black-tipped hairs; an ill-defined dusky ring around each eye, above which is a whitish spot about as large as the eye itself; a less distinct whitish spot just below the inferior root of the ear; upper lips white, the white color extending up on the cheeks more than half-way to the eyes; sides of face below eyes and ears washed with fulvous; whiskers blackish; tail concolor, dark umber-brown all round; upper surfaces of feet whitish, more or less clouded with dusky (varying considerably in the three specimens); under parts creamy white to the very roots of the hairs except along the sides of the belly, where the basal part of the fur is plumbeous; line of

demarcation between colors of upper and lower parts everywhere sharp and distinct.

Cranial and dental characters.—Most of the cranial and dental characters have been already given under the head of the genus and need not be here repeated. The rostrum is short and the ascending branches of the premaxillæ hardly reach as far back as the nasals. Molars large and broad; m^1 more than half as broad as long and

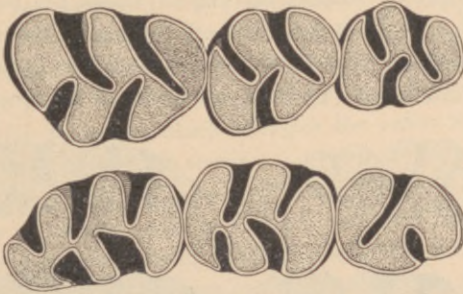


Fig. 4. *Xenomys nelsoni* Type. Upper and lower molar crowns. (x 7.)

curving outward anteriorly; m^1 with anterior half bent strongly outward, the anterior loop looking outward instead of forward; m^3 , S-shaped, with a small and nearly closed triangle on outer side of convexity, thus having an anterior loop projecting inward, a posterior loop projecting outward, and a re-entrant angle or loop on each side, the outer of which is the shallower and more posterior in position; both of the re-entrant angles are directed obliquely forward as well as toward the opposite side of the tooth (for further details see fig. 4).

Measurements of type (taken in flesh).—Total length, 300 mm; tail vertebrae, 143; hind foot, 30; ear 22 (in dry skin).

Cranial measurements of type.—Total length, 40.5; basal length, 35; basilar length of Hensel, 33; zygomatic breadth, 21; upper molar series on crowns, 8.

Genus NEOTOMA Say and Ord.

Neotoma Say and Ord, Journ. Acad. Nat. Sci. Phila., IV, pt. 2, 1825, 345, 346, pls. XXI and XXII. Type *Mus floridana* Ord, from eastern Florida.

*Generic characters.*¹¹—Crown of m^3 composed of two transverse

¹¹ The characters here given are selected with reference to antithesis with *Ptyssophorus*, *Hodomys*, and *Xenomys*.

loops (with the addition in rare cases of a narrow antero-external loop), never S-shaped (fig. 5); m^1 and m^2 with middle loop undivided (reaching completely across tooth); molar series relatively short; condylar ramus low and directed obliquely backward; coronoid notch horizontal or nearly so [nearly vertical in *Xenomys* and *Hodomys*]; angle of mandible only moderately inflected; symphysis relatively short and sloping strongly forward.

The accompanying illustration (fig. 5) shows the two extremes in pattern of m^1 , and differences in the crowns of the other molars also. The dominant type of m^1 throughout the genus is similar to that of *N. tenuicauda* (fig. 5, *c*), a member of the *mexicana* series.



Fig. 5. *a* and *c*. Upper molar crowns. *b* and *d*. Lower molar crowns.

a. b. *Neotoma desertorum* Merriam. Death Valley, Calif. No. 34138. ♂. (x 5.) *c. d.* *Neotoma tenuicauda* Merriam. Sierra Nevada, Jalisco, Mexico. 45629 ♀. Type. (x 5).

Neotoma is not in any sense a highly specialized type, but it is a very compact genus, its most divergent branches hardly meriting subgeneric recognition. Some of its members point strongly toward derivation from *Hodomys*, as may be seen in the *Nectomys*-like auditory bullæ and other cranial characters of *Neotoma pennsylvanica*, and in the high, upturned condyle of the *mexicana* group, but the immediate antecedent forms leading up to *Neotoma* from *Hodomys*, or some similar type, are not known. The oldest forms of which we have any knowledge, those from the cave deposits of Missouri, Kentucky, Virginia, and Pennsylvania, are fully modernized species of *Neotoma* proper.

Of the living species, *N. pennsylvanica* may be regarded as the most primitive, since it possesses several characters, not shared by the others, that point back to *Hodomys*. Moreover, *pennsylvanica* is more nearly intermediate between the two subgenera—*Neotoma* proper and *Teonoma*—than any other known species, indicating that

the differentiation of the trunk line into these two groups proceeded from a form at least very similar to *pennsylvanica*. *N. pennsylvanica* resembles *Hodomys* in the peculiar shape of the audital bullæ (which are abruptly narrowed anteriorly), in the nearly closed sphenopalatine vacuities, in the posterior production of the angle of the madible, and in the strong inward and upward curvature of the condylar ramus. It resembles *Teonoma* in the form of the sagittal area, which is kite-shaped, narrow, sharply angular, broadest far back (on or near plane of interparietal), whence its sides curve abruptly inward and backward to the sides of the interparietal shield. It resembles *Teonoma* further in the tendency to closure of the sphenopalatine vacuities,¹² the great length of the rostrum, and the presence of a long trough-like depression which occupies the entire length of the frontal and hinder part of the nasals.

That the absence of the sphenopalatine vacuity is a primitive character—or perhaps it would be better to say, that the presence of a vacuity is a modern character—is indicated by the following facts: (1) The ancestral genus *Hodomys* has no vacuity; (2) *Xenomys*, an early offshoot from the primitive *Neotomine* stem, has very small vacuities; (3) *Teonoma*, an older type than *Neotoma* proper, has the vacuities closed or partly open; (4) *Neotoma pennsylvanica*, the least differentiated known member of the modern genus, has the vacuities partly closed; and finally (5) some of the modernized species have the vacuities closed in early life though fully open in the adult.¹³

In its geographic distribution the genus is restricted, so far as known, to North America north of Dueñas, Guatemala.¹⁴ The species are most numerous in Mexico and the southern United States. The total number of species here recognized, including the subfossil *N. magister*, is 22, in addition to which 10 subspecies are admitted. It is probable that a few additional species will be added, and that some of the members of the *mexicana* group will be reduced to sub-specific rank.

¹² But there is this difference: The thin wing or lamella of bone which closes or partly closes the vacuity in *Teonoma* is derived wholly from the palatine, while in *N. pennsylvanica* it is made up almost equally of palatine and pterygoid. In the latter species the suture between the palatine and pterygoid moieties is on the plane of the suture between the basisphenoid and presphenoid.

¹³ Allen has recently shown this to be the case in *N. micropus* (Bull. Am. Mus. Nat. Hist., N. Y., VI, 1894, 239).

¹⁴ The Guatemala species (*N. ferruginea* Tomes) has not been seen by me and may not be a true *Neotoma*.

In 1843, J. E. Gray separated the bushy tailed from the round tailed species, proposing the name *Teonoma* for the former. In a recent communication I adopted the name for a subgenus, and defined the resulting two subgenera as follows:—

Subgenus NEOTOMA Say and Ord, 1825.

Neotoma Say and Ord, Journ. Acad. Nat. Sci. Phila., IV, pt. 2, 1825, 345, 346, pl. XXI, XXII. Type *Mus floridana* Ord, from eastern Florida.

Tail commonly round, scant-haired and tapering, but in one species moderately bushy; hind feet small or moderate.

Rostrum of moderate length, not more than one-third the length of cranium; sagittal area usually rounded, the broadest part always considerably anterior to plane of interparietal, whence the sides curve gradually backward to interparietal shield; sphenopalatine vacuities always open.

Subgenus TEONOMA Gray, 1843.

Teonoma Gray, List Spec. Mamm. British Museum, 1843, 117. Type *Neotoma cinerea drummondi* (Richardson), from the Rocky Mts. in lat. 57°N.

Tail very large, bushy, and somewhat distichous, like a squirrel's; hind feet very large.

Rostrum much elongated, measuring more than one-third the total length of cranium; posterior roots of zygomatica widely spreading; sagittal area long, narrow, and sharply angular, its broadest part far back, on or nearly on plane of anterior border of interparietal, whence the sides bend abruptly back to interparietal shield; sphenopalatine vacuities closed or open.

In the same communication I proposed, for convenience in arranging the species, to subdivide *Neotoma* proper into four minor groups, "none of which is worthy of the distinction of subgeneric rank. These groups may be designated, from a typical species in each, as follows: (1) the *leucodon* group; (2) the *mexicana* group; (3) the *desertorum* group, and (4) the *arizonæ* group."

In a recent paper on *Cranial Variations in Neotoma micropus*,¹⁵ Dr. J. A. Allen criticises my use of the color of the teeth as a subordinate character, and goes on to state that the range of individual variation in color in his series of *N. micropus* "covers the whole range of variation for the genus." His subsequent remarks show

¹⁵ Bull. Am. Mus. Nat. Hist., N. Y., VI, Aug. 3, 1894, 243, 244.

a total misapprehension of my meaning, for instead of speaking of the color of the teeth themselves he refers to the dirty coating on the outside of the teeth. He says: "The black coloring consists to a large extent of a superficial incrustation which tends to scale off in flakes in the prepared skull, and its absence apparently may be due sometimes to removal in the process of cleaning the skull for the cabinet. In other words, the blackness is to some extent an accidental or pathological condition, due probably more or less to the particular character of the food or to the health of the animal." But for this perverse interpretation of my very plain statement it would not be necessary to explain that when I said "color of teeth white or nearly white" I meant the teeth—the osteodentine and enamel—not the dirty deposit that sometimes collects on the outside of the teeth. But after all, the peculiarity is one of little consequence and was only mentioned by me after enumerating the characters by which members of the *leucodon*¹⁶ group may be distinguished from others.

The following list of the 22 species and 10 subspecies recognized by me contains under each name: (1) reference to the original description; (2) the principal synonymy; (3) the type locality; (4) the known geographic distribution.

Descriptions of the species are not added because they are included in a more formal and fully illustrated revision of the genus which will be published later.

***Neotoma leucodon* Merriam.**

Neotoma leucodon Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 120, 121.

Type locality: San Luis Potosi, Mexico.

Geographic distribution.—Upper part of Lower Sonoran Zone in Central Mexico, from Berriozabal, Zacatecas, easterly to southern San Luis Potosi, and thence southeast to Perote, Vera Cruz.

***Neotoma latifrons* Merriam.**

Neotoma latifrons Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 121.

Type locality: Querendaro, Michoacan, Mexico.

Geographic distribution.—Valley of Querendaro, south side of Lake Cuitzeo, Michoacan, Mexico (range unknown.)

¹⁶ Named, as stated, after *N. leucodon*, a central member of the group, not because all the species have white teeth.

Neotoma micropus Baird.

Neotoma micropus Baird, Proc. Acad. Nat. Sci. Phila., April, 1855, 333 (from Charco Escondido, Tamaulipas,¹⁷ Mammals of N. Am., 1857, 492-495. Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, No. 2, June, 1891, 282-285.

Neotoma micropus canescens Allen, Bull. Am. Mus. Nat. Hist., III, No. 2, June, 1891, 285-287 (from N. Beaver Creek, Pan Handle of Oklahoma).

Type locality: Charco Escondido,¹⁷ Tamaulipas, Mexico (100 kilometers or 62 miles west of Matamoros, and 44 kilometers or 27 miles south of Reynosa.)

Geographic distribution.—Eastern subdivision of Lower Sonoran Zone from San Fernando, Tamaulipas, northward to the Pan Handle of Oklahoma, and westward to the Staked Plains; in the Rio Grande Valley west to El Paso; and in the Pecos Valley to Eddy, New Mexico.

Neotoma baileyi Merriam.

Neotoma baileyi Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 123.

Type locality: Valentine, Nebraska.

Geographic distribution.—Probably Great Plains subdivision of Upper Sonoran Zone in southern South Dakota, Nebraska, and Kansas.

Neotoma floridana (Ord).

Mus floridana Ord, Bull. Soc. Philomath, Dec. 1818, 181-182

Type locality: Florida.

Geographic distribution.—Austroriparian Fauna of South Atlantic and Gulf Coasts and lower Mississippi Valley.

Neotoma pennsylvanica Stone.

Neotoma pennsylvanica Stone, Proc. Acad. Nat. Sci. Phila., Feb. 1893, 16-18.

Type locality: South Mountain, Cumberland Co., Pennsylvania.

Geographic distribution.—Allegheny Mountain region of Pennsylvania, and probably the whole of the southern Alleghenies; north to southern New York.

Neotoma magister Baird.

Neotoma magister Baird, Mam. N. Am., 1857, 498.

Type locality: Bone Caves near Carlisle (between North and South Mountains), Pennsylvania.

¹⁷ Two specimens were mentioned in the original description, an adult male from Charco Escondido, and a very young specimen in poor condition from Santa Rosalia, Chihuahua. The original description is based wholly on the Charco Escondido specimen, which, therefore, must be taken as the type of the species. The Santa Rosalia animal is somewhat aberrant, as shown by additional specimens.

Geographic distribution.—Pleistocene cave deposits of Pennsylvania and Virginia. Remains assumed to belong to the same species have been found in caves in Kentucky and in the Ozark Hills of Missouri.

***Neotoma mexicana* Baird.**

Neotoma mexicana Baird, Proc. Acad. Nat. Sci. Phila., VII, 1855, 333.

Type locality: [Mountains] near Chihuahua, Mexico.

Geographic distribution.—Hills and lower mountain slopes (usually pine covered) of Transition Zone in eastern New Mexico, southwestern Texas (Davis Mountains to Paisano), and Chihuahua, Mexico.

***Neotoma mexicana bullata* Merriam.**

Neotoma mexicana bullata Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 122-123.

Type locality: Santa Catalina Mountains, Arizona.

Geographic distribution.—Known only from the Santa Catalina Mountains in southern Arizona.

***Neotoma pinetorum* Merriam.**

Neotoma pinetorum Merriam, Proc. Biol. Soc. Wash., VIII, July 31, 1893, 111, 112.

Type locality: San Francisco Mountain, Arizona.

Geographic distribution.—The pine covered plateau of Arizona (Transition Zone).

***Neotoma tenuicauda* Merriam.**

Neotoma tenuicauda Merriam, Proc. Biol. Soc. Wash., VII, Sept. 29, 1892, 169, 170.

Type locality: North Slope of Sierra Nevada de Colima.

Geographic distribution.—Sierra Nevada de Colima, Jalisco, Mexico (probably in Transition Zone).

***Neotoma orizabæ* Merriam.**

Neotoma orizabæ Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 122.

Type locality: Mt. Orizaba, Puebla, Mexico.

Geographic distribution.—Mt. Orizaba, Mt. Malinche, and Cofre de Perote, Mexico (probably in Transition Zone).

***Neotoma fulviventris* Merriam.**

Neotoma fulviventris Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 121, 122.

Type locality: Toluca Valley, Mexico.

Geographic distribution.—Toluca Valley, Mexico.

Neotoma torquata Ward.

Neotoma torquata Ward, Am. Naturalist, XXV, Feb. 1891, 160, 161.

Type locality: [An abandoned tunnel] between Tetela del Volcan and Zacualpan Amilpas, Morelos, Mexico.

Geographic distribution.—Mountains of the states of Mexico and Morelos (south of the valleys of Mexico and Toluca).

Neotoma ferruginea Tomes.

Neotoma ferruginea Tomes, Proc. Zool. Soc. London, 1861, 282-284.

Type locality: Dueñas, Guatemala.

Geographic distribution.—Region about Dueñas, Guatemala. Range unknown.

NOTE.—I have not seen *N. ferruginea*; it may not belong here at all.

Neotoma fallax Merriam.

Neotoma fallax Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 123, 124.

Type locality: Gold Hill, Boulder Co., Colorado.

Geographic distribution.—Eastern base of Rocky Mountains in Colorado (up to about 7,000 feet altitude, where it is replaced by *N. orolestes*).

Neotoma bryanti Merriam.

Neotoma bryanti Merriam, Am. Nat. XXI, No. 2, Feb. 1887, 191-193.

Type locality: Cerros Island, Lower California.

Geographic distribution.—Cerros Island, Mexico (off Lower California).

Neotoma fuscipes Baird.

Neotoma fuscipes (Cooper MS.) Baird, Mam. N. Am., 1857, 495, 496 (from Petaluma, Calif.).

Neotoma monochroura Rhoads, Am. Naturalist, XXVIII, Jan. 1894, 67, 68 (from Grants Pass, Josephine Co., Oregon).

Neotoma splendens True, Proc. U. S. Nat. Museum, XVII, No. 1006, 1, 2 [Author's separates issued June 27, 1894], (from Marin Co., Calif.).

Type locality: Petaluma, Sonoma Co., California.

Geographic distribution.—Coast region of California and Oregon, from a little south of Monterey Bay northward to the Columbia River (Transition Zone).

Neotoma fuscipes macrotis (Thomas).

Neotoma macrotis Thomas, Ann. and Mag. Nat. Hist., 6th ser., XII, Sept. 1893, 234, 235 (from San Diego, California).

Neotoma macrotis simplex True, Proc. U. S. Nat. Museum, XVII, No. 1006, 2 [Author's separates issued June 27, 1894], (from Old Ft. Tejon, California).

Type locality: San Diego, California.

Geographic distribution.—Coast region (including coast ranges) of California, south of Monterey Bay (in upper Sonoran and Transition Zones).

Neotoma fuscipes streator Merriam.

Neotoma fuscipes streator Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 124.

Type locality: Carbondale, Amador Co., California.

Geographic distribution.—West slope of Sierra Nevada in California (including mountain region generally of northeast California except higher elevations.) Upper Sonoran and Transition Zones.

Neotoma fuscipes dispar Merriam.

Neotoma fuscipes dispar Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 124, 125.

Type locality: Lone Pine, Owens Valley, California.

Geographic distribution.—East base of Sierra Nevada in Owens Valley, California (and probably along western edge of Mohave Desert also). Upper Sonoran Zone.

Neotoma desertorum Merriam.

Neotoma desertorum Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 125, 126.

Type locality: Furnace Creek, Death Valley, California.

Geographic distribution.—Mohave and Colorado Deserts and Sonoran deserts generally of eastern California, Nevada, and western Utah (north to East Humboldt Valley, Nevada, and Kelton, Utah.) Upper and lower Sonoran Zones.

Neotoma desertorum sola Merriam.

Neotoma desertorum sola Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 126.

Type locality: San Emigdio, Kern Co., California.

Geographic distribution.—Head of San Joaquin Valley, California.

Neotoma intermedia Rhoads.

Neotoma intermedia Rhoads, Am. Naturalist, XXVIII, Jan. 1, 1894, 69, 70. (from Dulzura, San Diego Co., California).

Neotoma californica Price, Proc. Calif. Acad. Sci., 2d ser., III, May 9, 1894, 154-156, pl. XI (from Bear Valley, San Benito Co., California).

Neotoma intermedia gilva Rhoads, Am. Naturalist, XXVIII, Jan. 1, 1894, 69 (from Banning, California).

Neotoma venusta True, Proc. U. S. Nat. Museum, XVII, No. 1006, 2 [Author's separates issued June 27th, 1894]. (from Carrizo Creek, San Diego Co., California).

Type locality: Dulzura, San Diego Co., California.

Geographic distribution.—The typical form inhabits the valleys and lower slopes of the coast ranges of California south of Monterey Bay (specimens examined from Bear Valley, San Benito Co.; Priest Valley, Monterey Co.; San Luis Obispo; San Fernando; San Bernardino Mt. and Valley; San Jacinto Valley, and Dulzura). A slightly paler form (subspecies *gilva* Rhoads = *venusta* True) inhabits San Geronio Pass and the western edge of the Colorado Desert (specimens examined from Whitewater Ranch, Palm Springs, Cabazon, Carrizo Creek, Baregas Spring, and Vallecitas). Upper Sonoran.

***Neotoma intermedia melanura* Merriam.**

Neotoma intermedia melanura Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 126, 127.

Type locality: Ortiz, Sonora, Mexico.

Geographic distribution.—Sonora, Mexico, near west base of Sierra Madre. Upper Sonoran.

***Neotoma intermedia albigula* Hartley.**

Neotoma albigula Hartley, Proc. Cal. Acad. Sci., 2d ser., III, May 9, 1894, 157-159, pl. XII.

Type locality: Vicinity of Fort Lowell, Arizona.

Geographic distribution.—Lower Sonoran Zone in southern and western Arizona.

***Neotoma intermedia angusticeps* Merriam.**

Neotoma intermedia angusticeps Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 127.

Type locality: S. W. corner Grant Co., New Mexico (only 4 miles from Mexican boundary).

Geographic distribution.—Southwestern New Mexico, and doubtless also adjacent valleys of N. W. Chihuahua, Mexico (in Lower Sonoran Zone).

***Neotoma arizonæ* Merriam.**

Neotoma arizonæ Merriam, Proc. Biol. Soc. Wash., VIII, July 31, 1893, 110, 111.

?*Neotoma lepida* Thomas, Ann. and Mag. Nat. Hist., 6th ser., XII, Sept. 1893, 235 (from Utah).

Type locality: Keams Cañon, Apache Co., Arizona.

Geographic distribution.—Tusayan or Moki region in northeastern Arizona, northwestern New Mexico, southeastern Utah, and probably southwestern Colorado. Sonoran.

Neotoma cinerea (Ord.)

"*Mus cinereus* Ord, Guthrie's Geography, 2d Am. Ed., II, 1815, 292"
(based on description of Lewis and Clark, Paul Allen Ed., 1814, Vol. I, pp. 289, 290.)

Type locality: Near Great Falls, Montana.

Geographic distribution.—Northern Rocky Mt. region in Transition and Boreal Zones, from Utah and Wyoming northward; east to Black Hills and plains of North Dakota west of Missouri River; west in southern British Columbia to Cascade Range, and south throughout the Sierra Nevada to Mt. Whitney in southern California.

Neotoma cinerea occidentalis (Baird).

Neotoma occidentalis (Cooper MS.) Baird, Proc. Acad. Nat. Sci. Phila., VII, 1855, 335.

Neotoma cinerea occidentalis Merriam, Mammals of Idaho, N. Am. Fauna, No. 5, Aug. 1891, 58.

Type locality: Shoalwater Bay, Washington.

Geographic distribution.—Pacific coast region of Oregon and Washington and thence easterly over the lava beds to the Snake Plains of east-central Idaho (Transition and Upper Sonoran Zones).

Neotoma cinerea drummondii (Richardson).

Myoxus drummondii Richardson, Zool. Journ., III, 1828, 517, 518.

Neotoma drummondii Richardson, Fauna Boreali-Am., 1829, 137-140.

Type locality: Rocky Mts., British Columbia (lat. 57°).

Geographic distribution.—Eastern British Columbia and adjacent parts of western Canada north of the range of *cinerea*. Exact distribution unknown. Boreal (probably Hudsonian).

Neotoma orolestes Merriam.

Neotoma orolestes Merriam, Proc. Biol. Soc. Wash., IX, July 2, 1894, 128.

Type locality: Saguache Valley (20 miles west of Saguache, Colorado).

Geographic distribution.—Rocky Mts. of Colorado and New Mexico (southeast of range of *N. cinerea*). Boreal.

SPECIES AND SUBSPECIES OF NEOTOMA.

	leucodon group	{	leucodon	
			latifrons	
			micropus	
			baileyi	
			floridana	
			pennsylvanica	
			magister	
	mexicana group	{	mexicana	
			" bullata	
			pinetorum	
			tenuicauda	
			orizabæ	
			fulviventer	
Subgenus NEOTOMA				fallax
				fuscipes
				" macrotis
				" streatoris
				" dispar
		bryanti		
		? ferruginea ¹⁸		
		? torquata ¹⁸		
	desertorum group	{	desertorum	
			" sola	
			intermedia	
			" melanura	
			" albigula	
		" angusticeps		
	arizonæ group	{	arizonæ	
	cinerea group	{	cinerea	
			" occidentalis	
			" drummondi	
Subgenus TEONOMA				orolestes

¹⁸ *N. torquata* and *ferruginea* I have not seen, hence their relations may not be as here indicated.

ILLUSTRATIONS.

PLATE IX.

(Figures natural size.)

- Figs. 1-4, 7, 8. *Hodomys alleni*, ♀, 44,631, Manzanillo, Mexico.
 1, skull from above; 2, same from left side; 3, same from below; 4, mandible from left side; 7, same from below; 8, same from above.
- Figs. 5, 6, 9. *Neotoma*.
 5, mandible from left side; 6, same from below; 9, same from above.
- Figs. 10-13. *Xenomys nelsoni*, ♂, 45,287, Hacienda Magdalena, Colima, Mexico.
 10, skull from above; 11, same from left side; 12, same from below; 13, mandible from left side.

TEXT FIGURES.

- Fig. 1, *a, b, c. Ptyssophorus elegans* (from Ameghino).
a, right ramus of mandible, outer side. Nat size.
b, " " " " inner side. Enlarged.
c, crowns of right lower molars.
d, *Sigmodon hispidus*, crowns of right lower molars. Enlarged.
e, *Hodomys alleni*, " " " " " " " "
- Fig. 2. *Tretomys atavus*, left upper molars enlarged (from Ameghino).
- Fig. 3, *a* and *b, Hodomys alleni*.
a, crowns of left upper molars. (x 5.)
b, " " " lower molars.
c and *d. Hodomys vetulus*.
c, crowns of left upper molars. (x 5.)
d, " " " lower molars.
e and *f. Xenomys nelsoni*.
e, crowns of left upper molars. (x 5.)
f, " " " lower molars.
- Fig. 4. *Xenomys nelsoni*. Type No. $\frac{45286}{33281}$, ♂, ad.
 Hacienda Magdalena, Colima, Mexico.
a, upper molar series. (x 7.)
b, lower molar series.

Fig. 5, *a* and *b*. *Neotoma desertorum*. Death Valley, California,
No. 34,138, ♂, ad. (x 5.)

a, upper molar series.

b, lower molar series.

c and *d*. *Neotoma tenuicauda*. Type No. 45,629, ♀.

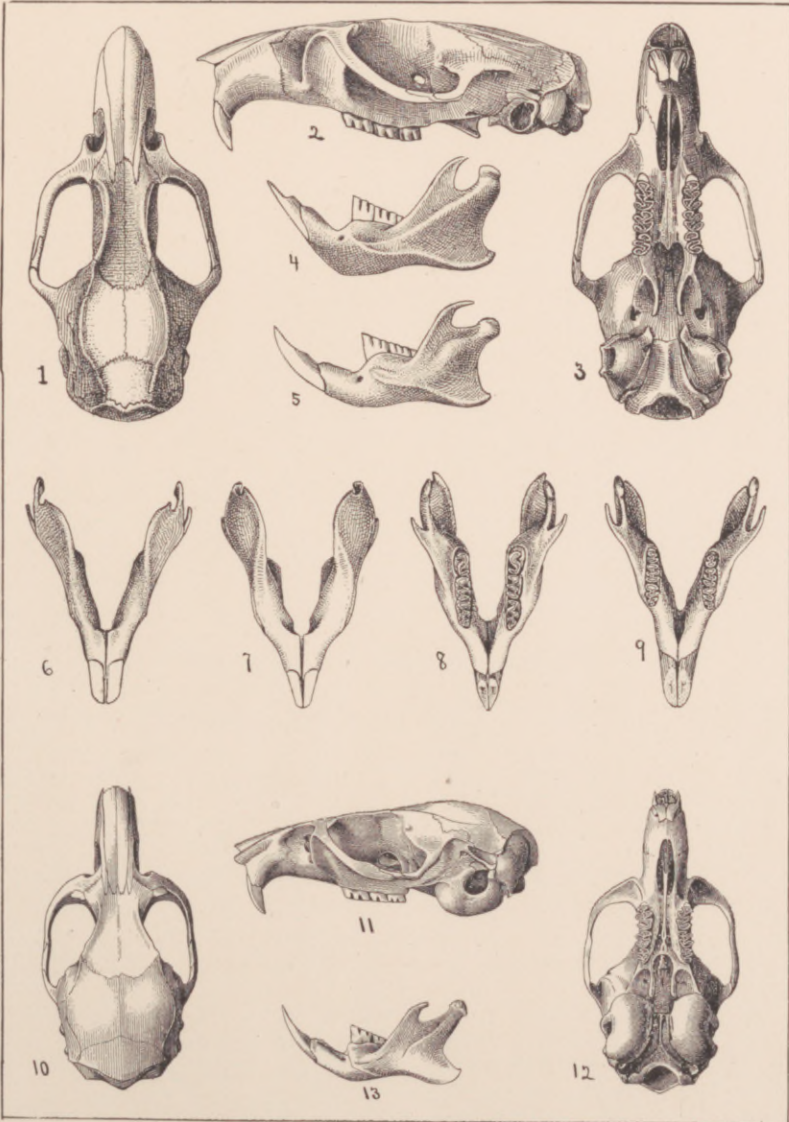
Sierra Nevada de Colima, Jalisco, Mexico.

(x 5.)

c, upper molar series.

d, lower molar series.

[NOTE.—The accompanying illustrations belong to the U. S. Department of Agriculture. They are here used by courtesy of Dr. Chas. W. Dabney, Jr., Asst. Secretary of Agriculture.]



MERRIAM, THE NEOTOMINÆ.

