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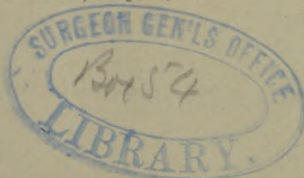
AUTHOR'S EDITION.

DEPARTMENT OF THE INTERIOR.
UNITED STATES GEOLOGICAL AND GEOGRAPHICAL SURVEY.
F. V. HAYDEN, U. S. Geologist-in-Charge.

PRECURSORY NOTES
ON
AMERICAN INSECTIVOROUS MAMMALS,
WITH
DESCRIPTIONS OF NEW SPECIES.
BY
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EXTRACTED FROM THE BULLETIN OF THE SURVEY, VOL. III, No. 3.

WASHINGTON, May 15, 1877.



ART. XXV.—PRECURSORY NOTES ON AMERICAN INSECTIVOROUS
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BY ELLIOTT COUES,

Captain and Assistant Surgeon U. S. A., Secretary and Naturalist of the Survey.

Although the material before me for a monographic revision of the American *Insectivora* is much greater than has been at the command of any previous investigator, I am not yet prepared to announce the final results of my study, there being several points still awaiting determination. Meanwhile, however, I think it advisable to publish without delay descriptions of such species as appear to be unquestionably new and valid, together with a number of other points which I consider established. These relate largely to the recognition of the excellent subgeneric distinctions which subsist among the *Soricidæ*. These notes may be considered preliminary to a monograph of the American *Insectivora*, now in preparation, the publication of which, however, may be long delayed.

Very little has been done with these Mammals since 1857, when Professor Baird* so greatly increased our knowledge of the subject. Though the species admitted by him at that date, upon consideration of the very limited material then at his command, require to be largely reduced, all the generic and subgeneric distinctions indicated by him are confirmed. The species additional to those given by him rest without exception upon specimens not at that time available. In 1861, the same naturalist reviewed the subject, making many new and important determinations, which, however, have never been published. Most of the new subgenera and species to be described in this paper are derived from his MSS., which he very generously placed at my disposal, when all the material contained in the National Museum, Smithsonian Institution, was given into my hands for elaboration.

The principal contributions to the knowledge of the subject since 1857 have been made by J. A. Allen and T. Gill. The former reviewed the genus *Blarina*,† coming to the conclusion, not supported by larger experience, that all the species of this genus were reducible to one, considering that Baird's section of *Blarina* with 30 teeth was based upon

* Mammals of North America, 1857, pp. 4-77.

† Catalogue of the Mammals of Massachusetts: with a Critical Revision of the Species. < Bull. Mus. Comp. Zoöl., Cambridge, i, No. 8, pp. 143-252. 1863. (*Blarina*, treated at pp. 213-221.)

the immature dentition, and suggesting that such was probably also the case with the corresponding section of *Sorex* with 30 teeth. But these sections are perfectly valid, and to them I add a third, in *Sorex*, of 28 teeth. In 1875, Dr. Gill* elaborately reviewed the Insectivorous Mammals at large, and proposed, mainly upon the basis of St. George Mivart's † investigations, verified by original examination of much material, a classification of the order believed to be the best yet presented. This valuable article is especially full in its treatment of the two North American families, *Talpidae* and *Soricidae*, and gives an extensive bibliography, but scarcely touches upon the characters of the genera and species.

Among other points may be mentioned the determination, by Professor Verrill, ‡ of the *Sorex palustris* of Richardson as a valid species of *Neosorex*; and the identification by Hr. Peters § of the *Scalops latimanus* of Bachman with *S. townsendi* of same author.

The most noteworthy laborer in this field before 1857 was Dr. Bachman, whose results, however, required much remodeling. The determination of his *Sorex fimbripes* was made by Professor Baird in 1861 from examination of the type, but is now first published in this paper.

§ 1.—THE AMERICAN GENERA OF TALPIDÆ.

America furnishes four good genera of Moles, namely, *Scalops*, *Scapanus*, *Condylura*, and *Urotrichus*. The last-named belongs to a special subfamily, *Myogalinae*, primarily distinguished from the *Talpinae* by the characters of the scapular arch and fore limb. It is related to the Desmans of the Old World, and is the only known insectivorous genus common to both hemispheres, furnishing one of the many evidences of a relation between the faunas of Western North America and Asia closer than that subsisting between Eastern North America and Europe. *Scalops* and *Condylura*, remarkable genera peculiar to America, have been recognized almost from the first; but the very strong claims of *Scapanus* to full generic rank have not been generally conceded. The genus differs so widely in dentition from *Scalops* that it would accord more closely with modern valuation of generic characters to give it full rank and subdivide it into two subgenera for the accommodation of its two remarkably distinct species, than to force it under *Scalops*, from which it differs more than some of the Old World genera do from each

* Synopsis of Insectivorous Mammals. < Bull. U. S. Geol. and Geogr. Surv., 2d ser., No. 2, pp. 91-120. May 14, 1875.

† Notes on the Osteology of the Insectivora. < Journ. Anat. and Phys., i, 1867, pp. 281-312; ii, pp. 117-154. (French translation: Notes sur l'Ostéologie des Insectivores. . . < Ann. Sc. Nat., 5e sér., zool. et paléont., viii, 1867, pp. 221-284; ix, 1868, pp. 311-372.)

‡ On Hemicentetes, a new genus of Insectivora, with some additional remarks on the osteology of that order. < Proc. Zool. Soc. Lond., 1871, pp. 58-79, pl. v.

§ Proc. Bost. Soc. Nat. Hist., ix, 1862, pp. 164-172, 225, 226. The same determination had been made by Baird in 1861 (MS. ined.).

§ Monatsb. Königl. Preuss. Akad. Wissensch. Berlin, 1863, p. 656.

other. In fact, it is scarcely less distinct from *Scalops* than from *Talpa* itself.

In this connection, I may notice the repeated ascription of "*Talpa*" to this country. The allegations to this effect have apparently arisen in two ways: from pure assumption and from mistaking of *Scapanus breweri* for *Talpa europæa*. The superficial resemblance of these two species is really curious; so close is it that casual examination might easily fail to detect any difference in external characters. Audubon and Bachman allude to specimens observed in the Museum of the Zoölogical Society of London marked "*Talpa europæa* from America".

Recent researches render it most probable that the current dental formulæ of our genera require to be reconsidered—not as to the total sum of the teeth nor as to their physical characters, but as to their morphological relations and their homologies. This is a subject, however, upon which I do not propose now to enter.*

§ 2.—THE AMERICAN SPECIES OF *TALPIDÆ*.

For aught that we now know to the contrary, the determination of our species offers no difficulty, if we regard the *Scalops argentatus* Aud. & Bach. as at most no more than a geographical race of *S. aquaticus*. The authors themselves were only "induced after some hesitation and doubt to designate it as a new species" (Quad. N. A., iii, p. 253), and Baird questions "whether the two can with entire propriety be separated" (Mamm. N. A., p. 63). It is certain that none of the ascribed characters are infallibly diagnostic.

No further material bearing upon the relationships of *Urotrichus gibbsii* and *U. talpoides* having come to hand, the case remains as Baird left it.

My present determination of our *Talpidae* gives the following results:—

Family *TALPIDÆ*.

Subfamily *TALPINÆ*.

Genus *Scalops*, "Cuv. 1800".

1. *SCALOPS AQUATICUS* (L.).

Talpa flavescens, Erxl.—*TT. fusca, purpurascens*, Shaw.

Scalops canadensis, Desm. (nec Rich.).—*S. pennsylvanica*, Harl.

1 a. *SCALOPS AQUATICUS ARGENTATUS* (Aud. & Bach.).

S. argentatus, Aud. & Bach.

* Cf. Spence Bate "On the dentition of the common mole (*Talpa europæa*)", Ann. Mag. Nat. Hist., xix, 1867, pp. 377-381, plate; and Trans. Odontogr. Soc. Lond., v, 1867, pp. 261-294, pl. vi; also Mosely and Ray-Lanckester "On . . . the dentition of the mole" . . . , Journ. Nat. and Phys., iii (2d ser. ii), 1869, pp. 73-80, pl. ii, figs. 5, 6.

Genus *Scapanus*, Pomel, 1848.

2. SCAPANUS TOWNSENDI (Bach.).

Scalops townsendii, *S. latimanus*, Bach.—*S. canadensis*, Rich. (nec auct.).—*SS. metallescens*, *aneus*, Cass. *—*S. tæniata*, Le C.†—*S. californica*, Ayres.‡

3. SCAPANUS BREWERI (Bach.).

(" *Talpa europæa ex Americâ* ", Aliq.)

Genus *Condylura*, Ill., 1811.

4. CONDYLURA CRISTATA (L.).

Sorex cristatus, L.—*Talpa longicaudata*, Erxl.—*T. radiata*, Shaw.—*T. longicauda*, Bodd.—*C. macroura*, Harl.—*C. prasinata*, Harris.§

Genus *Urotrichus*, Temm., 1842.

5. UROTRICHUS GIBBSI Bd.

(?=*U. talpoides*, Temm.)

§ 3.—GENERAL REMARKS ON THE *SORICIDÆ*.

Study of our Shrews will not give results with requisite precision, no matter how great the accessions of material, until we know more than we have yet learned of the limits of geographical and individual variation to which the same species may be subject. I am not aware that a single one of our species has yet become fully known in these respects, and we are still obliged to rely somewhat upon analogies which the cases of better known European species may afford. In treating of *Blarina talpoides* from this point of view, Mr. J. A. Allen (*loc. suprâ cit.*) certainly overreached the mark; yet enough has been ascertained to render it certain that he was right in insisting that a much wider range of geographical and individual variation exists than is admitted, infer-

* 1853.—Cassin (J.).—[Exhibition of a new mole, *Scalops metallescens* (descr. nulla).] <Proc. Acad. Nat. Sci. Phila., vi, Feb., 1853, p. 242.

[Described, *ibid.*, p. 299, as *S. aneus*.]

1853.—Cassin (J.).—Description of a new mole of the genus *Scalops*, from Oregon; a specimen of which is in the collection of the Exploring Expedition made by the U. S. ships Vincennes and Peacock, under the command of Captain Charles Wilkes, of the United States Navy. <Proc. Acad. Nat. Sci. Phila., vi, 1853, p. 299.

[*S. aneus*—named, not described, *ibid.*, p. 242.]

Mr. Cassin, whether intentionally or inadvertently, applied these two names to the same specimen.

† 1853.—Le Conte (J.).—[Remarks on the species of *Scalops* in the Collection of the Philadelphia Academy.] <Proc. Acad. Nat. Sci. Phila., vi, June, 1853, pp. 326, 327 (name on p. 327).

‡ 1855.—Ayres (W. O.).—"On *Scalops californicus*." <Proc. Cala. Acad. Sci. i, May, 1855, p. 54.

§ 1825.—Harris (T. W.).—"Description of a nondescript species of the genus *Condylura*." <Boston Journ. Philos. and Arts, ii, 1825, pp. 580, 583. (Also, Tilloch's Philos. Mag., lxvii, 1826, pp. 191-193.)

entially or in practice, by most authors. The only question is, how much to allow. It is also certain that the recognized species must be largely reduced in number, specific characters having been too often drawn from features which can be proven to not hold good.

The study of these diminutive quadrupeds would be difficult under the most favorable circumstances; and the kind of material that reaches us increases the difficulty. The skins are for the most part indifferently or very poorly prepared, and unaccompanied by cleaned skulls; while neither these nor the smaller number of alcoholic specimens are, as a rule, accompanied by the data requisite for their satisfactory utilization. They are generally unmarked for sex (difficult or impossible to determine from dried preparations at least) or date of capture. Measurements of dried skins are never more than approximately correct, frequently give very fallacious results, and must always be taken with allowance for probable error. This, in the case of such small objects, gives rise to much uncertainty. The date of capture is a very important item; for the seasonal changes of the pelage are evidently as decided as they are in the cases of animals better known in this respect, though terms expressive of length, fullness, softness, etc., of the fur continually recur in descriptive writing, without a hint as to what seasonal condition may be in point. To render such terms available in diagnosis, the date of capture must be known.

Similar remarks apply to the coloration. Color is unquestionably a good specific character in many or most cases, perfectly reliable within certain limits, or rather within limits still uncertain. Color-variation in this family is presented under three conditions (aside from purely individual variation in this respect), namely, with age or sex, with season, and with geographical distribution—none of which have hitherto received sufficient attention on the part of American writers. I am not aware that the first-mentioned variations have entered to any appreciable extent into the establishment and description of species; and I must confess my own very slight knowledge of the subject. Seasonal color-variation I know to be much greater than has ever been practically recognized by our writers, most of whom seem to have never even suspected its extent. In the Arctic material before me are some very striking illustrations of this variability in color. Under certain conditions of the change of pelage, specimens normally concolor or imperfectly bicolor show a narrow dark stripe along the back, sharply defined against rich-colored sides, the resulting pattern of coloration being comparable as to sharpness of effect with the pelage of a Weasel during the change from the summer to winter coat. I hope to enlarge hereafter upon this subject, which is one that no author, so far as I know, has adequately presented. The geographical variation in color is a third point which demands careful consideration. My studies up to the present go to show a very interesting parallelism with the state of the case I have determined for other small Mammals, notably the Mice

and Gophers, and which my friend Mr. Allen has admirably brought out in his studies of the Squirrels. In some cases, I find almost identical effects of climatic or other conditions upon the Shrews and the Mice of particular localities, by which they both acquire the same *facies loci*.

Present indications are that the normal variability of the Shrews in size, shape, and color is not less than has been determined to hold good in various other families of Mammals. But our species have yet to be handled with full appreciation of this fact, and revised accordingly.

Besides these general conditions of variability, there are some peculiar to *Insectivora*. The tail and lips, if not also the feet, are known to undergo extraordinary changes in connection with the rutting season. The remarkable swelling of the tail of the shrew-like Mole, *Condylura cristata*, finds its representation, if in less degree, among the Shrews, associated with tumidity of other parts. These facts are known at large, yet their practical application in the discrimination of species has been too limited. The implication of all such terms as "pachyurus", "longirostris", "platyrhinus", must be cautiously accepted.

The skull and teeth offer a ready means of throwing our species into genera and lesser groups, and no step in the study of the Shrews can be safely taken without examination of the cranial and dental characters. The skulls which come into our hands are very commonly mutilated or defective as to the back part, such is the fragility of the cerebral portions; but fortunately the rostral portion, including the jaw, is unusually strong for its size, and, with the teeth, is generally available for study. The dental armature of the Shrews is singularly powerful, far surpassing, in relative strength, that of the large Carnivores.

Notwithstanding assertions of authors to the contrary, the number of the teeth of the Shrews is constant in the same species. Replacement of the temporary teeth is said to occur in the fœtus; at any rate, specimens occur so young that the teeth are still encapsuled in membrane, which, nevertheless, show the normal adult number and permanent relative position when this envelope is torn off. All the American Shrews hitherto known have either 32, 30, or 28 teeth. The number in the lower jaw is the same for all, namely, 12. The difference in the upper jaw occurs in the "lateral" teeth intermediate between the large anterior incisor and the first molariform tooth. It has been wrongly supposed by at least one author that the *Blarina* and *Sorex* of 30 teeth were respectively the young of those of 32 teeth. In the case of the 30-toothed *Sorex*, the validity of the numerical distinction is curiously proven by the fact that it is not the minute tooth immediately preceding the large molariform premolar which is wanting, but one of the preceding premolars. The minute tooth is there still, but it is preceded by only 3 instead of 4 lateral teeth. In the new subgenus proposed beyond, in which there are but 28 teeth, it is the same premolar which is wanting.

We have no known white-toothed Shrews in America, like *Crociodura aranea*, though in our 28-toothed species the points of only a few anterior

teeth are colored, and these but slightly. In all the rest, the teeth are heavily pointed with color, as in *Sorex vulgaris* of Europe, with which our *Sorices* of 32 teeth are strictly congeneric. This color is usually described as "chestnut"; it varies much in intensity, from piceous reddish-black, through rich burnt sienna, to quite light and bright red. The younger teeth appear to be the more heavily colored; they take color with their early development. Since, too, it is their points that are most heavily colored, wearing of the dentition gradually lightens the tint at the same time that it decreases its extent.

The Shrews are remarkably voracious animals, like the Moles, requiring a large supply of food, and the ceaseless working of their jaws results in attrition of the teeth to such degree that the appearance is greatly altered with age. In extreme cases, the cusps of the molars, ordinarily so conspicuous, are entirely ground away, the premolars are reduced to mere stumps, while the fangs of the upper incisors and the curious denticulations of the lower incisors suffer quite as much. Teeth of the same or very closely allied species vary remarkably in their appearance as a whole, probably according to age; the variation being (besides the actual shortening of the teeth) in the apparent set or "dip" of the anterior teeth, the degree to which they are "tiled" or imbricated at base, and in the obliquity with which the anterior incisors connive. The precise nature and purport of these observed differences in the same or closely allied species, and the reliability of certain assumed specific characters thereby afforded, remain matters for further investigation.

I may here allude, however, to the curious fact first pointed out by Professor Baird, and which I have verified, of the modification of the premolar dentition which the Western species collectively, as compared with the Eastern, have undergone. A striking peculiarity of all the Western species, no matter how diverse in other respects, is to have the "third premolar" decidedly smaller than the "fourth"; while, in all the species east of the Rocky Mountains (with one possible exception), the same tooth is as large as or larger than the other. Of the fact there is no question; it may be observed in an instant, and is unmistakable. Its significance is another thing. Some of the Western species are scarcely distinguishable, if at all, from their respective Eastern analogues, except by this character, and they all show it. It is even repeated in *Neosorex navigator*, as compared with *N. palustris*. What relation this condition bears to the Pacific fauna it is difficult to understand. We may practically recognize it in two ways: by giving it prominence as a leading feature, by which two groups of *Sorex* proper may be discriminated, or by reducing it to merely a secondary character of certain species, irrespective of geographical distribution. To pursue the former course would be to rather widely separate certain species hardly or not distinguishable except by this technical character; to adopt the latter alternative would be to ignore a generalization equally legitimate and curious, that may have important if unsuspected rela-

tions with the determination of faunal areas. At present, I am inclined to follow Professor Baird in the appreciation of this character.

Certain other relative proportions of the anterior lateral teeth of the Shrews, which Professor Baird used as means of pushing the analysis of the species still further, seem to be of decidedly less applicability, even if they do not fall wholly within the limits of individual variation of particular specimens examined. These, therefore, I shall not bring into consideration of the question.

I may add here that no American Shrew is known to possess fewer than 28 or more than 32 teeth, though various authors have miscounted from 26 to 36, in the one case overlooking a minute premolar, in the other counting the posterior cusp of the upper anterior incisor as a distinct tooth. *Genera* have been founded on each of these blunders.

§ 4.—GEOGRAPHICAL DISTRIBUTION OF THE AMERICAN SPECIES OF *SORICIDÆ*.

Shrews have been commonly supposed, or tacitly represented, to be wanting in the warmer parts of America. Many years ago, however, J. E. Gray named two species of "*Corsira*" from Central America, and I have specimens from different localities in Mexico and from Costa Rica, whence only one* species has hitherto been described. No repre-

* *BLARINA (SORICISCUS) MICRURA*, Coues.

Corsira tropicalis, GRAY, P. Z. S., 1844, . . . , descr. nullâ (fide E. R. Alston in epist.).

Sorex micrurus, TOMES, P. Z. S., 1861, 279 (Guatemala, coll. Osbert Salvin).

HAB.—Guatemala (Salvin). Costa Rica (Carmioli).

This is a 30-toothed *Blarina* (subg. *Soriciscus*), very closely related to United States species like *B. cinerea*, *B. exillipes*, and *B. berlandieri*, if really distinct. As I have not finished my examination of the specific differentiation of this group, I should not here notice the supposed species were it not already described and did I not wish to indicate its proper generic and subgeneric position.

A short time ago I sent a number of Shrews to my valued correspondent Mr. E. R. Alston, of London, begging him to compare them with the types of certain species preserved in the British Museum. I receive his answer just in the nick of time, as these sheets are passing the press. He identifies my British American specimens with types of Sir John Richardson's species described in the F. B.-A., so that this matter will be placed beyond dispute as soon as I get ready to use the important information thus kindly communicated by Mr. Alston.

Among the Shrews sent to him was a specimen from Costa Rica (coll. J. Carmioli), of which he states:—"I have little or no doubt that it is the same as *Sorex micrurus* Tomes . . . I have not access to Mr. Tomes's types, but I have examined another of Mr. Salvin's specimens, in spirits, and have no doubt your animal is the same. I also believe that Gray's *Corsira tropicalis* is the same, though the types look darker from dirt."

Mr. Alston writes further:—"Gray's *C. temlyas*, afterward renamed in MS. *C. teculyas* is a large species, apparently a true *Sorex* . . ." Not to anticipate the description of the species, which I trust we shall have from Mr. Alston in due time, I thus merely allude to the apparent presence of *Sorex* proper in Central America, as the *Soricidæ* have not hitherto been ascertained to be represented there excepting by the genus *Blarina*, nor indeed south of the United States excepting by *Blarina* and by the beyond-described new subgenus and species of *Sorex*.

representatives of the *Soricidae*, or, indeed, of the order *Insectivora*, are known in South America.

In North America, the differentiation of the *Soricidae* into genera and species has progressed farthest in the temperate and cold-temperate portions of the continent. Shrews occur throughout British America and the United States, from Atlantic to Pacific, and north to the very shores of the Arctic Ocean. These diminutive quadrupeds are endowed with wonderful powers of resisting cold, generating heat enough in their small bodies to endure the rigors of hyperborean winters. Their rapacity, voracity, and salacity are of the highest order, and they are incessantly active, never hibernating, but running freely about on the snow during the long Arctic winters. In the high north, the species are few, but individuals abound, comparable in numbers with the Arvicolas and Lemmings which swarm in the sphagnous regions of the Arctic zone. The genus *Sorex* alone is known to occur in the higher latitudes, where it is represented by the subgenera *Sorex* proper (one species being very near *S. vulgaris* itself) and *Microsorex*, the latter only just now ascertained to extend to the region of the Yukon River.

Somewhat farther south, in Northern United States and contiguous portions of British America, the genera and species multiply directly. Here we encounter *Neosorex*, and with it or directly after it *Blarina*, the latter being the most characteristic American genus of the family. Species of *Neosorex* are known to occur from Nova Scotia and New England across to Washington Territory and Oregon, and south along the Rocky Mountain chains to New Mexico. It is not yet time to map its distribution. I suspect that its dispersion is wider than now known. I anticipate its occurrence in Alaska and other northern regions, where the present evidence of its absence is wholly negative; but I rather presume that its southward extension may prove to be really limited much in the way just indicated. It seems to find its centre of abundance in interior cold-temperate regions, as those of the Red River of the North and the Great Lakes.

Sorex proper occurs throughout the United States; at any rate, it cannot be supposed absent from any single area, so extensively is it represented by specimens now in our hands. Three or more species are peculiar to the Pacific Province of the United States; others are generally dispersed, but most abundant in individuals in northerly portions of the United States, where also occur the majority of the species. Exclusive of the peculiar Pacific ones, all the described United States species occur in New England or along the northern tier of States, this being also the United States distribution of the single known species of the subgenus *Microsorex* (*M. hoyi*), though the entire distribution of the latter must not be presumed to be known as yet.

The remarkable new subgenus *Notiosorex*, to be described on a succeeding page, is found in New Mexico and at Mazatlan, Mexico; it is, with one exception, the only representative of the genus *Sorex* known to occur

south of the United States, the subtropical extension of the family further being represented, as far as is now known, only by one or two species of *Blarina*, and by the still undescribed species of *Sorex* (?) named *Corsira temlyas* by Gray.

Blarina, the genus of *Soricidae* which contains the most species among those peculiar to this continent, is on the whole rather southerly in distribution. It is not known to occur much beyond the northern border of the United States, nor has it been detected on the Pacific side. A species of *Blarina* proper (*i. e.*, of *Blarina* with 32 teeth) is the commonest representative of the family in New England and adjacent portions, and with another species (or variety) extends more sparingly into a part at least of the Southern States. Westward, I have no specimen of this subgenus beyond the plateau-region whence Say described the original "*Sorex*" *brevicauda*; but it probably reaches the Rocky Mountains at least. *Blarina* of 30 teeth is still more decidedly southerly. I am not aware that it is known north of the Middle States, and it appears to be the most abundant and characteristic representative of *Soricidae* in various South Atlantic States, as the Carolinas and Georgia. One species (if not also a second) occurs throughout the Southern States, and extends through the Western States to Kansas and Nebraska, if not farther, and at least as far north as Council Bluffs. This same subgenus, to be characterized beyond as *Soriciscus*, extends through Mexico to Costa Rica, being represented south of the United States by at least two species. With the exception of one Mexican species of *Sorex* (*Notiosorex*), and one Central American species, perhaps a true *Sorex*, it is the only known subtropical representative of the *Soricidae*.

§ 5.—DETERMINATION OF THE AMERICAN GENERA AND SUBGENERA OF *SORICIDÆ*.

According to reliable authority, the Old World Shrews occur under three principal modifications, represented by as many leading genera and their respective intimate associates. These three are *Sorex*, *Crocidura*, and *Crossopus*.

Sorex, the most generalized type, is the only one which is known to occur in America. With its Old World subdivisions I am not familiar. *Paradoxodon* and *Soriculus* appear to be the most prominent. The American species of *Sorex* are nearly all strictly congeneric with *Sorex vulgaris*,* having 32 colored teeth. I am uncertain to which one, if to any one, of the subdivisions the type *Microsorex* of 30 colored teeth may belong. We have nothing in America exactly like *Crocidura* (type *C. aranea*) of 28 uncolored teeth; but the new subgenus *Notiosorex*, of 28 nearly colorless teeth, large naked ears, etc., seems to answer for this type. *Crossopus*, embracing the Old World Water-shrews of 30 colored

* Which I here consider the type of *Sorex*, though some authors restrict the name to a species with white teeth (*Hydrosorex* Duv., 1834).

teeth, large fringed feet, and long keeled tail, finds its strict representative in the American genus *Neosorex*, which includes equally aquatic species, with large fimbriate feet, though the tail is scarcely carinate with hairs, and the teeth are 32 in number.*

Blarina with its several species is the most characteristic American genus, and the most prominent of those peculiar to this continent, having no exact Old World analogue. It is well marked by the structure of the small external ears, invisible on ordinary inspection, very short tail, and a special condition of the dentition, although the number of the teeth, 32 or 30, is the same as in *Sorex*. Like the latter, it is divisible into subgenera, according to the number of the teeth; *Blarina* proper (type *brevicauda*) having 32 teeth, while there are but 30 in the section *Soriciscus*, defined beyond.

Following are the diagnostic characters of the American genera and subgenera of *Soricidae*, with their respective synonyms:—

I. Genus NEOSOREX, Baird, 1857.

Sorex, sp., RICH., F. B. A., i, 1829, 5. (*S. palustris*, orig. descr. in Zool. Journ., iii, No. xii, April, 1828, 517. Teeth miscounted 30 instead of 32, the true number.)

Neosorex, BAIRD, M. N. A., 1857, 11. (Type *N. navigator* Cooper, sp. n.)

Hydrogale, GILL, Bull. U. S. Geol. and Geogr. Surv., 2d ser., No. 2, 1875, 111. (Not of Pomel, 1848, which is a figment, based on a blunder.)

CHARS. GEN.—Teeth 32 ($\frac{20}{12}$), as in *Sorex* proper. Upper unicuspid† 5, the fifth minute, the fourth and third smaller than the second and first, which are equal to each other; third equal to or smaller than fourth. Upper incisors with a posterior hook as large as the succeeding tooth, and like it in shape, and with a notched lobe on the inner side, connivent with its fellow. Lower incisors with several (normally three) denticulations on the cutting edge, and reaching back beyond the next tooth, which is thus entirely above them. Teeth all colored.

* Dr. Gill having recently proposed to supplant the term *Neosorex* Baird, 1857, by *Hydrogale* Pomel, 1848, it becomes expedient to inquire into the case. *Hydrogale* was based upon *Sorex fimbripes* of Bachman—a species which has occasioned much uncertainty and confusion. The name suggests an aquatic species; but this is altogether erroneous. In 1861, Baird examined Bachman's type preserved in the Philadelphia Academy, and found it to be a species of ordinary 32-toothed *Sorex*, scarcely or not distinguishable from "cooperi". Bachman miscounted 34 teeth (which number no known American species possesses), and wrongly laid stress on certain characters of the feet, which had no basis except in the accidental condition of the specimen as preserved. *Hydrogale* is therefore based on a misapprehension, the characters assigned having no existence in nature, and the type of the "genus" being scarcely or not specifically separable from a previously known form; it therefore becomes of course a synonym of *Sorex* proper, as a pure figment—so far is it from being "undoubtedly congeneric with *Neosorex*", as assumed by Dr. Gill without that degree of caution which distinguishes that trained naturalist.

† By the descriptive term "unicuspid", I intend to cover in these descriptions the anterior series of lateral teeth between the bicuspid front incisor and the pluricuspid molariform teeth, purposely avoiding committal to the homologies which would be im-

Rostral part of skull very slender and attenuate, with nearly straight and horizontal upper profile far out of line with the profile of the swollen cerebral part. Interorbital constriction at the maximum. Bridge over the anteorbital foramen comparatively narrow. Coronoid process of jaw slender, tilted forward; angular process comparatively short, extremely slender, and nearly horizontal. Tail scarcely or not shorter or much longer than the head and body, without a decided keel of hairs along the under side. Ear distinct, the auricle directed backward (as usual). Feet large, fringed with long, straight, stiffish hairs in regular series; the hinder feet especially well developed and natatorial, about one-fourth as long as the head and body. Pelage long, soft, and thick, to resist water. Of large size and highly aquatic habits.

TYPE.—*Neosorex navigator* Cooper. Peculiar to North America, where it replaces *Crossopus* of the Old World. Includes the Water-shrews of the Western Hemisphere. Although the strict representative of *Crossopus*, it differs decidedly from the latter in cranial, dental, and external characters. In *Crossopus* there are but 30 teeth, the unicuspid being only 4, the three anterior ones regularly graduated in size, the fourth minute; the upper incisors appear to lack the lobe on the inner edge, the posterior hook is smaller, and the under incisors have but one denticulation (in the only specimen before me). The skull is much broader, as shown especially between the orbits and at the interpterygoid space. The contour of the palate is more broadly pyriform; the rostral part of the skull is much less attenuate, with wider bridge over the anteorbital foramen. The mandible as a whole is stronger, with stouter, more nearly perpendicular, coronoid process, and more oblique angular process. The tail has a prominent keel of stiffish hairs along the under side, not developed in *Neosorex*. I am unable to compare the ears. The feet are very similar, though the fimbriation is less conspicuous. In general appearance, *Neosorex navigator* and *N. palustris* are quite like *Crossopus fodiens*, all these Water-shrews being large, long-tailed, large-footed species, sharply bicolor, blackish above and whitish beneath.

plied in the use of the term "premolars", applied by Baird to these teeth. The Shrew's teeth are conveniently separable, for purposes of ordinary description, into three sets, namely:—(1) The enlarged and peculiarly modified single incisor, on each side, above and below; (2) A series of varying number of small unicuspid teeth, intervening between the incisors and the molariform teeth; (3) The molariform teeth, always four above on each side and three below on each side. The anterior one of these last on each side above is homologically a premolar, though it is like the true premolars in appearance; the homologies of some of the unicuspid teeth are in question. All the American *Soricida* (like all the Shrews as far as known) have the same number of under teeth, namely, 12. The differences in the number of the teeth arise from the presence of 3, 4, or 5 "unicuspids". The following formula covers the numerical composition of the teeth of all American shrews, without being committed to their homologies:—

$$\frac{1-1}{1-1} + \frac{3-3 \text{ or } 4-4 \text{ or } 5-5}{2-2} + \frac{4-4}{3-3} = \frac{16 \text{ or } 18 \text{ or } 20}{12} = 28 \text{ or } 30 \text{ or } 32.$$

Incisiform. Lanariform. Molariform.

All are highly aquatic, comparing with the species of *Sorex* and *Blarina* as a Mink or Otter does with most *Mustelidæ*, or as a Muskrat with ordinary *Arvicolæ*.

To the type-species is to be added the *Sorex palustris* of Richardson, and possibly another species.

II. Genus SOREX, Linn.

(a)

Sorex, LINN. (Type *S. vulgaris*, fide Nathusius, Arch. f. Naturg., 1833, 45.)

Sorex of AUTHORS referring to *S. vulgaris* (not of those applying the name to *Crocidura aranea*).

Corsira, GRAY, Proc. Zool. Soc., 1837, . . . (Type . . .)

Otisorex, DE KAY, Zool. N. Y., 1842, . . . (Type *O. platyrhinus*.)

Hydrosorex, DUVERNOY, 1836, nec 1834.

Amphisorex, DUVERNOY, 1834, nec 1836.

Hydrogale, POMEL, . . . 1848. (Type *S. fimbripes* Bach. Genus based in error.)

(b)

Paradoxodon, WAGNER, . . . 1855. (Separate subgenus.)

(c)

Soriculus, WAGNER, . . . 1855. (Separate subgenus.)

(d)

Microsorex, BAIRD, MSS., 1861. (Separate subgenus. Type *S. hoyi* Bd.)

(e)

Notiosorex, BAIRD, MSS., 1861. (Separate subgenus. Type *S. crawfordi* Bd. n. sp. infra.)

In the present uncertainty which obtains respecting the limitation of the original Linnæan genus, I do not attempt to give a diagnosis covering all its modifications. Its value is very differently rated by authors, some confining the term to *S. vulgaris* and its strict congeners, while others, even among the latest systematists, make the genus coextensive with the family, as Peters and Mivart* have done. I think that the genus may be most naturally defined to exclude *Crossopus* and *Crocidura* with their respective allies, and *Blarina*, making subgeneric sections according to the numerical composition of the teeth, though some of the forms included in the foregoing synonymy may be worthy of full generic rank. It will tend to prevent confusion to hold *S. vulgaris* as the type.

To the genus *Sorex*, as thus rigidly restricted, belong nearly all the

* According to the latter author, the constants of the teeth of *Soricidæ* are as follows:—

$$i. \frac{-}{1-1}, c. \frac{1-1}{1-1}, pm. \frac{-}{1-1}, m. \frac{3-3}{3-3};$$

the variables being confined to the upper incisors and upper premolars, which may be either

$$i. \frac{4-4}{-} pm. \frac{2-2}{-}; \text{ or } i. \frac{3-3}{-}, pm. \frac{2-2}{-}; \text{ or } i. \frac{3-3}{-}, pm. \frac{1-1}{-}; \text{ or } i. \frac{2-2}{-}, pm. \frac{1-1}{-}.$$

American species, and it is the only Old World type found in this country, *Crossopus* being replaced by *Neosorex*, and *Crocidura* having no exact analogue, though the new subgenus *Notiosorex* may be considered to answer to it.

Among our numerous species of *Sorex*, however, is found considerable diversity of external characters, coupled with difference in the numerical composition of the teeth, enabling us to mark off three sections with ease. The teeth are either 28, or 30, or 32, according to the number of upper unicuspid, whether 3, or 4, or 5. Other distinctions may be drawn from the relative proportions of the unicuspid and from certain conditions of the tail, feet, and ears.

The species of American *Sorex* at large offer the following characters:—

Body slender, head elongate, and muzzle attenuate; breadth of the head nearly or about half its length; muzzle naked, with a terminal vertical furrow continuous with the horizontal one formed below by meeting of the lips, *i. e.*, end of the snout bilobate; nostrils lateral; whiskers long, some of them reaching beyond the head; ears large (comparatively), with auricle directed backward (as usual); the antetragus elliptical or semicircular, fitting and closely applied to the meatus, its upper root passing beneath a second transverse nearly horizontal flap, which projects forward and forms a second valve, closing the remaining portion of the naked auditory region. Both faces of these flaps are generally naked, the anterior always so; both surfaces of the auricle are thinly haired, while its edge and the edges of both the flaps are fringed with long hairs. The fore feet are from one-half to two-thirds as long as the hinder ones; both are naked below; the sides of the heels, however, are hairy, leaving only a narrow strip bare. The soles are paved with small granulations, among which are six large tubercles, one at the base of respectively the first, second, and fifth digits, one common to the bases of the third and fourth, and another on each side of the sole midway between the heel and the bases of the digits. The feet are not fimbriate in the sense that those of *Crossopus* and *Neosorex* are. The tail is generally subequal to the trunk alone, sometimes, however, about as long as the head and body; in only one instance known to be less than half this latter dimension. It is more or less thickly, but uniformly, covered with hairs, which usually form a slight pencil at the tip; but under some conditions, probably seasonal or otherwise fortuitous, the tail is nearly naked.

The skull is slender, constricted behind the molars. The upper unicuspid are 3, 4, or 5. When 3, they are regularly graduated in size, none being very small. When 4, the first three are graduated in size, the fourth being abruptly smaller and very minute, scarcely visible from the outside, and liable to be overlooked, so crowded is it between the closely approximated or even touching teeth which precede and follow it. When 5, the first four are abruptly larger

than the minute fifth, which occurs under the same conditions as last described; among the larger unicuspid there is either regular gradation in size, or oftener the two first are coequal and larger than the third and fourth, or again the third is decidedly smaller than the fourth or second. In the species with 30 or 32 teeth, these conditions are contrasted with those occurring in *Blarina* of the same numbers of teeth; for in the latter the last two or three unicuspid are always smaller than the first two, and much crowded. The large upper incisor has a notched lobe or snag on its inner face, besides the strongly developed posterior hook, which looks like a separate tooth, and closely resembles the succeeding tooth. The under incisor has one, two, or three denticulations on its cutting-edge, and reaches so far back that the next tooth is entirely above it, while more or less of the succeeding tooth is likewise similarly placed with reference to the incisor. The teeth are always colored (as they are also in *Neosorex* and *Blarina*), but in one subgenus the coloration is very slight.

Such sum of characters is offered under three modifications (of the teeth more particularly), which must be made the basis of subgeneric distinction, if not to be more highly appreciated. These are as follows:—

a. Subgenus **SOREX**, L. (emend).

CHARS. SUBG.—Teeth 32 ($\frac{29}{13}$). Upper unicuspid 5; the fifth minute, but generally visible from the outside, though crowded between the preceding unicuspid and the first molariform tooth, which are not in contact; the first and second appreciably larger than the third and fourth, which latter vary in size relatively to each other. Interior snag and posterior hook of upper incisor well developed; lower incisor with (normally) three denticulations; whole of next tooth and half of the next placed above incisor. Teeth all well colored. Coronoid of jaw long and comparatively slender, nearly vertical. Skull moderately high behind, the profile of the cerebral portion rising out of line with that of the rostrum; depth of rostrum (including closed jaw) less than that of cerebral portion of the skull. Molar dentition moderate in development; distance across outer edges of molars not over half the width of the cranium; length of series of molariform teeth not more than half the length of the whole line of teeth. Tail not less than half the length of the head and body, usually longer than the trunk alone. Central line of heel naked. Ears moderately large.

TYPE.—*Sorex vulgaris*, with which most of the American *Sorices* are strictly con-subgeneric.

Group A.—Species with the third and fourth unicuspid approximately equal in size (both smaller than the first and second).

Group B.—Species with the third unicuspid decidedly smaller than the fourth (which is itself less than the second and first). (Confined to the Pacific Province.)

d. Subgenus MICROSOSEX, Baird, MS., 1861.

CHARS SUBG.—Teeth 30 ($\frac{1}{2}$). Upper unicuspid 4; the fourth minute, concealed from view externally by the contact of the third unicuspid and first molariform tooth; the third appreciably smaller than the second and first, which are equal to each other and to the hook of the incisor. Interior snag and posterior hook of upper incisor well developed; lower incisor with (normally) two denticulations, and extending so far back that the two succeeding teeth are placed entirely above it. Teeth all well colored. Coronoid process of jaw long and comparatively slender. Molariform teeth large; distance between their outer edges more than half the width of the skull. Depth of rostrum (including jaw) greater than that of the cerebral portion of the cranium. Series of molariform teeth longer than half the length of the whole series of teeth. External characters not obviously different from those of *Sorex* proper. Tail about as long as trunk.

TYPE.—*Sorex hoyi* Baird, from which *S. thompsoni* does not appear to be specifically distinguishable.

This perfectly valid section of *Sorex* has been suspected to rest upon immature dentition, the decrease in the number of teeth being supposed due to suppression or non-development of the minute last unicuspid. But it will be seen from the foregoing that this minute tooth, immediately preceding the first molariform tooth, is present in both cases, being in *Sorex* proper preceded by four larger unicuspids, while in *Microsorex* the unicuspids preceding it are only three in number.

e. Subgenus NOTIOSOREX, Baird, MS., 1861.

CHARS. SUBG.—Teeth 28 ($\frac{1}{2}$); upper unicuspid 3, the minute last unicuspid of *Sorex* proper and *Microsorex* here wanting; first and second unicuspids about equal to each other, larger than either the third unicuspid or the posterior hook of the incisor. No internal snag or notch on upper incisor, and the posterior hook only moderately developed, being smaller than the succeeding tooth. Lower incisor with only one denticulation, or merely a slight situation; its tip hooked upward, its base reaching below the two succeeding teeth. Teeth scarcely colored, and only on the tips of the incisors and a few succeeding teeth, the molariform ones left white. Coronoid process of jaw comparatively short, obtuse, and widely diverging outward. Proportion of molariform teeth to the rest of the series and width across them relative to the cranial width as in *Microsorex*. Skull very low behind, broad across the orbits, and comparatively little attenuate in front. Ears remarkably large, thinly haired, and conspicuous. Tail short, somewhat as in *Blarina*, scarcely or not half as long as the head and body. General external appearance of *Crocidura*.

TYPE.—*Sorex (Notiosorex) crawfordi* Baird, MS., 1861, sp. n., described at length beyond.

This remarkable new subgenus, the only one of America possessing 28 teeth, is related to *Crocidura*, having the same number of teeth as *C. aranea*, and sharing other dental characters, such as absence of internal snag and small size of posterior hook of the upper incisor, single or obsolete denticulation of the under incisor, massiveness of the teeth, and particularly of the molars, relative length of the molariform series to the whole line of teeth, etc. The teeth of *Crocidura* are entirely white, of *Notiosorex* scarcely colored. In both, the skull is lower behind than in *Sorex* proper, much less constricted across the orbits, and much less attenuate anteriorly, while the coronoid process of the jaw is shorter, stouter, and more divergent from its fellow.

The type of *Notiosorex* is in very bad order, not permitting satisfactory examination of external characters. A dried specimen of *Notiosorex* from Mazatlan, apparently a second species of the group, is in excellent condition. This is strikingly similar to *Crocidura* in general external appearance, even to the large scant-haired ears and short tail. The size is about the same, while in coloration it is scarcely distinguishable from some Bavarian specimens of *Crocidura* labeled "*S. leucodon* Hermann".

III. Genus BLARINA, Gray, 1837.

(a)

Sorex, *sp.*, AUCT. AMER.

Blarina, GRAY, Proc. Zool. Soc. Lond., 1837. (Type *Sorex talpoides* Gapper.)

Brachysorex, DUVERNOY, Mag. de Zool., 1842.

Talpasorex, POMEL, . . . 1848. (Nec auct.)

Cryptotes, POMEL, . . . 1848.

Anotus, WAGNER, . . . 1855.

(b)

Soriciscus, COUES, *infra*, subg. n. (Type *Sorex parvus* Say or *S. cinereus* Bachm.)

CHARS. GEN.—Teeth 32 ($\frac{20}{12}$) or 30 ($\frac{18}{12}$). Upper unicuspid either 5 or 4, the two anterior of which are abruptly larger than the two or three posterior ones, which latter are small and much crowded. When there are 5 unicuspids, the third and fourth are subequal to each other; in any case, the fifth is minute, much smaller than any preceding one. The larger unicuspids have supplementary cusps. Upper incisors without internal snag or notch, and rarely connivent, with greater or less development of the posterior hook. Under incisor with several obtuse denticulations, or nearly sinuate, extending backward a variable distance, according to the subgenera. Skull variable in massiveness, etc., in the same way. Teeth all colored on the points. Coronoid process of jaw comparatively short, stout, and erect (rather inclined forward as well as outward, as in *Sorex* and its subdivisions). Styliform angular process of jaw very short, scarcely or not reaching as far back as the condyle. Tail short, scarcely or not as long as the head, uniformly haired, with a small

terminal pencil. External ears small, invisible on ordinary inspection, and peculiarly constructed; the auricle, as well as other parts, being directed forward to close the meatus, leaving no opening or appearance of a concavity of auricle. Fore feet broad, large in comparison with the hinder ones, the palms naked, the claws enlarged and somewhat fossorial, longer than the hind claws. Hind feet very small comparatively, the soles granular and pluri-tuberculate, the heels hairy, excepting usually a very narrow central strip. Body stout; size variable, the species ranging from much the largest to the smallest of American Shrews; coloration either uniform or sharply bicolor.

The short-tailed or so-called "earless" Shrews of America constitute a strongly marked group not represented at all in the Old World. They are readily recognized by the characters of the tail and ears; while the skull and teeth furnish equally or more satisfactory means of discrimination from any other genus of *Soricidae*. In the foregoing diagnosis I only present the more salient cranial and dental characters, serving for ready determination, omitting here, as elsewhere in this paper, many details, which, however necessary in full description, would, if here introduced, tend to obscure the characters I wish to set forth prominently.

Nevertheless, I am obliged to define the genus somewhat loosely, owing to the dissimilarity of the two types of form it covers. So far from there being only one species of *Blarina*, as Mr. Allen has sought to maintain, there are a number of them, representing two subgenera as distinct as any of those just established in the genus of *Sorex*, if not more so. Erroneous statements respecting the ears, and miscouints of the number of the teeth, which have been rated as many as 34 and even 36, have already caused the erection of several groundless genera, such as *Anotus* and *Cryptotis*; but all these, as Baird has remarked, are strictly synonymous with *Blarina* of Gray or *Brachysorex* of Duvernoy, and belong to the section with 32 teeth represented by *B. talpoides*. The other section, of 30 teeth, properly characterized by Baird in 1857, but not hitherto named, I propose to call *Soriciscus*. It is the only known representative of the genus in Mexico and Central America.

a. Subgenus BLARINA, Gray (emend.).

CHARS. SUBG.—Teeth 32 ($\frac{20}{12}$); upper unicuspid 5; the two anterior ones largest, subequal to each other, exceeding in size the hook of the incisor; next two abruptly smaller, subequal to each other; last one smaller still, very minute, scarcely or not visible externally; three last appearing crowded together. Upper incisor with the posterior hook reduced to a mere rectangular lobe, much smaller than the succeeding tooth. Lower incisor reaching back below the first molar, so that two teeth and part of a third are above it. Skull comparatively massive with well developed lambdoidal and sagittal crests, the former defining an occipital plane. Very little interorbital constriction, and rostral part of skull moderately tapering, not nearly so attenuate as in *Sorex*.

Upper profile of skull nearly in one line from end of nasals to occiput. Size from medium to largest. Fore feet at maximum of size, with largest claws. Coloration nearly uniform.

TYPE.—*Sorex brevicauda* Say or *S. talpoides* Gapper.

b. Subgenus **SORICISCUS**, Coues, subg. n.

CHARS. SUBG.—Teeth 30 ($1\frac{1}{2}$); upper unicuspid 4; first two largest and subequal to each other; third abruptly smaller; fourth smaller still, very minute and usually crowded out of view externally. Upper incisor developing a decided posterior hook, nearly or quite as large as the succeeding tooth, and much as in *Sorex* itself. Lower incisor reaching back only below the second succeeding tooth, so that only one tooth and part of a second are placed above it. Skull in general more like *Sorex* than like *Blarina* proper; sagittal and lambdoidal crest obsolete, the occiput rounding insensibly into the parietal walls. Interorbital constriction and attenuation of rostrum much as in *Sorex*. Upper profile of skull straight in front, rounding up behind, nearly as in *Sorex*. Size small to very small. Fore feet relatively smaller than in *Blarina* proper, with less developed claws. Coloration indifferently bicolor or concolor, oftener the former.

TYPE.—*Sorex parvus* Say or *S. cinereus* Bachm.

Here belong the greater number of the species, among them the very smallest Shrews of America. In bulk of body, some species are about the same as *Microsorex hoyi*, but the shortness of the tail makes the total length much less. Thus, apparently full-grown specimens before me are under two and a half inches long, tail and all, while *M. hoyi* measures at least three inches, tail included. In general configuration, the skull is more like that of an ordinary Shrew than it is like that of the other section of the same genus.

I conclude this portion of the subject with an analysis of the genera and subgenera according to a few salient features:—

A.—Ears ordinary. Feet fimbriate. Tail about equaling or exceeding the head and body in length.

Teeth 32 **NEOSOREX.**

B.—Ears ordinary. Feet ordinary. Tail shorter than head and body.

Teeth 32 **SOREX.**

Teeth 30 *Microsorex.*

Teeth 28 *Notiosorex.*

C.—Ears peculiar. Feet not fimbriate. Tail about as long as the head.

Teeth 32 **BLARINA.**

Teeth 30 *Soriciscus.*

§ 6.—DESCRIPTION OF FIVE NEW SPECIES OF AMERICAN
SORICIDÆ.

1. *SOREX PACIFICUS* Baird, n. sp.

Sorex pacificus, BAIRD, MSS. inéd., 1861.

Teeth 32. Upper unicuspid 5, the third decidedly smaller than the fourth, the fifth smaller still, but distinctly visible externally. Upper incisor lacking an obvious internal notch, but with well developed posterior hook as large as the succeeding tooth. Under incisor with two blunt lobes and a slight sinuation, reaching back to first molar, two teeth being placed entirely above it.

Nearly unicolor, without line of demarkation, becoming insensibly a little paler below. Rusty iron-gray, or light dull reddish-brown, gradually fading to a lighter grayer shade of the same on the under parts. Feet and under side of tail brownish-white; tail more decidedly bicolor than the body, colored above to correspond. Teeth colored as usual.

Large; length (of skin, approximate) 3.00 inches. Tail-vertebræ 2.25, with hairs 2.45. Hand 0.35. Foot 0.60.

Hab.—Fort Umpqua, Oregon (Dr. E. P. Vullum).

Type No. 3266, Nat. Mus. (Smiths. Inst.).

Readily distinguished by the peculiar proportions of the unicuspid teeth, which are as in all the other Shrews of the Pacific Province—these species being entirely different in other respects. One of the largest species, rather surpassing the *S. "richardsoni"* of Baird, and two or more times as bulky as any of the Shrews like "*cooperi*" or "*platyrhinus*". Nearly identical in color with the type of *S. "richardsoni"* of Baird (No. 830, Nat. Mus., Racine, Wis.), but larger; tail an inch longer, differing in the latter respect much as *Neosorex navigator* does from *N. palustris*. Requiring no comparison with any other species hitherto described.

2. *SOREX SPHAGNICOLA* Coues, n. sp.

Teeth unknown; undoubtedly 32; with third unicuspid undoubtedly not smaller than fourth.

Nearly unicolor, without line of demarkation, merely paler below; blackish-brown, changing insensibly on under parts to blackish-gray, with a slight rusty shade; tail obscurely bicolor, to correspond; feet dark brown.

Very large, fully equaling *S. "alpinus"* of Europe; length (of skin, approximate) 3.25; tail only about half as long, 1.50; foot 0.50.

Hab.—Fort Liard, H. B. T., or vicinity (W. L. Hardisty).

Type No. 6361, Nat. Mus. (Smiths. Inst.).

Belonging to the group of large whole-colored species, of which *S. pacificus* and *S. "richardsoni"* of Baird are other members, and which represent the large plumbeous whole-colored *S. "alpinus"* of Europe. General appearance that of *Blarina talpoides*, being sooty-blackish and as large as many specimens of the latter. Distinguished from *S. "rich-*

ardsoni" of Baird by superior size and fuliginous coloration; from *S. pacificus* by the same points in which *S. richardsoni* differs, tail an inch shorter, etc.

3. SOREX (NOTIOSOREX) CRAWFORDI Baird, n. subg. et sp.

Sorex (Notiosorex) crawfordi, BAIRD, MSS. ined., 1861.

Teeth 28; upper unicuspid 3; third a little smaller than second and first; upper incisor without internal notched lobe, the posterior hook smaller than the next tooth; lower incisor reaching below the two succeeding teeth, its cutting edge not denticulate, merely sinuate; dentition as a whole very heavy, the teeth uncolored, except points of a few anterior ones. Head large. Tail short; little over half as long as head and body.

Color "light chestnut-brown, paler beneath". Very small; length (alcoholic) 1.90; tail-vertebræ 1.10, with hairs 1.15; hand 0.25; foot 0.40; tip of nose to incisors 0.11, to eye 0.40, to occiput about 0.80; length of skull 0.68, its width 0.31, its height 0.18; width at interorbital constriction 0.17.

Hab.—Fort Bliss, New Mexico, or vicinity (Dr. S. W. Crawford, U. S. A.).

Type No. $\frac{2653}{4437}$, Nat. Mus. (Smiths. Inst.); specimen in alcohol 2653; prepared skull 4437.

In further elucidation of this interesting form, I quote passages from Professor Baird's original MS. :—

"It is much to be regretted that the only known specimen of this species is in exceedingly bad condition. There is enough, however, to show its strongly-marked distinction from any other North American species The muzzle is wider than usual in our small Shrews, owing to the size of the molar teeth; the head, too, appears disproportionately large. The skull is very large for the size of the animal, measuring nearly 0.70; the rostral part is broad, and the interorbital constriction slight; the greatest width of the upper jaw is more than half as much as that of the cranium. The coronoid process of the mandible is short and stout. The molar teeth are of enormous size. Thus the middle of the ante-orbital foramen falls over the line of separation of the first and second molars [*i. e.*, molariform teeth], and the molar series is nearly two-thirds as long as the whole line of teeth. The upper incisor has no inner lobe or spoon-shaped expansion, resembling that of *Blarina* in this respect. There are but three upper premolars [*i. e.*, unicuspid teeth]; all compressed transversely, forming a trenchant edge, the lateral outline pointed. The 1st and 2d premolars are equal and larger than the 3d, which exceeds the posterior hook of the incisor. The lower incisor has no lobes, though the point is hooked upward and the upper outline sinuous. It extends backward to the 1st molar, the 1st and 2d premolars being entirely above it; the latter have each a single cusp. The teeth are entirely colorless, except a slight chestnut tinge to the tips of the incisors and still less on the anterior premolars.

"The ears appear to be much as in *S. cooperi* and its allies, and larger than in *S. hoyi*. The 5th hind claw reaches half-way over the penultimate phalanx of the 4th digit. The heels appear to be hairy behind, without a central linear naked space. The hairs at the ends of the toes appear of unusual length, extending beyond the claws. The color, as far as the hair remains on the alcoholic specimen, is a nearly uniform rufous, rather paler beneath; the fur is long."

4. SOREX (NOTIOSOREX) EVOTIS Coues n. sp.

Teeth 28, and dentition otherwise substantially the same as that of *N. erawfordi*. (Lower incisor with one decided lobe, not seen in *N. erawfordi*, but the difference may be due to age of the teeth, a supposition which the more decided coloration of the points of several anterior teeth of *N. evotis* tends to confirm.)

Bicolor, but not very sharply so. Above, clear light brownish-cinereous, with a decided hoariness; below, cinereous-gray, with scarcely a shade of rusty. Tail colored to correspond. Feet brownish-white. Claws and most of the whiskers colorless. The coloration is very nearly that of some specimens of *Crocidura* "*leucodon*", but rather more cinereous above, and less distinctly bicolor.

Tail very short, almost *Blarina*-like; rather scant-haired, with slight terminal pencil, scarcely or not one-third as long as head and body, and about equaling the head alone. Snout not peculiar. Ears extremely large, scant-haired, conspicuous in the fur of the parts, recalling *Crocidura*; structure, however, as well as can be judged, not peculiar. Soles naked to the heels along a narrow linear strip. Pelage short, close, and sleek.

Length (of a well-prepared skin, closely approximate) 2.90. Tail-vertebræ 0.90, with hairs 1.00. Hind foot 0.45. Fore foot 0.25. Snout to incisors about 0.15; to angle of mouth 0.30; to eye 0.45; to ear 0.80; to occiput 1.00.

Hab.—Mazatlan, Mexico (F. Bischoff).

Type No. 9066, Nat. Mus. (Smiths. Inst.).

The condition of *N. erawfordi* does not permit entirely satisfactory comparison; but the material, so far as it goes, indicates specific distinction. The type of *erawfordi* is certainly adult, as shown by the teeth, hence its smaller dimensions are not attributable to immaturity. The more salient points of difference may be contrasted as follows:—

N. erawfordi.—Length 1.90; tail-vertebræ 1.10; foot 0.40; tail about as long as trunk. Color "light chestnut-brown, paler beneath".

N. evotis.—Length 2.90; tail-vertebræ 0.90; foot 0.45; tail about as long as head. Color hoary brownish-cinereous, ashy-gray beneath.

5. BLARINA (SORICISCUS) MEXICANA Baird, n. sp.

Blarina mexicana, BAIRD, MSS. ined., 1861.

Teeth 30; upper unicuspid 4; first and second equal to each other and largest, exceeding a little the posterior hook of the incisor; third

abruptly much smaller (only about half as large); fourth minute, concealed from external view by contact of third with the first molariform tooth. Posterior hook of upper incisor well developed, larger than third unicuspid; no internal snag. Under incisor with two prominent lobes, reaching back below the two succeeding teeth. Teeth all well colored; the points of the incisors quite black.

Unicolor; entirely sooty blackish-brown, merely a little paler below, without any line of demarkation whatever; tail and feet likewise dusky.

Tail rather long for *Blarina*, contained only two and a half times in length of head and body; very scant-haired. Claws rather large. Fur soft and full, almost fluffy, with very little lustre.

Length (of well-prepared skin, closely approximate) 2.50. Tail 1.00; the terminal pencil hardly 0.10 longer. Hands 0.35. Feet 0.50. Longest claws 0.08 or 0.09. Skull (slightly defective behind, estimated) 0.75; its width 0.37; its height 0.25.

Hab.—Xalapa, Mexico (R. Montes d'Oca).

Type No. $\frac{3525}{4438}$, Nat. Mus. (Smiths. Inst.) (skin 3525, skull 4438).

This remarkable species combines the 30 teeth of *Soriciscus* and other dental characters of that group with the external appearance of *Blarina* proper, resembling *B. talpoides* in its uniform blackish color, though it is still darker, as well as much smaller. The tail is relatively longer, though the dimensions above assigned may be somewhat too large. The skull is heavier and less attenuate than usual in *Soriciscus*, to which section the species nevertheless belongs.

