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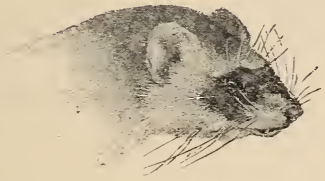

Descriptions of fourteen new species and one new genus of North American Mammals

By Dr. C. Hart Merriam

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U. S. Department of Agriculture, *July* 17, 1889.

Sir: I have the honor to transmit herewith No. 2 of North American Fauna. It contains descriptions of a new genus, twelve new species, and one new sub-species; and also a diagnosis of the genus *Onychomys*, and a synopsis of the known forms.

Respectfully,

C. Hart Merriam,
Chief of Division of
Ornithology and Mammalogy.

Hon. J. M. Rusk,
Secretary of Agriculture.

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No. 2. NORTH AMERICAN FAUNA. October, 1889.

DESCRIPTIONS OF TWO NEW SPECIES AND ONE NEW SUBSPECIES OF GRASSHOPPER MOUSE,

WITH A DIAGNOSIS OF THE GENUS ONYCHOMYS, AND A SYNOPSIS OF THE SPECIES AND SUBSPECIES.

By C. Hart Merriam, M. D.

A. DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES.

ONYCHOMYS LONGIPES sp. nov.

(Texas Grasshopper Mouse.)

Type $\frac{3207}{3839}$ ♀ ad. Merriam Collection. Concho County, Texas, March 11, 1887. Collected by William Lloyd.

Measurements (taken in the flesh by collector).—Total length, 190^{mm}; tail, 48 [this measurement seems to be too short]; hind foot, 25; ear from crown, 13 (measured from dry skin).

General characters.—Size larger than that of the other known representatives of the genus, with larger and broader ears, and much longer hind feet. Ears less hairy than in *O. leucogaster*, with the lanuginous tuft at base less apparent; tail longer and more slender.

Color.—Above, mouse gray, sparingly mixed with black-tipped hairs, and with a narrow fulvous stripe along each side between the gray of the back and white of the belly, extending from the fore-legs to the root of the tail; under parts white.

Cranial characters.—Skull longer and narrower than that of *O. leucogaster* (particularly the rostral portion), with much longer nasals, and a distinct supraorbital "bead" running the full length of the frontals and there terminating abruptly. The nasals overreach the nasal branch of the premaxillaries about as far as in *leucogaster*. The incisive foramina, as in *O. leucogaster*, barely reach the anterior cusp of the first molar. The roof of the palate extends further behind the last molar than in *leucogaster*, and gives off a median blunt spine projecting into the pterygoid fossa. The palatal bones end anteriorly exactly on a line

with the interspace between the first and second molars. The presphenoid is excavated laterally to such a degree that the middle portion is reduced to a narrow bar less than one-third the width of its base. The condylar ramus is lower and more nearly horizontal than in *leucogaster*, and the angular notch is deeper. The coronoid process resembles that of *leucogaster*.

ONYCHOMYS LONGICAUDUS sp. nov.

(Long-tailed Grasshopper Mouse.)

Type $\frac{52201}{88996}$ ♂ ad. St. George, Utah, January 4, 1889. Collected by Vernon Bailey.

Measurements (taken in the flesh by the collector).—Total length, 145; tail, 55; hind foot, 20; ear from crown, 10 (measured from dry skin).

General characters.—Similar to *O. leucogaster*, but smaller, with longer and slenderer tail. Pelage longer, but not so dense. General color above, cinnamon-fawn, well mixed with black-tipped hairs.

Cranial characters.—Skull smaller and narrower than that of *O. leucogaster;* zygomatic arches less spreading; nasals less projecting behind nasal branch of premaxillaries. The coronoid and condylar processes of the mandible are shorter, and the coronoid notch is not so deep as in *leucogaster*. The presphenoid shows little or no lateral excavation. The incisive foramina do not quite reach the plane of the anterior cusp of the first molar. The shelf of the palate projects posteriorly considerably beyond the molars, and terminates in a nearly straight line without trace of a median spine.

ONYCHOMYS LEUCOGASTER MELANOPHRYS subsp. nov.

(Black-eyed Grasshopper Mouse.)

Type, $\frac{51393}{88994}$ ♂ ad. Kanab, Utah, December 22, 1888. Collected by Vernon Bailey.

Measurements (taken in the flesh by collector).—Total length, 154; tail, 41; hind foot, 21. Ear from crown 10 (measured from the dry skin).

Size of *O. leucogaster*. Ear a little smaller. Hind foot densely furred to base of toes. Color above, rich tawny cinnamon, well mixed with black-tipped hairs on the back, and brightest on the sides; a distinct black ring round the eye, broadest above. This ring is considerably broader and more conspicuous than the very narrow ring of *leucogaster*.

Cranial characters.—Skull large and broad; very similar to *O. leucogaster* in size and proportions, but with zygomatic arches less spreading posteriorly, interparietal narrower, nasals not reaching quite so far beyond the nasal branch of premaxillaries, and antorbital slit narrower. Presphenoid moderately excavated, as in *leucogaster*. The incisive foramina reach past the plane of the first cusp of the anterior molar. The condylar ramus is longer and directed more obliquely upward than in *leucogaster*, with the coronoid and infra-condylar notches deeper.

Note.—In order to render the preceding diagnoses of new forms more useful, the following brief descriptions of the skulls of the two

revious ly known species are appended for comparison, together with figures of the skull of the type of the genus (*O. leucogaster*):

Onychomys leucogaster Max.—Skull large and broad, with zygomatic arches spreading posteriorly. Antorbital slit larger than in the other known species. Palate hort, ending posteriorly in a short median spine (see figure).

Onychomys torridus Coues.—Skull small, narrow, with zygomatic arches not spreading, and vault of cranium more rounded than in any other member of the genus. Interparietal relatively large. Nasals projecting far beyond nasal branch of premaxillary. Incisive foramina very long, extending back to second cusp of first molar. Shelf of palate produced posteriorly nearly as far as in *longicaudus*, and truncated. Presphenoid slightly excavated laterally. Mandible much as in *longicaudus*, but with coronoid process more depressed and condylar ramus more slender.

B. DIAGNOSIS OF THE GENUS ONYCHOMYS.

The striking external differences which distinguish the Missouri Grasshopper Mouse from the other White-footed Mice of America (*Hesperomys* auct.) led its discoverer, Maximilian, to place it in the genus *Hypudæus* (=*Evotomys*, Coues), and led Baird to erect for its reception a separate section or subgenus, which he named *Onychomys*. Coues, the only recent monographer of the American Mice, treats *Onychomys* as a subgenus, and gives a lengthy description of its characters. Since, however, some of the statements contained in this description are erroneous, and the conclusions absurd,* and since the most important taxonomic characters are overlooked, it becomes necessary to redefine the type. A somewhat critical study of the cranial and dental characters of *Onychomys* in comparison with the other North American White-footed Mice has compelled me to raise it to full generic rank. It may be known by the following diagnosis:

Genus ONYCHOMYS Baird, 1857.

Baird, Mammals of North America, 1857, p. 457 (*sub*genus).
Type, Hypudæus leucogaster, Max. Wied, Reise in das innere Nord Amerika, II, 1841, 99–101 (from Fort Clark, Dakota).
Hesperomys auct.

First and second upper molars large and broad; third less than half the size of the second. First upper molar with two internal and three external cusps, the anterior cusp a trefoil when young, narrow, and on a line with the outside of the tooth, leaving a distinct step on the inside. Second upper molar with two internal and two external cusps, and a narrow antero-external fold. Last upper molar subcircular in outline, smaller than in *Hesperomys*, and less indented by the lateral notches.

* Coues says: "Although unmistakably a true Murine, as shown by the cranial and other fundamental characters, it nevertheless deviates much from *Mus* and *Hesperomys*, and approaches the Arvicolines. Its affinities with *Evotomys* are really close." (Monographs of North American Rodentia, 1877, p. 106.) As a matter of fact, *Onychomys* has no affinities whatever with *Evotomys*, or any other member of the Arvicoline series, its departure from *Hesperomys* being in a widely different direction.

Lower molar series much broader than in *Hesperomys*. First lower molar with an anterior, two internal, and two external cusps, and a postero-internal loop. In *Hesperomys* the anterior cusp is divided, so that there are three distinct cusps on each side. Second lower molar with two internal and two external cusps, an antero-external and a postero-internal fold. Third lower molar scarcely longer than broad, subcircular in outline, with the large posterior lobe of *Hesperomys* reduced to a slight fold of enamel, which disappears with wear.

Coronoid process of mandible well developed, rising high above the condylar ramus and directed backward in the form of a large hook (see accompanying cut). Nasals wedge-shaped, terminating posteriorly considerably behind the end of the nasal branch of the premaxillaries.

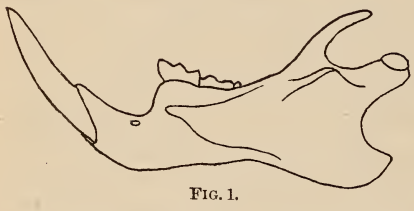

FIG. 1.

1. Lower jaw of *Onychomys leucogaster*.

FIG. 2.

2. Lower jaw of *Hesperomys leucopus*.

Body much stouter and heavier than in *Hesperomys*. Tail short, thick, and tapering to an obtuse point.

Fore feet larger than in *Hesperomys*; five-tuberculate, as usual in the Murine series. Hind feet four-tuberculate, and densely furred from heel to tubercles. Tubercles phalangeal, corresponding to the four anterior tubercles of *Hesperomys*, that is to say, the first is situated at the base of the first digit, the second at the base of the second digit, the third over the bases of the third and fourth digits together, the fourth at the base of the fifth digit. The fifth and sixth (or metatarsal) tubercles of *Hesperomys* are altogether wanting.

C. SYNOPSIS OF SPECIES AND SUBSPECIES.

(1) By External Characters.

Length, about 150^{mm}; tail, about 40; hind foot, about 21; ear from crown, 10. Color above, mouse-gray; black ring around eye inconspicuous ..... *O. leucogaster.*

Size of *O. leucogaster*. Color above, rich tawny cinnamon, brightest on the sides; black ring round eye conspicuous ..... *O. leucogaster melanophrys.*

Length, about 145^{mm}; tail, about 55; hind foot, 20; ear from crown, 10. Color above, cinnamon fawn ..... *O. longicaudus.*

Length, about 190^{mm}; tail, about 50; hind foot, 25; ear from crown, 13. Color above, mouse-gray, with a narrow fulvous stripe along the sides ..... *O. longipes.*

Length, about 135^{mm}; tail, about 45; hind foot, 20; ear from crown, 10. Color above, uniform dull tawny cinnamon; no black ring around the eye. Tail thick with a dark stripe above reaching three-fourths its length; rest of tail white. *O. torridus.*

(2) By Cranial Characters.

Palate ending posteriorly
- with a blunt median spine
  - a distinct supraorbital bead ..... *longipes.*
  - no distinct supraorbital bead ..... *leucogaster.*
- with straight or slightly convex edge
  - skull large and broad ..... *melanophrys.*
  - skull smaller and narrower
    - incisive foramina barely reach plane of first molar ..... *longicaudus.*
    - incisive foramina reach second cusp of first molar ..... *torridus.*

Cranial measurements of the known forms of the genus Onychomys.

	O. leucogaster, Fort Buford, Dakota.		Melanophrys, Kanab, Utah.		Longipes, Concho County, Texas,
	4418 ♀	4419 ♂	5893 ♂	5894 ♂	3839 ♀
Basilar length of Hensel (from foramen magnum to incisor)	22	22	22.3	21.6	23.3
Zygomatic breadth	15	15.2	15.4	15.5	15.5
Greatest parietal breadth	12.9	12.7	12.8	12.5	12.2
Interorbital constriction	4.5	4.5	5.2	4.8	4.4
Length of nasals	10.8	11.6	10.7	10.7	12.5
Incisor to post-palatal notch	12	12	11.7	11.5	12.4
Foramen magnum to incisive foramina	14.7	14.6	15	14.5	15.7
Foramen magnum to palate	9.7	10	10.2	9.9	10.6
Length of upper molar series (on alveolæ)	4.5	4.2	4.6	4.8	4.4
Length of incisive foramina	5	5.7	5	5	5.3
Length of mandible	15.5	15.8	15.7	15.3	16
Height of coronoid process from angle	6.5	7.3	6.8	6.8	7.2
Ratios to basilar length:					
Zygomatic breadth	68.1	69	69	71.7	66.6
Parietal breadth	58.9	57.7	57.3	57	52
Nasals	49	52.7	47.9	49.5	52.3
Molar series (on alveolæ)	20.4	19	20.6	22	20
Incisive foramina	22.7	25.9	22.4	23.1	22.7
Foramen magnum to incisive foramen	66	66.3	67.3	67	67.3
Foramen magnum to palate	44	45.4	45.7	45.8	45.4

	Longicaudus, St. George, Utah.			Torridus, Grant County, N. Mex.
	5895 ♀	5896 ♂	5897 ♂	2839 ♂
Basilar length of Hensel (from foramen magnum to incisor)	19.3	19.3	19.4	18.5
Zygomatic breadth	13	13	13.1	12.5
Greatest parietal breadth	11.2	11.5	11.2	11.4
Interorbital constriction	4.7	4.7	4.8	4.2
Length of nasals	10	9.5	9.7	9.6
Incisor to post-palatal notch	10.5	10.5	10.4	10
Foramen magnum to incisive foramina	13.5	13.4	13.3	12.5
Foramen magnum to palate	8.8	8.7	8.7	8.5
Length of upper molar series (on alveolæ)	3.8	3.8	3.8	3.5
Length of incisive foramina	4.3	4.3	4.4	5
Length of mandible	13.4	13.5	13.2	13.2
Height of coronoid process from angle	6.2	6.3	6.2	5.8
Ratios to basilar length:				
Zygomatic breadth	67.3	67.3	68	67.5
Parietal breadth	58	59.5	57.7	61.6
Nasals	51.8	49.2	50	51.8
Molar series (on alveolæ)	19.6	19.6	19.5	18.9
Incisive foramina	22.2	22.2	22.6	27
Foramen magnum to incisive foramen	68.3	69.4	68.5	67.5
Foramen magnum to palate	45.5	45	44.8	45.8

DESCRIPTION OF A NEW MARMOT FROM THE BLACK HILLS OF DAKOTA.

By Dr. C. Hart Merriam.

But three species of Marmots have been heretofore recognized in North America. They are *Arctomys monax* of the East; *A. flaviventer* of the West; and *A. caligatus* (=*A. pruinosus* auct.)* of the northern Rocky Mountains and Cascade Range from just within our northern border to the Arctic Circle.

The name *Arctomys flaviventer* was given by Audubon and Bachman to a specimen collected by Mr. Douglas "between western Texas and California," the exact locality being unknown. It was assumed by Baird, who has been followed by subsequent authors, that all the Marmots inhabiting the region between the Great Plains and the Pacific Ocean were specifically the same, excepting only the subarctic *A. caligatus*. This assumption was the result of the examination of scanty and defective material, for Baird remarked that a specimen which he had from The Dalles, Oregon, and which was very imperfect and in the molt, differed considerably from a specimen from the Black Hills of Dakota. Fortunately, my own collectors have succeeded in securing fine series of skins and skulls both from the Sierra Nevada Mountains in California and from the Black Hills of Dakota.

The Sierra Nevada animal agrees very closely with Audubon and Bachman's description of *A. flaviventer*, and undoubtedly is closely related to, if not identical with, their species. The Black Hills Marmot is a very different animal. It is fully a half larger than the largest specimen of the Sierra Nevada form, and differs from it wholly in coloration. Its most striking feature is the possession of a mantle or cloak of golden yellow, covering the shoulders and upper third of the back. The hairs here are fully twice the length of those on the remainder of the back and rump. The under parts are deep chestnut-red, while in the Sierra Nevada species they are bright yellow, as described by Bachman. The

**A. caligatus* Esch.=*A. pruinosus* auct. For the change of name see Tyrrell, "*The Mammalia of Canada*," Proc. Canadian Inst., 3d series, vol. VI, 1888, p. 88.

feet are concolor with the under parts, and the hairs are reddish brown to the skin, there being no black basal portion, as in *flaviventer*. The whole top of the head is black or brownish black, with a more or less distinct white transverse bar between the eyes and the nose. The tail is long and broad, distichous, reddish brown above, with a black median stripe below, in sharp contrast with the brown of the sides. The whiskers are less heavy than in *flaviventer*. The species may be known by the following description:

ARCTOMYS DACOTA sp. nov.

(Black Hills Marmot.)

Type $\frac{4478}{5113}$ ♂ ad. From Custer, Black Hills, Dakota, July 21, 1888. Collected by Vernon Bailey.

Measurements.—Total length, 670^{m}; tail, 188; hind foot, 86 (taken in flesh by the collector); ear from crown, 13 (from dry skin). Weight, 7.73 kilograms (=17 lbs).

General characters.—Size large, considerably exceeding the largest individuals of *A. flaviventer* and equaling large specimens of *A. monax*. Tail long, large, and bushy, squarely truncated at the end. Hairs of the neck and shoulders very much elongated and mixed with a thick coat of woolly underfur, forming a sort of mantle.

Color.—Above, light yellowish brown, becoming grizzled on the posterior half of the back (by the admixture of black hairs having a subapical zone of white); head black, or nearly black, grizzled on the face and sides of the neck with white and reddish brown, and interrupted between the nose and eyes by a few white hairs (indicating the position of a transverse whitish bar in other specimens); end of muzzle white all round, including tip of nose and chin; under parts uniform dull rusty chestnut, including fore legs and feet all round, except that the feet and hind legs are mixed with yellowish; tail above and on the sides dull rusty chestnut, very similar to the color of the belly; tail below with a broad median band of clear black, broadening toward the end, and protruding slightly beyond the brown of the upper surface, so that it shows from above. Whiskers and superciliary bristles black.

Cranial characters.—The skull of *Arctomys dacota* differs from that of *Arctomys flaviventer* in having the nasal branches of the premaxillaries much broader throughout, the nasal bones shorter, the interorbital breadth greater, the basisphenoid fenestrated, and the basioccipital with a subcircular median fossa. The skull, as a whole, including the zygomatic arches, is much broader, shorter, and heavier than that of *A. flaviventer*, but is in no way intermediate between *flaviventer* and *monax*.

General remarks.—Another specimen, an adult female (No. $\frac{4476}{5111}$), killed at the same place July 19, 1888, measured: Total length, 62.5; tail, 165; hind foot, 79; ear from crown, 12. The mantle is light golden-

yellow, sharply defined from the color of the posterior part of the back, and a distinct transverse bar of yellowish-white crosses the face between the eyes and nose. Several half-grown young, taken at the same place during the middle and latter part of July, agree with the above in color and in the distinctness of the mantle. The mantle is less sharply defined in the type specimen than in any of the others. Probably this is due in part to the condition or stage of growth of the pelage, and will be found to vary somewhat with season.

DESCRIPTION OF A NEW SPECIES OF PIKA (LAGOMYS SCHISTICEPS) FROM THE SIERRA NEVADA MOUNTAINS IN CALIFORNIA.

By Dr. C. Hart Merriam.

The "Little Chief Hare," or Rocky Mountain Pika (*Lagomys princeps*), was described by Dr. Richardson from a specimen collected in the Rocky Mountains near the south branch of the Mackenzie, considerably north of the United States boundary. He gave its distribution as "the Rocky Mountains, from latitude 52° to 60°" (Fauna Boreali-Americana, 1829, 227). It has been since ascertained to range southward along the summits of the Rocky Mountains to latitude 42°, increasing its altitude with the decrease in latitude till in Colorado it is not found below timber-line—about 11,000 feet.

As long ago as 1863 Dr. J. G. Cooper found a species of *Lagomys* near the limit of perpetual snow in the Sierra Nevada Mountains in California,* and it has been assumed that this animal is specifically identical with that from the Rocky Mountains. Comparison of specimens, however, shows the Sierra Nevada *Lagomys* to be a very distinct species, which may be easily distinguished from its Rocky Mountain congener by both external and cranial characters. Its most conspicuous external feature is the slate-gray color of its head, which circumstance has led me to bestow upon it the specific name *schisticeps*. It may be characterized as follows:

LAGOMYS SCHISTICEPS sp. nov.

Type, $\frac{47255}{53176}$ ♂ ad. From Donner, California, June 9, 1883. Charles A. Allen.

Measurements.—Total length, 188mm; tail, 9.5 (taken in flesh by collector). Ears from crown, 16; hind foot, 29.5 (taken from dry skin).

Color.—Entire upper surface of head slate-gray, in striking contrast to the yellowish brown of the same parts in *L. princeps*. The slate-gray of the head extends from the nose to the nape, where it gradually shades into the grayish brown of the back; rest of upper parts strongly suffused with fulvous, which is most intense along the sides near the

* Proc. Cal. Acad. Sci., III, 1863, 69; also IV, 1868, 6.

belly; the black-tipped hairs are not so numerous as in *L. princeps*, and are more uniformly distributed, with no tendency to form a dark patch on the lower part of the back, as is usually the case in the latter species. Belly and upper surfaces of feet whitish, washed with buff or pale fulvous, deepest on the pectoral region. Under fur slate-black; soles of hind feet dusky; of fore feet, silky yellowish white; ears, whiskers, toe-pads, and character of fur precisely as in *L. princeps*.

Cranial characters.—Compared with *L. princeps*, the skull of *L. schisticeps* presents several excellent specific characters. Viewed from above, the preorbital portion is shorter and more obtuse, with consequent shortening of the nasal bones. The intermastoid breadth is greater, and the posterior part of the calvarium is broader and *more obtusely rounded*. The supraoccipital takes part in the formation of the vault of the cranium, where it appears as a narrow bridge between the mastoids, with a smooth face continuous with the superior surface of the skull and nearly at right angle to its vertical plane. In the type specimen (No. 5376 ♂) this horizontal strip of the supraoccipital is broadest in the middle, where it attains a breadth of two and a half millimeters. In the seven skulls of *L. princeps* examined the supraoccipital does not appear on the superior surface of the cranium, except to take part in the formation of the lambdoidal crest, which is obsolete in *L. schisticeps*.

Viewed from beneath, the most striking difference between the two species becomes apparent, as may be seen from the accompanying figures. In *L. princeps* the palatine fossa is broadly pyriform and the anterior border of the palatal bridge which forms its base is either straight or slightly excavated (see pl. viii, fig. 6). Allen, in his diagnosis of the family *Lagomyidæ*, states that this bridge "is wholly devoid of the pointed anterior extension seen in the latter" (the Hares, *Leporidæ*). The type specimen of *Lagomys schisticeps* in this respect presents exactly the condition seen in the Hares, the anterior margin of the palatal bridge being produced forward in a sharp point, much altering the shape of the fossa of which it forms the base (see pl. viii, fig. 4). Moreover, the palatal fossa is both narrower and longer than in *L. princeps*, and the vomer projects backward a considerable distance beyond its anterior border, which is formed by the premaxillaries. The distance from the incisors to the palatal fossa is less than in *L. princeps*. Still another important difference, perhaps the most important of all, exists in the base of the skull. The basi-occipital is shorter and very much broader in *L. princeps* (pl. viii, fig. 5) than in *L. schisticeps* (pl. viii, fig. 3). In three skulls of *L. schisticeps* the average ratio of breadth to length of basi-occipital is 70; in three skulls of *L. princeps* it is 44.

Measurements of skulls of Lagomys schisticeps and L. princeps.

	Lagomys schisticeps Merriam.				
	3346♂	3347♀	3348♀	5375♀	5376♂
Basilar length (from one of the occipital condyles to posterior edge of alveola of incisor of same side)	37	.....	35	.....	40
Basilar length of Hensel (from inferior lip of foramen magnum to posterior edge of alveola of incisor)	34	.....	33.7	.....	36.8
Greatest zygomatic breadth	.....	.....	20.4	21	22
Greatest mastoid breadth	21	.....	.....	.....	21.5
Interorbital constriction	.....	4.8	4.5	5.3	5.2
Greatest length of nasal bones	13.2	.....	13	13.4	14.3
Length of upper molar series (on alveolæ)	8	8	8.2	8.2	8.5
Incisor to molar	9.3	10.5	9.3	9.4	10
Incisor to post-palatal notch	15.8	.....	14.1	14.2	15.7
Distance between alveolæ of upper molar series anteriorly	.....	.....	5.8	6	6
Distance between alveolæ of upper molar series posteriorly	.....	.....	7.7	8	7.8
Foramen magnum to post-palatal notch	18.3	.....	20	.....	21.2
Length of mandible (symphysis to angle)	28	.....	27	28	30
Height of mandible from angle to condylar process	16	.....	15.3	15.6	17
Length of under molariform series	8	8	7.8	8	8
Distance from incisor to molariform series	5.5	.....	5.4	5.8	5.8

	Lagomys princeps Richardson.				
	5221♀?	5756	5758	5759♂	5760♀im.
Basilar length (from one of the occipital condyles to posterior edge of alveola of incisor of same side)	36.7	38	41	38.7	35
Basilar length of Hensel (from inferior lip of foramen magnum to posterior edge of alveola of incisor)	33.2	34.5	37.5	35.5	31.5
Greatest zygomatic breadth	21.4	21.4	22	21.3	20.8
Greatest mastoid breadth	20.7	21	20.3	19.5	19
Interorbital constriction	5.4	5.5	4.7	5.4	5.6
Greatest length of nasal bones	13.7	14.6	16	14.9	13
Length of upper molar series (on alveolæ)	8.1	8	8.6	8.6	8
Incisor to molar	9.6	10.7	11.3	10.5	8.5
Incisor to post-palatal notch	15	16	16.6	16	14
Distance between alveolæ of upper molar series anteriorly	6.5	6	6	6	5.3
Distance between alveolæ of upper molar series posteriorly	7.5	7.8	7.5	7.4	7.7
Foramen magnum to post-palatal notch	18.7	18.7	21.4	20	17.7
Length of mandible (symphysis to angle)	27.7	28.8	29.5	28.8	26.4
Height of mandible from angle to condylar process	16.2	16.4	16.2	16.2	14.6
Length of under molariform series	8	7.8	8.4	8.2	7.8
Distance from incisor to molariform series	5.3	6.3	6.4	6	5.3

DESCRIPTION OF A NEW SPERMOPHILE FROM SOUTHERN CALIFORNIA.

By Dr. C. Hart Merriam.

SPERMOPHILUS MOHAVENSIS sp. nov.

(Mojave Desert Spermophile.)

Type $\frac{55234}{32223}$ ♂ ad. From Mojave River, California, June 29, 1886. Collected by F. Stephens.

Measurements (taken in flesh by collector).—Head and body, 162; tail vertebræ, 68; hairs, 16. Hind foot 38 (measured from the dry skin after soaking to straighten the toes.

General characters.—Size about equal to *S. mollis;* slightly larger than *S. tereticaudus;* tail with hairs about half the length of head and body, distichous; ears rudimentary; feet large; claws long and moderately curved; thumb with a large blunt claw; palms naked; soles densely hairy to claws; pelage rather harsh.

Color.—Above, uniform grizzled grayish brown or drab-brown; below, soiled white; eyelids white; tail above like the back, but with much black intermixed, particularly in the distal two-thirds where it is fully half black and bordered with creamy-white; below creamy-white, bordered all around by a subterminal black band.

Cranial and dental characters.—Compared with that of *S. tereticaudus* the skull is larger, thinner, and smoother; the nasals are broader posteriorly and also extend further backward, slightly overreaching the nasal branches of the premaxillaries, which latter are narrower posteriorly than in *S. tereticaudus*, though broader than in *S. mollis;* the shelf of the palate is produced backward in the median line in the form of a long, slender spine instead of the blunt point of *tereticaudus.* The length of the molar series is the same as in *tereticaudus*, though the skull is larger—consequently the ratio of this length to the length of the skull is less; the first upper premolar is smaller and shorter than in either *tereticaudus* or *mollis*—in fact it falls short of the level of the crowns of the molar series.

Habitat.—So far as known the present species is confined to the arid desert in which the Mojave River sinks. At all events enough is known

of the mammals of the surrounding region to justify the statement that it does not occur to the west, south, or east of the Mojave desert—hence the only direction in which it may yet be found is to the northward, in the desert region of southern Nevada.

General remarks.—The number of specimens examined is nine, including adults of both sexes and young. The characters are very constant, there being little variation either in size or color. The species is entirly distinct from any previously described.

DESCRIPTION OF A NEW SPERMOPHILE FROM NORTHWESTERN ARIZONA.

By Dr. C. Hart Merriam.

SPERMOPHILUS NEGLECTUS sp. nov.

Type $\frac{\text{adult}}{5263}$ ♂. Dolan's Spring, Arizona, February 9, 1889. Vernon Bailey.

Measurements (taken in flesh by collector).—Head and body, 204mm; tail vertebræ, 74; hairs, 14; hind foot, 32.

General characters.—Similar to *S. tereticaudus* but smaller, with much shorter tail and hind feet; ears reduced to a rim above, probably not more than 1mm high in the living animal; soles densely haired from heel to claw; tail vertebræ about half the length of head and body; basal third of tail terete; distal two-thirds distichous; pelage softer and longer than in *S. tereticaudus*, particularly on the sides and under parts. This may be due largely to season, as the specimens were collected in winter (February).

Color.—Above, grizzled grayish brown, resulting from the intimate and very fine admixture of white and black tipped hairs over a cinnamon ground color. The long black hairs form interrupted lines on the back as in *S. tereticaudus*, only less distinct. Under parts yellowish white; eyelids white; tail above and below concolor with the back, except that it has a subterminal black band which is continuous laterally with an indistinct subterminal border which disappears altogether a little above the middle of the tail.

General remarks.—This Spermophile is nearly related to *S. tereticaudus*, from which it may prove to be only subspecifically separable when specimens are collected from the region between Fort Yuma and Fort Mojave. At all events it is distinct enough from *S. mollis* and *S. mohavensis*.

Three specimens from the valley 1 mile west of Dolan's Spring (altitude about 3,000 feet), collected February 9, 1889, and all males, are so much alike that the only noticeable difference is in the length of the tail, which varies from 72mm to 82mm. The individual having the longer tail (No. 5263 ♂) is larger in every way, the head and body measuring 222mm, and the hind foot 34mm. A specimen from Mineral Park, Arizona (No. 5264 ♂), collected February 12, 1889, is almost an exact duplicate of the one last mentioned. Four specimens (one ♂ and three ♀) collected at Mojave, Ariz., March 11 and 12, 1889, are in the molt. The pelage is harsher in texture and redder in color.

DESCRIPTION OF A NEW SPECIES OF GROUND SQUIRREL FROM THE ARID LANDS OF THE SOUTHWEST.

By Dr. C. Hart Merriam.

TAMIAS LEUCURUS sp nov.

The Ground Squirrels of the *Tamias harrisi* type from the region of the lower Colorado River are separable into two very distinct species, according to the color of the under side of the tail. In the form described as *harrisi* by Baird and Allen this part of the tail is white, and becomes the most conspicuous feature of the animal as it runs swiftly away with the tail cocked up over its back, after the manner of the antelope. To this circumstance, Mr. H. W. Henshaw informs me, it owes the name "Antelope Squirrel," by which it is locally known. This species is represented in my collection by specimens from southern Utah, northern Arizona, southern Nevada, southern California, and the peninsula of Lower California.

Specimens from western and southern Arizona resemble those just mentioned so closely, both in size and coloration, that it would be difficult to separate them but for the difference in the color of the under surface of the tail, which is dark iron-gray instead of white, both upper and under surfaces being colored alike. Hence the striking effect produced by the white under-tail of the Antelope Squirrel is wanting. This form is the true *harrisi* of Audubon and Bachman, as will be shown directly, though it seems to have escaped the notice of naturalists during the past thirty-five years.

Tamias harrisi (originally, and I am not sure but correctly, placed in the genus *Spermophilus*) was described by Audubon and Bachman from a single specimen presented to them by Edward Harris, esq., and supposed to have been collected in the West by J. K. Townsend during his overland journey to Oregon (Quadrupeds of North America, III, 1854, 267–269). Since, however, the route followed by Townsend was far to the northward of the known range of the species, and since the animal was not in the collection of mammals brought back by Townsend and by him placed at the disposal of Dr. Bachman for examination and de-

scription,* it seems at least possible that it was not collected by Townsend at all, but was wrongly accredited to him by some accident or trick of memory during the fourteen years intervening between his return and the publication of Audubon and Bachman's description. At all events, we know nothing of the locality whence it came. Therefore, in deciding which of the two forms must retain the name *harrisi*, the only guide is Bachman's published description and figure. Unfortunately, the under surface of the tail is not shown in the figure and is not mentioned specifically in the description. Both plate and description, however, agree in giving the tail a length [" vertebræ $3\frac{1}{4}$ in."$=82.5^{mm}$] which is considerably greater than that possessed by any of the numerous specimens examined of the white tailed form. Moreover, had the under side of the tail been white, Bachman surely would have mentioned the fact. His detailed description of the color-zones of the hairs of the tail agrees perfectly with the dark-tailed Arizona animal, and differs markedly from the usual condition of the white-tailed. The description is as follows: "The hairs of the tail are whitish at the roots, twice annulated with black, and tipped with white"—which is true of this species whether examined from above or below. In the species having the under tail white, on the other hand, the hairs of the under side of the tail are white throughout and those of the upper side are black at the roots, then white, with a single free zone of black, and tipped with white.† Hence there can be little doubt that *Tamias harrisi* really is the species with the *dark* under tail. This question decided, it remains to name and describe the white-tailed species. It may be known from the following:

TAMIAS LEUCURUS sp. nov.

(Antelope Squirrel).

Type $\frac{11908}{1660}$ ♂ ad. San Gorgonio Pass, California, May 16, 1885. F. Stephens.

Measurements.—Head and body, 140; tail vertebræ, 69 (taken in flesh by collector). Hairs, 17; hind foot, 38; ear from crown, 4 (taken from skin).

General characters.—Size a little smaller than *T. harrisi*, with which it agrees in form and proportions, except that the tail is shorter. The tail is distichous. This species and *T. harrisi* are nearly related to the Spermophiles and differ at least subgenerically from *Tamias* proper, as

* Concerning these specimens Dr. Bachman said: "Mr. J. K. Townsend having placed at my disposal for examination and description his valuable collection of quadrupeds obtained in his recent laborious and perilous journey over the Rocky Mountains and along the western borders of our continent, I proceed to give short descriptions of such as appear to be undescribed."—(Jour. Phil. Acad. Sci., VIII, pt. I, 1839, 57.) No mention is made of it in this paper or in Townsend's narrative of his journey.

† In some individuals there is an (abnormal?) elongation of the lateral hairs of the proximal third of the tail, in which case the very base of each hair is white, and there are two black zones as in *harrisi*.

pointed out by Allen (Monog. N. Am. Rodentia, 1877, 811). The soles are densely haired from heel to tubercles.

Color.—Above, finely grizzled, the ground color varying from grayish on the anterior half of the back to pinkish vinaceous on the rump and head, and becoming salmon on the outside of the fore legs and thighs. A single white stripe on each side extends from the shoulders to the rump. Eyelids and underparts white. Tail bicolor: above, iron-gray, resulting from the fine admixture of the white and black annulation of the hairs, with an indistinct white border; below, clear white, with a subterminal black border more or less obscured by the underlying hairs, which are white throughout without annulations. On the upper side of the tail all the hairs are annulated. On the proximal half the lateral hairs are longer than elsewhere, the very base of each hair is white, and there are two annulations of black as in *harrisi* *; on the distal half the base of each hair is black, with but one free black annulation.

Cranial characters.—The skull of *Tamias leucurus* closely resembles that of *T. harrisi*, but differs from it in having the nasal bones much narrower posteriorly.

* Whether this condition is abnormal, or due to the stage of growth of the hair, I do not know.

DESCRIPTION OF A NEW SPECIES OF FREE-TAILED BAT FROM THE DESERT REGION OF SOUTHERN CALIFORNIA.

By Dr. C. Hart Merriam.

NYCTINOMUS FEMOROSACCUS sp. nov.

Type 2276 ♂ ad. Agua Caliente, Colorado Desert, California, March 27, 1885. Collected by F. Stephens.

Measurements (from the alcoholic specimen).—Total length, 103; head and body, 60; tail, 41; exserted part of tail, 23; head, 23; ear from crown, 14; ear from base of antitragus, 20; tragus, 1; humerus, 28; fore-arm, 47; third finger: metacarpal, 45; first phalanx, 20; second phalanx, 19; fifth finger, 44.

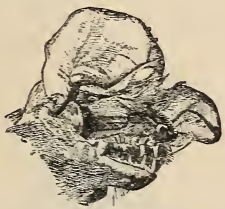

Fig. 3.—Head of Nyctinomus femorosaccus.

General characters.—Incisors $\frac{1-1}{2-2}$. Lower incisors bifid and crowded; first upper premolar small, but well developed; second very large, with a large and high antero-internal cusp. Ears thick, united by bases of inner margins 4.5^{mm} from end of nose; ear keel greatly developed, with a large lobe on its lower third; antitragus higher than long, convex anteriorly, slightly concave posteriorly, and separated by a deep notch; tragus subquadrate, hidden behind the large antitragus, its outer angle projecting upward in the form of a small pointed lobule; upper margin of ear conch with two minute horny projections, not symmetrical on the two sides. Tail more than half exserted. Gular sac present (opening on right side of median line). There is a curious fold of membrane stretching from the inner third of the femur to the middle of the tibia, forming a deep pocket between it and the interfemoral membrane. The wing membrane is attached to the leg at the same point (immediately below the middle of the tibia), so that there are three folds of membrane here. The fur extends out on the wing membrane, above and beneath, as far as a line drawn from the middle of the humerus to the junction of the middle and outer thirds of the femur. Color, dull brown.

DESCRIPTION OF A NEW SPECIES OF FREE-TAILED BAT FROM THE LOWER COLORADO RIVER IN ARIZONA.

By Dr. C. Hart Merriam.

NYCTINOMUS MOHAVENSIS sp. nov.

Type 54183 ♂ ad. Fort Mojave, Arizona, March 8, 1889. Vernon Bailey.

Measurements (from alcoholic specimen).—Total length, 94; head and body, 56; head, 19.5; ear from base of antitragus, 18; ear from crown, 12; tragus, 2; tail to end of vertebræ, 34; exserted part of tail, 13.5; humerus, 24; fore-arm, 44; third finger: metacarpal, 43; first phalanx, 16; second phalanx, 16; fifth finger, 42.

Fig. 4.—Head of Nyctinomus mohavensis.

General characters.—Incisors $\frac{1-1}{2-2}$. Lower incisors not distinctly bifid; first upper premolar minute; second large, with a well developed antero-internal cusp. Ears thinner and more translucent than in *N. femorosaccus*, united by bases of inner margins; posterior surface marked by about five indistinct transverse wrinkles; ear keel small, without a distinct lobe on its inner third; anterior convexity of auricle with six horny spines; antitragus very low and flat, much longer than high, not hiding tragus; tragus rather large, subquadrate. Lips deeply and obliquely wrinkled. Wings from lower third of tibia. Fur above extending from middle of humerus to distal third of femur; below from middle of humerus to knee. Tail less than half exserted. No gular sac. Color above, sooty; paler below.

DESCRIPTION OF A NEW GENUS (PHENACOMYS) AND FOUR NEW SPECIES OF ARVICOLINÆ.

By Dr. C. Hart Merriam.

The genus which is the subject of the present paper is of unusual interest, inasmuch as it is the most central or generalized form yet discovered in the Arvicoline series. It not only combines in a remarkable manner the characters of the Arvicoline genera *Myodes*, *Synaptomys*, *Cuniculus*, *Arvicola*, and *Evotomys*, but is near if not in the direct line of descent from the Murine series.

It was first brought to my notice by Dr. George M. Dawson, Assistant Director of the Geological and Natural History Survey of Canada, who sent me for identification a specimen collected by him near Kamloops, British Columbia, October 2, 1888. Dr. Dawson had no facilities for the preparation of this kind of material, hence the specimen reached me in the form of a rough skin, turned inside out to dry, with the broken skull attached. Fortunately the feet, tail, and teeth were preserved—enough to furnish the most important characters. So far as external features are concerned—size, proportions, and coloration—there is nothing to indicate that the animal might not be a pale individual of the common eastern meadow mouse or vole (*Arvicola riparius*), but the skull and teeth differ essentially from those of any previously known genus. All of the molars in both jaws are rooted, each having two true divergent roots, instead of growing from a persistent pulp, as in *Arvicola*. The crowns of the upper molars, in the number and arrangement of their triangles, resemble those of the Mississippi Valley voles of the subgenus *Pedomys*, while they agree with *Evotomys* in the large size of the dentine islands and the crowding of the teeth. The crowns of the lower molars not only differ from those of any section of the genus *Arvicola*, but resemble in certain respects the corresponding teeth of the singular genera *Myodes*, *Synaptomys*, *Cuniculus*, and *Evotomys*.

In studying the affinities of this remarkable animal I examined the entire series of skulls of the subfamily *Arvicolinæ* in the U. S. National Museum, as well as those in my own collection (several hundred in number), and also a large number of alcoholics. The result of this investigation was the discovery of five additional specimens of the new

genus. Two of these are broken skulls labeled in Dr. Coues's handwriting as having been collected by himself at Groswater Bay, Labrador, in 1860, but not mentioned in his published writings on the *Muridæ*. The remaining three (all new species) were alcoholics, one collected by Napoleon A. Comeau at Godbout, on the north shore of the St. Lawrence, near the point where the river widens into the gulf; the two others collected by Lucien M. Turner, near Ft. Chimo, Ungava Bay. Hence the range of the new genus is demonstrated to extend across the continent from Labrador to British Columbia. Probably it will be found to invade northern Idaho, Washington, and perhaps Montana also. The results of this study will be found in the following pages.

PHENACOMYS* genus nov.

Type *Phenacomys intermedius* sp. nov., from Kamloops, British Columbia.

DIAGNOSIS.

Brain case subquadrate, with prominent supraorbital ridges bordering a median frontal sulcus; postorbital process of squamosal peglike; interparietal rather large; zygomatic arches lowest opposite first molar, and expanded vertically into a broad lamina; shelf of palate broadly emarginate posteriorly, without the "step" of *Arvicola;* ascending ramus of mandible long and slender, slightly higher than coronoid process; root of lower incisor ending at level of alveola of last molar; molars rooted, each having two true divergent roots; crowns large, crowded, with broadly rounded prisms; pattern of upper molar series and arrangement of prisms as in *Arvicola* (section *Pedomys*); anterior face of second and third upper molars concave, the anterior loop pyriform, bulging on the inner side; lower molars with line of infolding of enamel near the outer side; last lower molar very large, as broad or nearly as broad anteriorly as posteriorly, and consisting of three elongated transverse loops joined along the outer side of the tooth, without any distinct external loop or triangle.

GENERAL CHARACTERS AND COMPARISONS.

External characters.—Forefoot 5-tuberculate; hindfoot 6-tuberculate, the outer tubercle large and prominent (see pl. II, figs. 4 and 5 *b*) [in *Arvicola* it is nearly obsolete]; posterior half of sole well haired; ears reaching or slightly overtopping the tips of the surrounding hairs; whiskers reaching the shoulders, larger and stiffer than in *Arvicola*; pelage full and soft.

Cranial characters.—Viewed from above, the brain case is subquadrate, marked by prominent lateral ridges, as in *Synaptomys* and *Cuni-*

* Phenacomys, from φέναξ=*a cheat, an imposter;* and μυς=*a mouse,* in reference to the circumstance that the external appearance of the animal gives no clue to its real affinities.

culus (pl. II, fig. 1; pl. III, fig. 9). There is a distinct supraorbital ridge bordering a median longitudinal frontal sulcus. It rises from the anterior border of the orbit and passes backward, following the outline of the calvarium to the lateral border of the interparietal, where it bends downward and becomes continuous with the vertical crest of the squamosal, which ends at the upper margin of the audital opening. In addition to the deep frontal sulcus there is on each side of the brain-case a shallow lateral sulcus between the ridge just described and a horizontal ridge of the squamosal, which is formed by the extension forwards and backwards of the posterior root of the zygoma. At the point of junction of the orbital and temporal fossæ this ridge gives off a very distinct postorbital process (*squamosal*, not frontal), which, with the laminar expansion of the zygoma below serves to sharply differentiate the orbit from the temporal fossa.* Furthermore, the temporal fossa is much reduced in breadth by the lateral encroachment of the brain-case, which is abruptly truncated in front of the postorbital process. The antero-posterior diameter of the interparietal is much greater than in *Arvicola*, and its transverse diameter less. In this respect it approaches *Synaptomys* and *Myodes*. In *Phenacomys celatus*, *P. ungava*, and *P. latimanus* the interparietal is pentagonal, and its posterior border is nearly straight. The nasal bones are truncated posteriorly a little in front of the ends of the nasal branches of the premaxillaries. The rostrum is not shortened or strongly deflexed as it is in the Lemmings, but more nearly agrees with its normal condition in *Arvicola*.

The zygomatic process of the maxillary bends down so abruptly that the lowest part of the zygomatic arch is opposite the first molar, as in *Myodes* (pl. II, fig. 3). In *Arvicola* the slope is more gradual, and the lowest part of the arch is opposite the last molar. The middle portion of the zygoma is expanded into a large lamina or plate, which consists of the expanded anterior end of the jugal or malar bone and the posterior portion of the zygomatic process of the maxillary. This plate slopes obliquely upward, as in *Myodes* and *Synaptomys*.

Viewed from below, several characters of importance become apparent. The shelf of the palate is broadly emarginate posteriorly, with a median azygos projection. The pterygoid fossa is much broader anteriorly than in *Myodes*, and the "step" at the back of the palate is less apparent on the sides, and is altogether wanting in the median line (pl. II, fig. 2). In this respect *Phenacomys* presents a condition intermediate between *Evotomys* and *Arvicola*, though resembling the former more than the latter. It resembles *Evotomys* further in the breadth and flatness of the palate and in the shape and relative size of the audital bullæ. The latter, while conforming to the general *Arvicoline*

* In *Myodes* and *Synaptomys* the horizontal ridge of the squamosal forms a projecting shelf, overhanging the temporal fossa, and rounded off anteriorly. In *Phenacomys* and *Cuniculus* this ridge is not developed into a projecting shelf, but terminates anteriorly in a distinct peg-like process.

pattern, are somewhat suborbicular instead of subfusiform. In this particular the departure from *Synaptomys* and *Myodes* is as marked as that from *Arvicola*. The basisphenoid is essentially as in *Arvicola*—it is not cut away laterally so much as in *Synaptomys* and *Myodes*.

The ascending ramus of the under jaw is long, and the articular facet is slightly above the level of the coronoid process (as in *Evotomys* and *Cuniculus*), which is sharp pointed and bent back at the tip (pl. III, fig. 9). The hamular process of the angle is rather large and curves slightly outward as well as upward. Its postero-inferior border is obliquely flattened, but not to the extent seen in *Synaptomys* and *Myodes*. The root of the lower incisor ends posteriorly at the level of the alveola of the last molar, and a little outside and behind it, as in *Evotomys*. In *Arvicola* it passes back into the ascending ramus of the jaw as far as a point above and behind the dental foramen, this point being, as a rule, about two-thirds the distance from the crown of the last molar to the articular condyle. In *Synaptomys* and *Myodes* it ends at a point opposite and a little inside of the last molar. Hence in the posterior extension of the under incisor *Phenacomys* is intermediate between the Lemmings and the true Field Mice.

When the skull is allowed to rest on the upper molar series a perpendicular let fall from the end of the nasals passes in front of the arc of the incisors, as in *Evotomys* and *Synaptomys* (pl. II, fig. 3).

Dental characters.—*Phenacomys* has genuine rooted molars (pl. III, fig. 6), not half-rooted molars like those of *Evotomys*, which grow from persistent pulps. In this respect it differs from all known members of the sub-family *Arvicolinæ*, and approaches the typical condition of the *Muridæ*. Each tooth in both upper and lower jaws has two distinct roots, which are long, divergent, and closed at the bottom, as in all truly-rooted teeth. The crowns of the teeth are large and crowded, with broadly rounded loops inclosing dentine islands of much larger size than in *Arvicola*, and somewhat larger even than in *Evotomys*, with correspondingly smaller interspaces or re-entrant angles (pl. VI). The dentine is umber-brown instead of white, thus emphasizing the peculiar appearance of the tooth-row as a whole.

Upper molar series.—The upper molars resemble those of *Arvicola* (section *Pedomys*) in the general pattern, number, and arrangement of the prisms, but the crowding of the teeth produces a depression on the anterior face of the first loop of the second and third molars at the point where the preceding tooth presses against it, and a resultant bulge just inside of this point, giving the loop a pyriform shape, with an anterior concavity (pl. VI, fig. 1), as sometimes seen in *Evotomys*. In *Arvicola* this loop is always strongly convex anteriorly. The details of the crowns are as follows: First upper molar with a broadly rounded anterior transverse loop, two external and two internal rounded triangles; second upper molar with an anterior pyriform transverse loop, one large internal and two smaller external rounded triangles; third

upper molar with an anterior pyriform transverse loop, one external and one internal closed triangle, and a posterior trefoil (pl. IV, fig. 12*a*). Sometimes the outer loop of the trefoil is closed, giving the tooth two external closed triangles and a postero-internal loop (pl. IV, fig. 11*a*).

Lower molar series.—Line of infolding of enamel near outer side of tooth row. First lower molar with a posterior transverse loop, four greatly elongated internal triangles or digitations, of which at least two are completely closed, an anterior loop of variable shape, and three short external triangles, of which at least one is completely closed. Second lower molar with a posterior transverse loop, two greatly elongated internal triangles, of which one or both are closed, and two small external rounded triangles, one or both of which are closed. Third lower molar much larger than in *Arvicola*, as broad or nearly as broad anteriorly as posteriorly, with three greatly elongated internal loops, as in *Synaptomys* and *Myodes*, but without external triangle, the outer side being plane or having at most only two convexities, which correspond with the middle and last loops, respectively. By reference to the accompanying figures it will be seen that the last lower

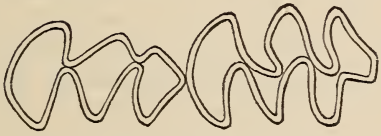

Fig. 5.—Last lower molars of Arvicola.

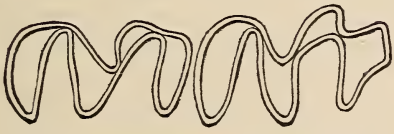

Fig. 6.—Last lower molars of Synaptomys.

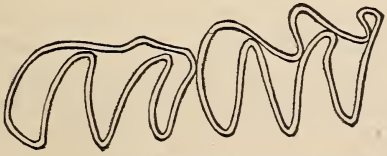

Fig. 7.—Last lower molars of Phenacomys.

molar of *Phenacomys* differs widely from that of *Arvicola*, but closely resembles that of *Myodes* and *Synaptomys*, the principal difference being the presence in the last-mentioned genera of a distinct loop and corresponding re-entrant angle on the outer side of the tooth. The deepening of the externo-lateral sulcus in *Phenacomys* would produce almost precisely the condition this tooth presents in *Synaptomys*. In all the sections of the genus *Arvicola* the last lower molar is much broader posteriorly than anteriorly, while in *Evotomys* the reverse is true, it

being broadest anteriorly. In all the lower molars of *Phenacomys* the posterior loop is rounded off externally, as in *Synaptomys* and *Myodes*, instead of forming a prominent angular projection as it does in *Arvicola* and *Evotomys* (see cuts on preceding page).

PHENACOMYS INTERMEDIUS sp. nov.

(Plate IV, fig. 11; pl. VI; pl. VII.)

Type No. 780, immature. Museum of the Geol. and Nat. Hist. Survey of Canada. From Kamloops, British Columbia,* October 2, 1888. Dr. Geo. M. Dawson.

Measurements (from dry skin).—Total length about 118; head and body, 90; tail vertebræ, 28; hairs, 2; hind foot, 18; ears from crown, 8; from anterior root, 13.

General characters.—Size rather small; tail slender, cylindrical; ears moderate, thin, protruding slightly beyond fur, well haired on both sides; roots rather near together; antitragus small, about as high as long; hind foot more slender than in *P. celatus*; whiskers long and stiff; pelage deep, full, and soft.

Color.—Above, grizzled grayish brown, paler than in *Arvicola riparius;* black-tipped hairs most abundant posteriorly, with no tendency to collect into a median darker area; under parts white, the basal plumbeous portion showing through; tail bicolor, nearly black above; fore feet light; hind feet dark, darkest on the ankle and outer side of foot. There is a strip of whitish hair on the soles.

Cranial characters.—Unfortunately the skull is badly broken, and the occipital and basal portions are absent. Enough remains, however, to show that the brain-case is broad and flat, much like that of *Chilotus.* The specimen was young, though probably full grown, and the skull differs from those of the other species here described in the usual way in which skulls of young *Arvicolinæ* differ from those of adults. It is lower and more evenly rounded, with broader interorbital and parietal regions. In fact, the breadth of the brain-case is considerably greater, both actually and in relation to the zygomatic breadth. This difference may be in part specific. There is no trace of the superciliary ridges which are so conspicuous in the adults, and but a faint indication of the lateral muscular impressions. The vertical lamellæ of the zygomatic arches are less developed, the incisive foramina are smaller, and the upper incisors are much shorter than in the other species.

Dental characters.—Upper incisiors marked with an indistinct groove near the outer side. Upper molars with all the loops and triangles closed (pl. VI, fig. 1). Last upper molar with an anterior pyriform transverse loop, two small external triangles, one large, transversely elongated internal triangle and a postero-internal loop, making in all three angular projections and two re entrant angles on each side. The

* The exact locality, Dr. Dawson writes me, is a basaltic plateau about 20 miles NNW of Kamloops, at an altitude of 5,500 feet.

ratios of the first, second, and third upper molars to the length of the upper molar series are, respectively, 40, 29, and 31. Front lower molar (pl. VI, fig. 2, and pl. IV, fig. 11 *b*) with an anterior transverse loop, a posterior transverse loop, four internal triangles, and three external triangles, making eleven projections, six of which are on the inner and five on the outer side of the tooth; three triangles on each side are entirely closed, and the fourth inner triangle is nearly closed; anterior loop flattened from before backward, inner half nearly transverse, outer half bent obliquely backward, as sometimes seen in *Cuniculus*. Second lower molar with a posterior transverse loop, two small, rounded, external closed triangles, and two large elongated, subequal internal closed loops or triangles, the posterior loop abruptly rounded off externally as in *Synaptomys*. Last lower molar large, about as broad anteriorly as posteriorly. It consists of three vertical prisms set side by side and connected at their bases along the outer face of the tooth. The line of enamel-folds is thus brought in contact with the outer side of the tooth, there being no outer angles at all; in fact the outer side has a plane, nearly flat surface, marked only by a slight ridge and compensating groove opposite the middle triangle of the inner side. Therefore, the crown of the last lower molar presents the appearance of three long lobes directed inward and slightly backward, the middle one connected with the lateral on each side by a narrow isthmus at the base. The most anterior of these three divisions is about as long as the second and third, though the latter are much broader. The ratios of the first, second, and third lower molars to the length of the lower molar series are, respectively, 49.3, 27 7, and 22.8. The length of the upper molar series, measured on the alveolæ, is 6.1; on the crowns 5.7. The corresponding measurements of the lower molar series are 5.9 and 5.5.

PHENACOMYS CELATUS sp. nov.

(Plate II, figs. 1-3; pl. III, figs. 6 and 7; pl. IV, fig. 13.)

Type No. $\frac{2851}{5958}$ ♂ ad. Godbout, P. Q., Canada, June 10, 1886. N. A. Comeau.

Measurements (from alcoholic specimen before skinning).—Total length, about 130; tail vertebræ, 32; hairs, 2.5; hind foot, 17.5.

General characters.—Size rather small, about equal to *P. intermedius;* feet broader than in *intermedius;* fore foot 5-tuberculate; hind foot 6-tuberculate, tubercles all well developed; thumb rudimentary, armed with a blunt nail; tail slender, cylindrical, not particularly short (about one-third as long as head and body); whiskers long and conspicuous; ears defective, but thicker than in *intermedius,* and hardly appearing above fur, not so hairy as in *ungava;* antitragus small.

Color.—Above, brown with a tawny cast, which may be the result of immersion in wood alcohol, out of which it was skinned; below, whitish, the basal portion (about two thirds) dark plumbeous. Tail bicolor, but without line of demarkation; darkest above, near the tip. Fore feet

and wrists whitish all round; hind feet and ankles whitish, suffused with pale fulvous on the upper side.

Cranial and dental characters.—Interparietal much larger than in *P. latimanus* and *ungava*, with antero-posterior diameter much greater (pl. II, fig. 1). First lower molar with a posterior transverse loop, four internal triangles of which two are closed, three external triangles of which one is completely closed, and a broadly open anterior loop directed forward and slightly outward; in all, five angular projections and four deep re-entrant angles on each side. Second lower molar with anterior triangles communicating. Third lower molar with a marked convexity followed by a distinct notch opposite the long middle lobe of the inner side (pl. IV, fig. 13). The length of the upper molar series, measured on the alveolæ, is 5.9; on the crowns, 5.5. The corresponding measurements of the lower molar series are 5.6 and 5.5 respectively.

General remarks.—In the National Museum collection there are the remains of two broken skulls of *Phenacomys* labeled "Groswater Bay, Labrador, Elliott Coues," of which I can find no mention in Dr. Coues's writings. They have the appearance of skulls found in the pellets of hawks and owls. One of them (No. 4218) is very young; the other (No. 4217) is older and larger, with correspondingly heavier processes and ridges than any of the specimens here described. I have provisionally referred it to *P. celatus*, because it has the same squarish interparietal, and essentially the same tooth pattern (see pl. III, figs. 6 and 7).

PHENACOMYS LATIMANUS sp. nov.

(Plate II, fig. 5; pl. IV, fig. 12.)

Type No. $\frac{4484}{61559}$ ♂ yg. ad. Fort Chimo, Ungava, Hudson Bay. Feb. 4, 1883. Lucien M. Turner.

Measurements (from alcoholic before skinning).—Total length, 116; head and body, 90; tail vertebræ, 28; hairs, 4; hind foot, 18; ear from crown, 5.5; from anterior root, 11. Additional measurements: Tip of nose to eye (inner canthus), 12; to center of pupil, 13; to meatus, 22; to occiput, 27; to tip of ear, 31; length of manus, 11; breadth of manus, 5; breadth of pes, 5; fore leg, 25.

General characters.—Size rather small: tail short, cylindrical; fore feet broad, as in the Lemmings (pl. II, fig. 5 *a*); whiskers not so long and stiff as in the other species; ears defective, but evidently peculiar, apparently very narrow and thin.

Color.—Above, dull rusty-brown, reddest about the eyes and nose (which may be due to alcoholic staining); below, whitish, the basal portion of the fur dark plumbeous. Tail sharply bicolor, brown above and white beneath, the latter occupying considerably more than half the circumference of the tail.

Dental characters.—First lower molar with a posterior transverse loop, four internal triangles of which three are closed, three external

triangles of which two are closed, and an anterior loop directed inward. Second lower molar with anterior triangles communicating (pl. IV, fig. 12).

General remarks.—Mr. Turner writes me that this specimen was found dead in the path, and that the Indians believe that the species always dies on coming in contact with human foot-prints.

PHENACOMYS UNGAVA sp. nov.

(Plate II, fig. 4; pl. III, figs. 8 and 9.)

Type No. $\frac{5468}{6155}$ ♂ ad. Fort Chimo, Ungava, Hudson Bay Territory. Spring of 1884. Lucien M. Turner.

Measurements (from alcoholic before skinning).—Total length, 138; head and body, 104; tail vertebræ, 31; hairs, 3.5; hind foot, 19; ear from crown, 7; ear from anterior root, 12. Additional measurements: Tip of nose to eye (inner canthus), 12; to center of pupil, 14; to meatus, 24; to occiput, 28.

General characters.—Size, largest of the four species herein described; tail moderately short, slender, cylindrical; ears appearing above fur, densely haired inside and on the margin outside; hind feet longer and more slender than in *P. celatus*; whiskers long and stiff.

Color.—Above, rusty-brown, reddest on the nose; below, whitish, the basal portion of the fur dark plumbeus.

Dental characters.—First lower molar with a posterior transverse loop, four internal triangles of which three are closed, three external triangles of which two are closed, and an anterior loop which forms a projection on the inner side. Second lower molar with the anterior triangles broadly communicating (pl. III, fig. 8).

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PLATE I.

Figs. 1, 2, 3, 4, and 5, *Onychomys leucogaster*, ♂ young. (Skull No. 4422.) Fort Buford, Dakota.

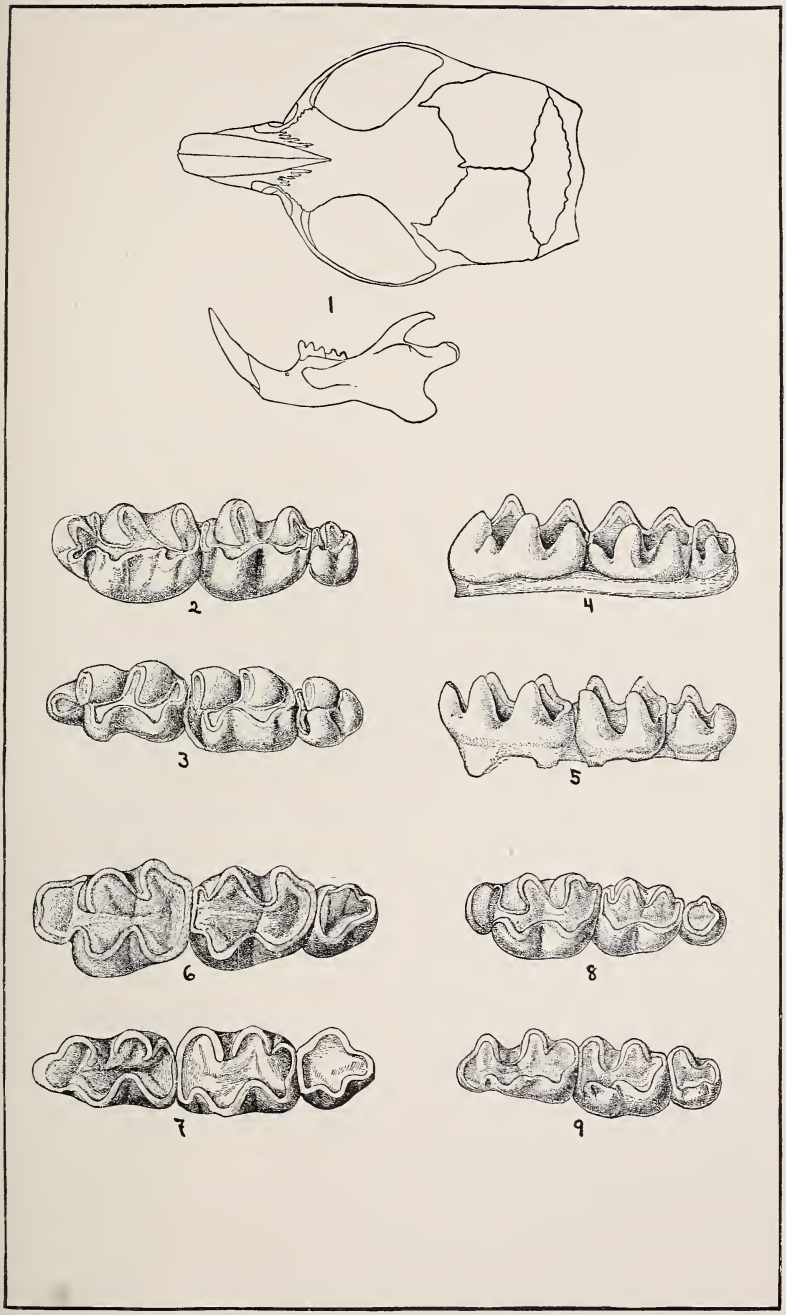
1. Skull from above, and left under jaw from outside (× 2).
2. Crowns of left upper molars from below (× 10).
3. Crowns of left lower molars from above (× 10).
4. Crowns of right upper molars from the side (× 10).
5. Crowns of right lower molars from the side (× 10).

Figs. 6 and 7, *Onychomys leucogaster*, ♀ ad. (No. 5012). Valentine, Nebraska.

6. Crowns of left upper molars from below (× 10).
7. Crowns of left lower molars from above (× 10).

Figs. 8 and 9, *Onychomys longicaudus*, ♂ ad. (No. 5896). St. George, Utah.

8. Crowns of left upper molars from below (× 10).
9. Crowns of left lower molars from above (× 10).



1-5. *Onychomys leucogaster*, ♂ young.
6, 7. *Onychomys leucogaster*, ♀ adult.
8, 9. *Onychomys longicaudus*, ♂ adult.

PLATE II.

1–3. *Phenacomys celatus*, ♂ ad. (No. 5988.) Godbout, P. Q., Canada. *Type.*

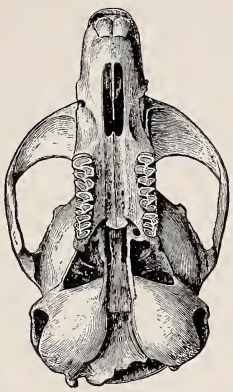
1. Skull from above (× 2).
2. Skull from below (× 2).
3. Skull from the side (× 2).

4. *Phenacomys ungava*, ♂ ad. (No. $\frac{5}{6}\frac{4}{1}\frac{6}{5}\frac{8}{5}$.) Ungava. *Type.*

a. Left forefoot.
b. Left hind foot (× about 1¼; drawn from alcoholic specimen).

5. *Phenacomys latimanus*, ♂ yg. ad. (No. $\frac{5}{6}\frac{4}{1}\frac{8}{5}\frac{4}{9}$.) Ungava. *Type.*

a. Left forefoot.
b. Left hind foot (× about 1¼; drawn from alcoholic specimen).



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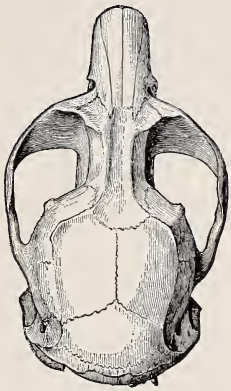

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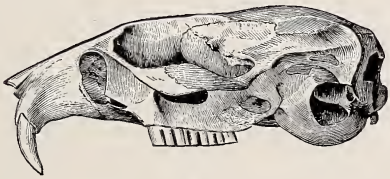

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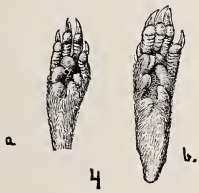

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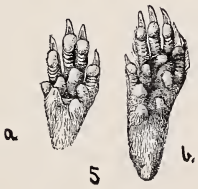

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1–3. *Phenacomys celatus*, ♂ adult.
4. *Phenacomys ungava*, ♂ adult.
5. *Phenacomys latimanus*, ♂ young adult.

PLATE III.

6 and 7. *Phenacomys celatus*, ad. (No. 4217.) Groswater Bay, Labrador.

6. Molar teeth in profile (× about 4); (*a*) upper series; (*b*) lower series.

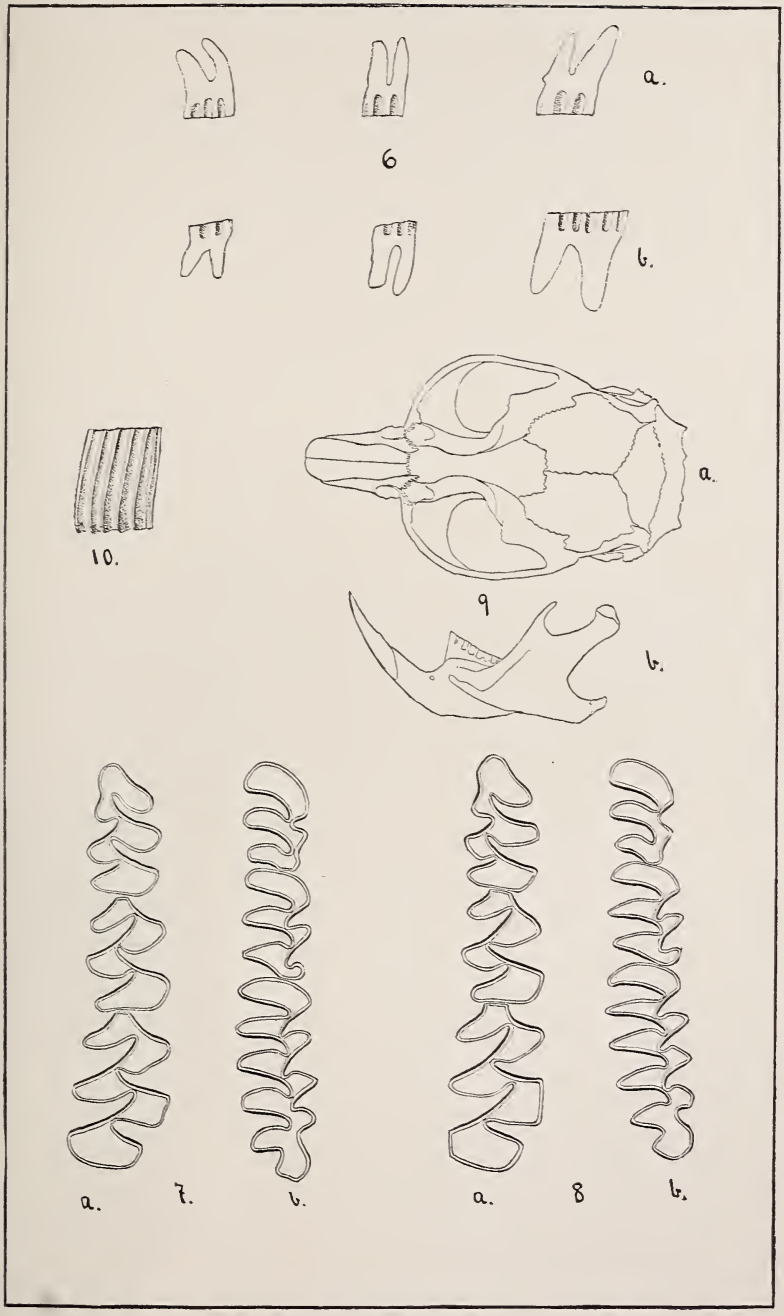
7. Crowns of molar teeth (× about 10); (*a*) upper series; (*b*) lower series.

8 and 9. *Phenacomys ungava*, ♂ ad. (No. 6155.) Ungava. *Type.*

8. Crowns of molar teeth (× about 10); (*a*) upper series; (*b*) lower series.

9. (*a*) Skull from above; (*b*) under jaw from left side (× 2).

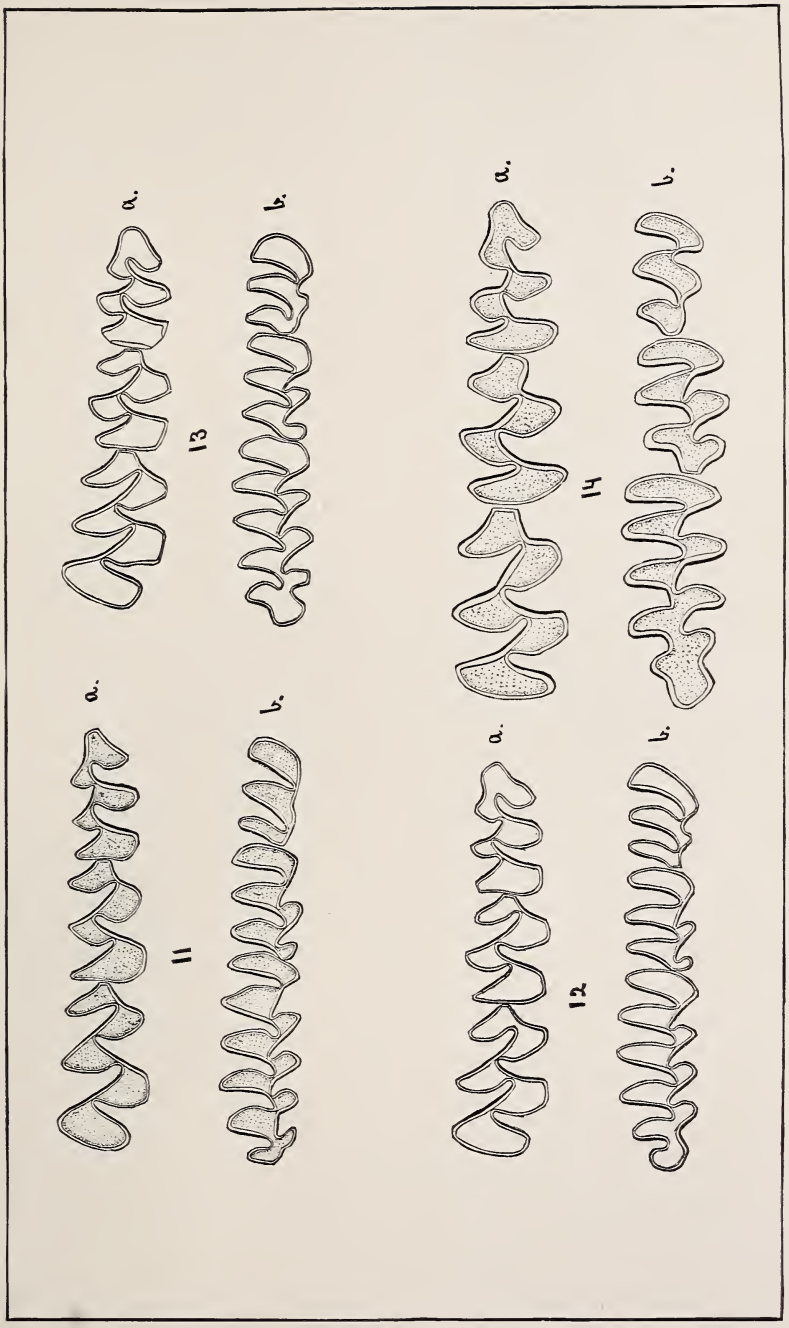
10. *Arvicola riparius*, ad. Washington, D. C. First lower molar for comparison with corresponding tooth in *Phenacomys* (fig. 6*b*); (× about 4).



6, 7. *Phenacomys celatus*. adult.
8, 9. *Phenacomys ungava*. ♂ adult.
10. *Arvicola riparius*. adult.

PLATE IV.

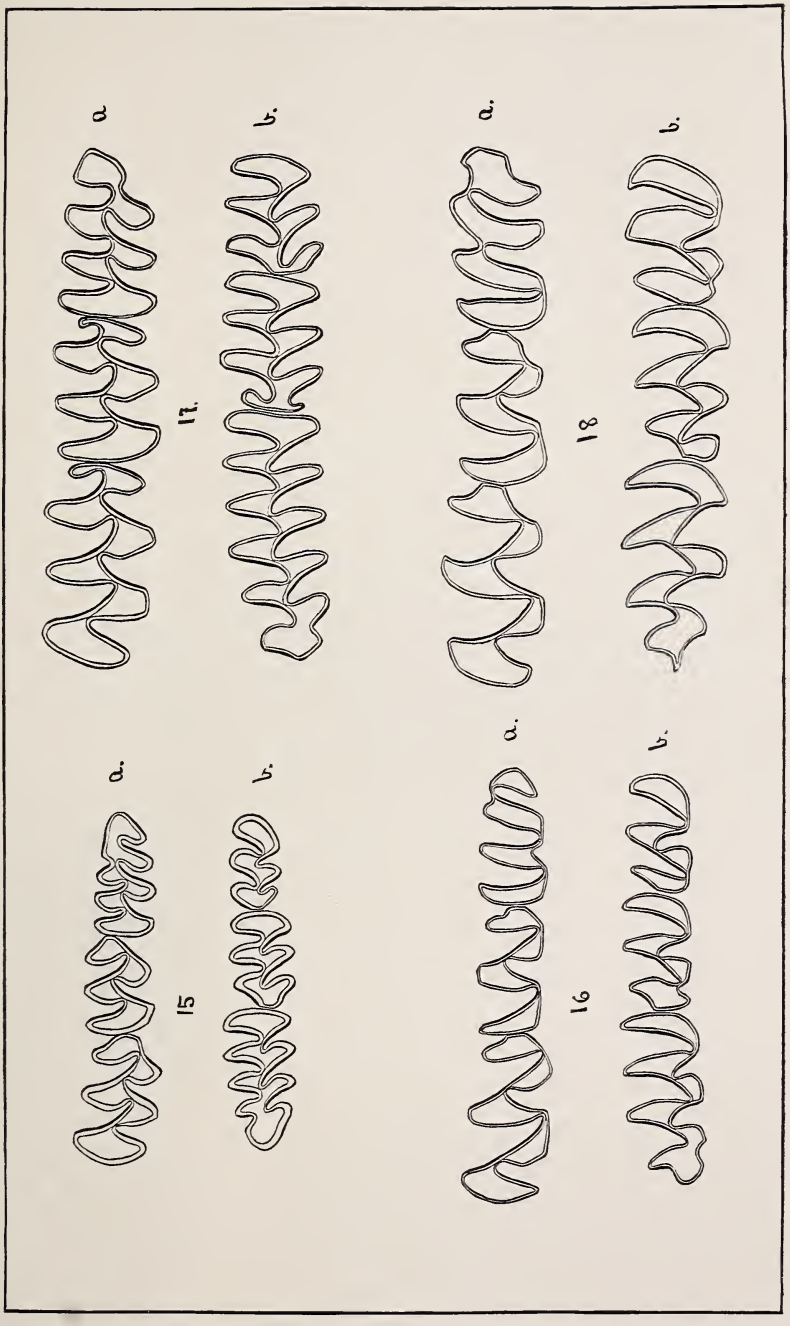
11. *Phenacomys intermedius*, young. Kamloops, British Columbia. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
12. *Phenacomys latimanus*, ♂ young ad. (6159.) Ungava. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
13. *Phenacomys celatus*, ♂ ad. (5988.) Godbout, P. Q., Canada. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
14. *Arvicola austerus*, ♀ ad. (1620.) Knoxville, Iowa.
    a = upper molar series; *b* = lower molar series (× 10).



11. *Phenacomys intermedius*, young.
12. *Phenacomys latimanus*. ♂ young adult.
13. *Phenacomys celatus*. ♂ adult.
14. *Arvicola austerus*. ♀ adult.

PLATE V.

15. *Evotomys gapperi*, ♂ ad. (1956 U. S. N. M.) Lake Superior.
    a = upper molar series; *b* = lower molar series (× 10).
16. *Synaptomys cooperi*, yg. ad. (3230.) *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
17. *Cuniculus*, ♀ ad. (6160.) Fort Chimo, Ungava.
    a = upper molar series; *b* = lower molar series (× 10).
18. *Myodes*, ♀ ad. (6166.) Point Barrow, Alaska.
    a = upper molar series; *b* = lower molar series (× 10).



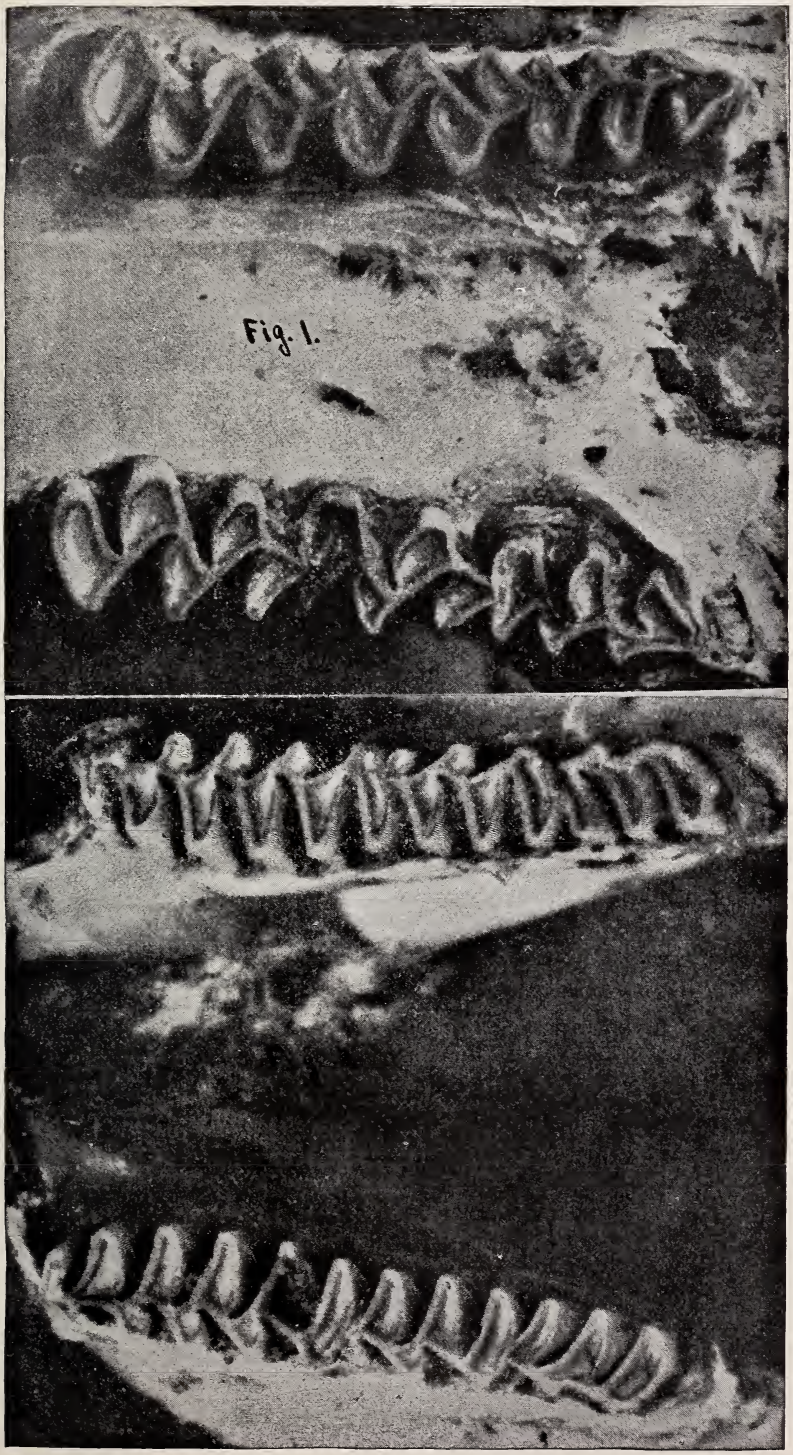
15. *Evotomys gapperi*, ♂ adult.
16. *Synaptomys cooperi*, young adult.
17. *Cuniculus*, ♀ adult.
18. *Myodes*, ♀ adult.

PLATE VI.

Phenacomys intermedius, young. (No. 780, Mus. Geol. and Nat. Hist. Surv., Canada.) Kamloops, British Columbia. *Type.*

Fig. 1. Upper molar series, *in situ* (from a photograph. × 15).

Fig. 2. Lower molar series, *in situ* (from a photograph. × 15).



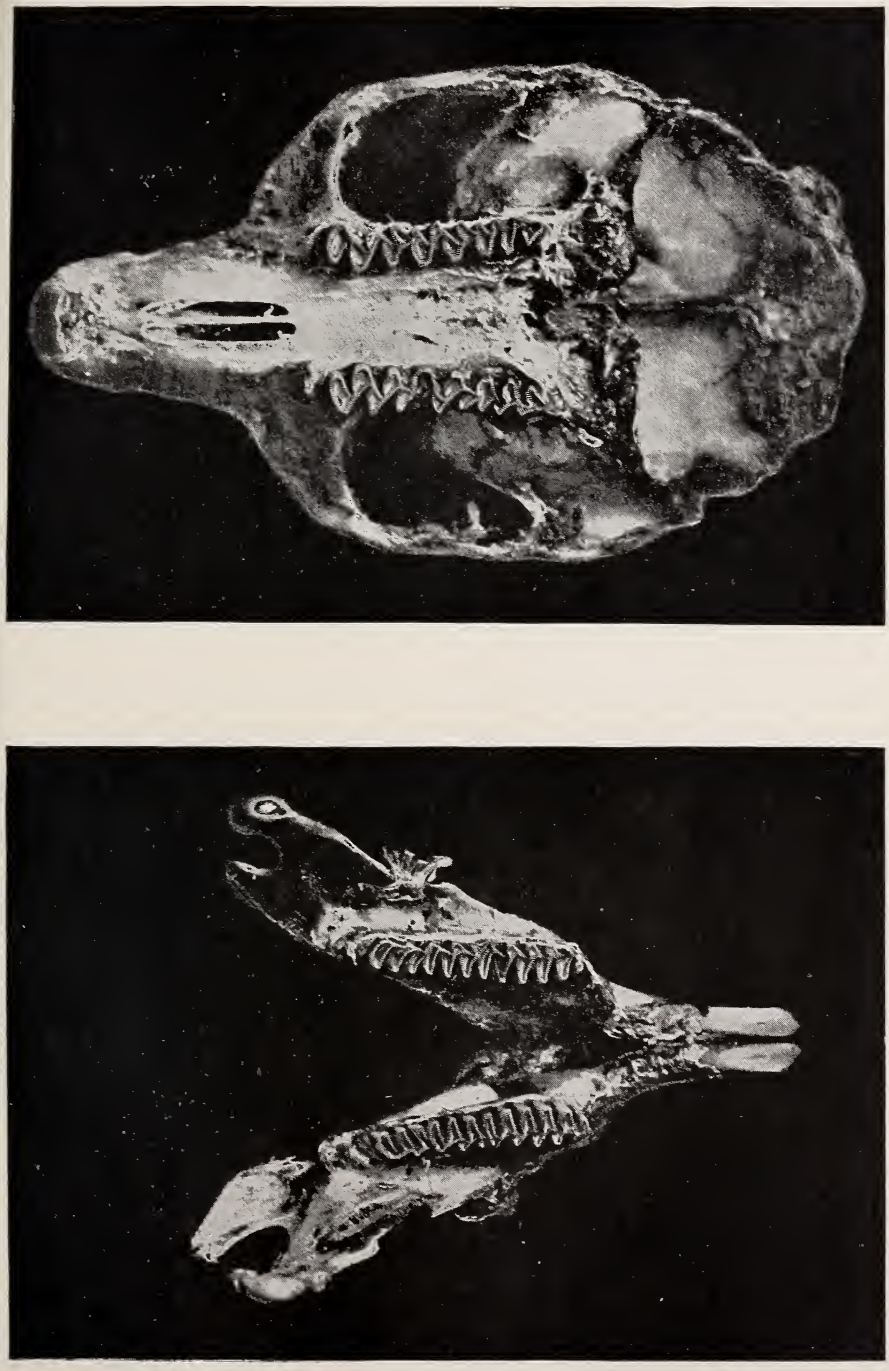
PHENACOMYS INTERMEDIUS, young.

PLATE VII.

Phenacomys intermedius, young. (No. 780, Mus. Geol. and Nat. Hist. Surv., Canada.) Kamloops, British Columbia. *Type.*

Fig. 1. Skull from below, showing teeth and the remains of the skull (from a photograph. × 5).

Fig. 2. Under jaw from above (from a photograph. × 5).



PHENACOMYS INTERMEDIUS. (Type.)

PLATE VIII.

(All natural size.)

1–4. *Lagomys schisticeps*, ♂ ad. (No. 5376.) Donner, California. *Type.*

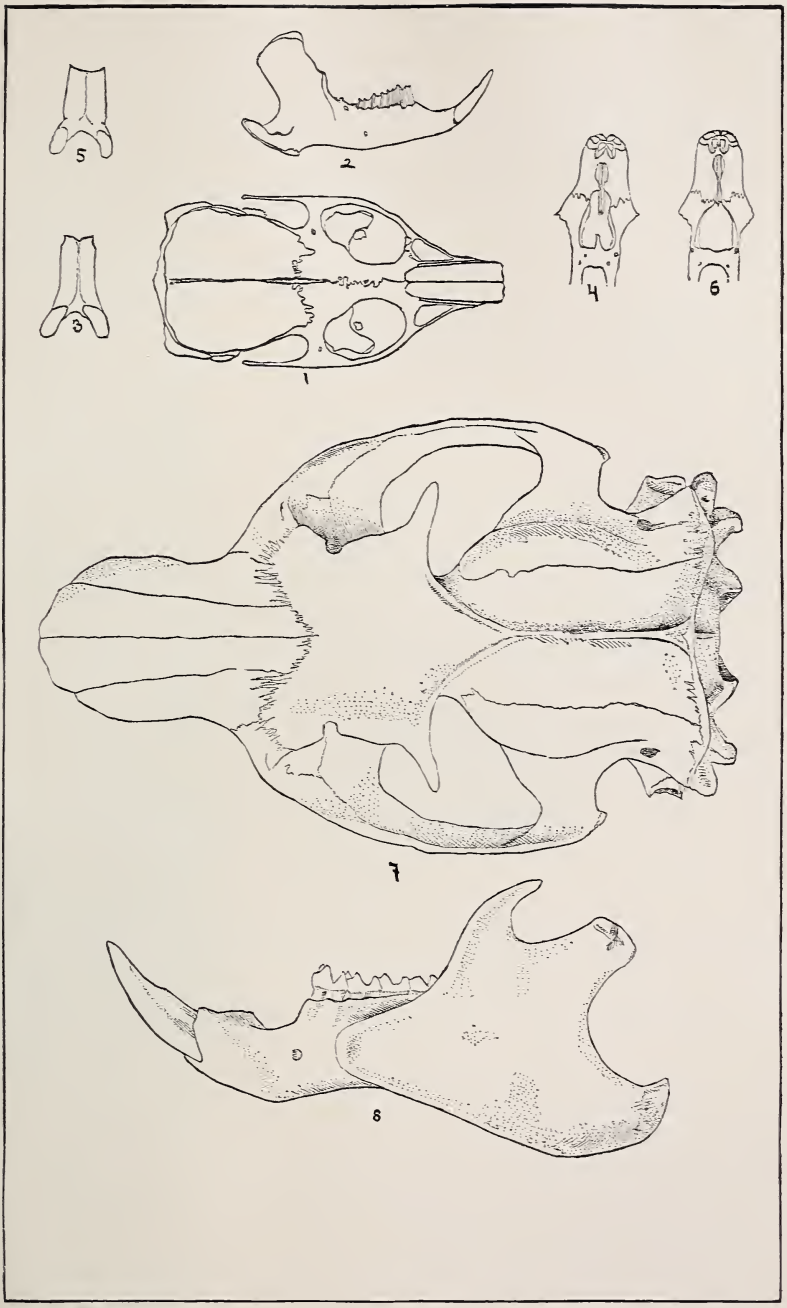
1. Skull from above.
2. Under jaw from the outside.
3. Basioccipital from below.
4. Palatine fossa.

5 and 6. *Lagomys princeps.* Boulder County, Colorado.

5. Basioccipital.
6. Palatine fossa.

7 and 8. *Arctomys dacota*, ♂ ad. (No. 5113.) Black Hills, Dakota. *Type.*

7. Skull from above.
8. Under jaw from the outside.



1–4. *Lagomys schisticeps*. ♂ adult.
5–6. *Lagomys princeps*. adult.
7–8. *Arctomys dacota*, ♂ adult.